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INFORMATION NEEDS ASSESSMENT OF THE PATUXENT RIVER NAVAL HOSPITAL

by

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ABSTRACT

The Patuxent River Naval Hospital is examining methods 'o provide the highest quality and access to care at the lowest cost possible. To do this, a number of data or information needs must be identified. It is the purpose of this thesis to identify Patuxent River Naval Hospital's information needs.

A research method was applied to capture these information needs. Interviews with key managers revealed a number of Critical Success Factors (CSF). These CSFs are: Access to Quality Care, Management of Financial Resources, Management of Physical Resources, and Management of Human Resources. Under each CSF, a number of functional needs were identified, with each being tied to a number of effectiveness measures. From these effectiveness measures, the information needs of the organization emerge. The identified information needs are then examined against the existing information systems capabilities.

A frame work is developed for examining the information needs of the Patuxent River Naval Hospital. Many of the identified information needs do not exist in the current information systems and recommendations are provided on how to fill the gaps.

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A research method is applied to capture these information needs. Interviews with key managers reveal a number of Critical Success Factors (CSF). These CSFs are: Access to Quality Care and Service, Management of Financial Resources, Management of Physical Resources, and Management of Human Resources. Under each CSF, a number of functional needs are identified, with each being tied to a number of effectiveness measures. From these effectiveness measures, the information needs of the organization emerge. The identified information needs are examined against the existing information systems capabilities.

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I. INTRODUCTION

A. BACKGROUND

Naval Hospital Patuxent River, Maryland is a 20-bed primary care facility located at Patuxent River Naval Air Station. The original impetus for this study began as a request for assistance from the Commanding Officer, Naval Hospital Patuxent River, to evaluate the effectiveness of a recently implemented Executive Information System. The Commanding Officer was unsure if the system, as implemented, could fully support his resource allocation and facility operation decisions. This request evolved into a broader question concerning the information that was necessary to make management decisions at Patuxent River Naval Hospital.

B. MISSION

The mission of Naval Hospital Patuxent River includes:

1. Providing a comprehensive range of emergency, outpatient, and inpatient health care services to all eligible beneficiaries.

2. Ensuring assigned personnel are aware and trained for performance of assigned contingency and wartime duties.

3. Ensuring maintenance of proper state of material and personnel readiness to fulfill wartime and contingency plans.

4. Providing health care services in support of Navy and Marine Corps shore activities/units of operating forces.

5. Conducting staff education programs to promote appropriate health care standards of conduct and performance.

6. Cooperating with military/civilian authorities in matters of public health, local disasters, and other emergencies.

7. Maintaining requisite quality health care standards to ensure quality inpatient and ambulatory health care services.

C. PROBLEM

The information management problems at Naval Hospital Patuxent River include a lack of understanding of what the information needs are, no clear vision of the current information management system and its effectiveness, and no foresight as to what future information needs might be. There is an immediate functional need to provide effective performance monitoring and improved resource allocation.

II. SPECIFIC INFORMATION GATHERING PLAN

A. INTRODUCTION

In this chapter, the research methodology described in Appendix A is applied in determining Patuxent River Naval Hospital's information requirements. The following are the steps used in the collection of data for evaluating the organization's functional needs:

1. An initial visit was made to the hospital at Patuxent River, including a meeting with the Commanding Officer to determine his assessment of the organization's current performance and expectations for future results.

2. Telephone interviews, personal interviews, and on-site observations were conducted with key managers to collect data on the Patuxent River organization.

3. The raw data collected during the information gathering process was synthesized into a number of Critical Success Factors (CSFs). Under each CSF, a number of functional needs were identified by the organization as their top priorities. For each functional need, a number of functional goals and effectiveness measures were identified along with the information needs required to meet these goals and needs.

4. An organizational profile was developed by identifying the mission of the naval hospital and the strategy of the organization in fulfilling its mission. The operations of the organization were then outlined and the current computing environment examined.

5. User profiles were developed, identifying the cognitive styles of the various staff members and the internal dynamics among the various users within the organization.

6. Through work flow analysis and the identified functional needs, the key processes of the Patuxent River Naval Hospital were described using data flow diagrams which highlight the inputs and outputs to each process.

B. INFORMATION NEEDS ASSESSMENT OF THE PATUXENT RIVER MTF

1. The Information Gathering Plan For Patuxent River Naval Hospital

The information gathering plan started with a one day, on-site meeting with the Commanding Officer of the Patuxent River Naval Hospital. The purpose of the meeting was to introduce the research team and determine the CO's view of where the organization currently was; his vision of where the organization should be going; and his perception of the information requirements for the organization. The results of this meeting highlighted the fact that the CO was unsure as to what information was required to run the organization in a proactive manner instead of its current reactive state. The visit also allowed for a tour of the hospital facilities.

With the Commanding Officer's desires known, the next step was to start querying the key players in the organization, these included the XO, the five directors, and key division heads. Telephone interviews were used to introduce the research team to these key players and to start constructing a rough picture of the organization. The telephone interviews were composed of mostly structured question, with a few "feeler" questions to allow the respondents to address undiscussed issues. Appendix B is a sampling of the questions asked. The interviews were designed to last fifteen minutes but invariably ran upwards of thirty minutes. The telephone interviews proved useful

in establishing points of contacts within the organization and in providing a framework of the organizational structure. This technique did, however, provide little quantitative data due to time constraints and the impersonal nature of telephone interviews.

The next phase of the information gathering plan included the use of personal interviews and on-site observations during a five day stay at the naval hospital. A question set, listed in appendix B, again was developed with a mixture of structured and open ended questions. An in-brief with the Commanding Officer was followed by fifteen to thirty minute personal interviews with the Executive Officer; the Directors of Administration Services, Nursing Services, Medical Services, Surgical Services, and Ancillary Services; and department heads of Patient Administration, Management of Information Department, Manpower, and Training. The personal interviews yielded the greatest amount of raw data in building the organizational/user profiles and in determining Patuxent River MTF's information needs.

In conjunction with the personal interviews, the researchers became familiar with the lay out of the facilities and the work flow of a number of key departments.

Prior to the processing of this raw data, the scope of the project was established with the following boundary:

- The management information needs of solely the Patuxent River Naval Hospital organization were examined. The results of this project are not meant to be universally applicable to other naval hospitals. It is expected, however, that many of the results in this study are not only relevant to Patuxent River but are applicable to other MTFs.

The constraints of this study include the following:

- The information systems currently available or being implemented, must be utilized and cannot be replaced in lieu of another system.
- Resources, monetary and personnel, can be expected to be tighter while the levels of standards in quality of care and service will increase.
- The identified information needs are based on the expertise of the members of the Patuxent River Naval Hospital staff only and do not include the recommendations of external consultants with medical expertise.

2. Patuxent River Naval Hospital's Information Needs

With the raw data collected from the information gathering plan, the next step in the process was the identification of the organization's critical success factors. Critical success factors (CSFs) are defined as a set of core management processes, the effectiveness of which is crucial for the success of an organization. The CSFs identified by the Patuxent River Naval Hospital as requiring the greatest information needs are those listed below:

- Management of Human Resources
- Management of Physical Resources
- Management of Financial Resources
- Access to Quality Care and Service

Under each critical success factor, the CO, XO, directors, and key department heads identified the most important functional needs of the organization. These functional needs are the core issues that will be addressed in analyzing the information requirements of the Patuxent River Naval Hospital organization.

For each of the functional needs identified by the organization, functional goals can be established by the organization. A functional goal is a quantitative measure that the hospital hopes to achieve. A functional goal would be, for example, "appointment wait time from when a appointment is scheduled to when a patient is seen, must not exceed 15 days".

The achievement of each functional goal is made through any number of effectiveness measures. Effectiveness measures are indicators of the organization's progress in meeting a functional goal, for example, "appointment wait time is currently 17 days". Each effectiveness measure is composed of a number of information needs. Information needs are the data an organization needs in building an effectiveness measure, for example, "number of appointments available, the number of patients seen, a listing of all the time intervals between appointment request and when the patient is seen, etc.".

Chapter III, Information Needs Assessment, will outline in detail, the functional needs, functional goals, effectiveness measures, and information needs of the Patuxent River Naval Hospital by CSFs.

3. Patuxent River Naval Hospital Organizational Profile

The mission of the Patuxent River MTF organization is to ensure the wellness of eligible beneficiaries within the assigned catchment area by providing a wide range of high quality health care services, while supporting DoD requirements and maintaining a ready force able to respond to contingencies. Patuxent River Naval Hospital serves a catchment area of approximately 40 miles with a non-overlapping catchment area (those

areas not serviced by other military facilities) containing approximately 15,000 beneficiaries. Patuxent River provides health services to approximately 12,000 military and civilian employees, as well as emergency services to contract employees from 52 tenant commands.

Patuxent River's strategy in meeting their mission statement is by providing quality outpatient, inpatient, and emergency care to all eligible beneficiaries. Patuxent River MTF provides outpatient and inpatient care to active duty personn their dependents, retirees and their dependents, and civil service personnel. Inpatient care is provided through two wards, a 16 bed ward for inpatient procedures treatable at Patuxent River and a maternity ward for expectant mothers. Patuxent River provides emergency care, OB/GYN, and radiology services through civilian contractors. An organizational chart is provided of the top managers at the Patuxent River MTF in Figure 1.

The operations of the organization are primarily based on reactive responses to the current environment. This reactive environment is due to uncertainty based on factors, such as how many people show up for sick call, the number of patients needed to be transported to other hospitals, the day to day demands for appointments, the number of patients seen by the emergency room, etc. All these activities are handled in an as needed basis as there is currently no predictor for this demand. Managers at the Patuxent River Naval Hospital feel they do not have the information required to forecast patient care requirements and match these with staff allocation requirements.

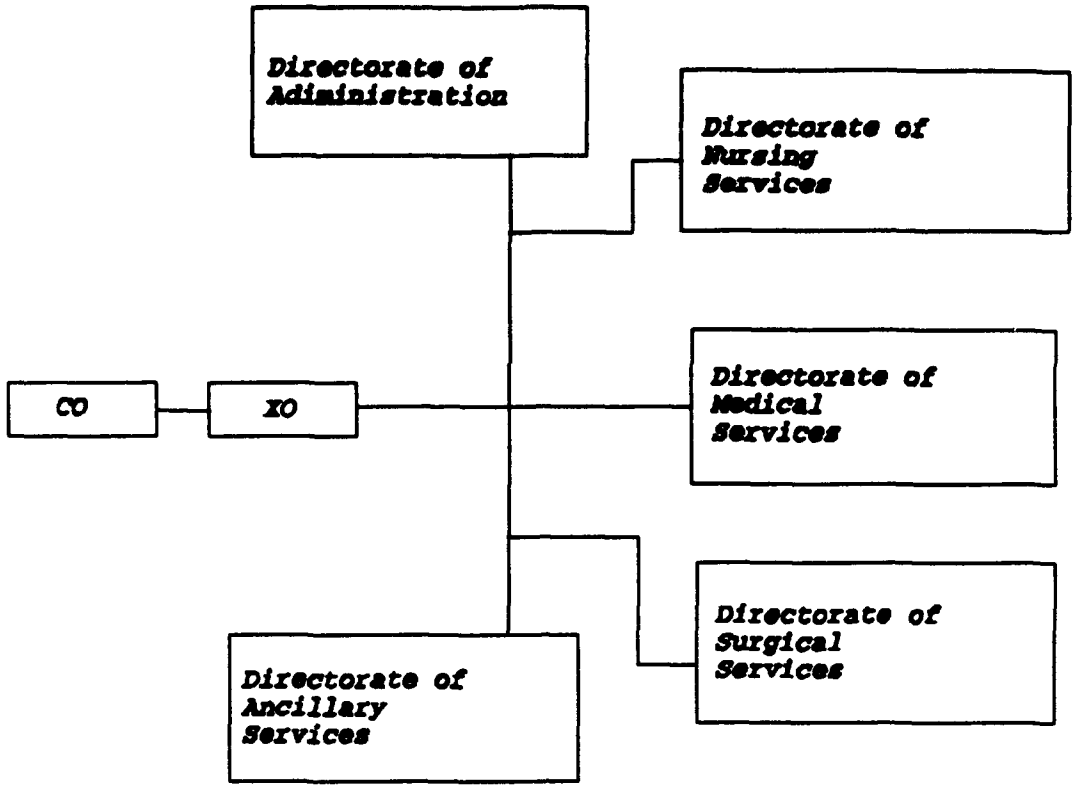

Figure 1. Organizational Chart (high level view)

The Patuxent River Naval Hospital organization is required to adhere to a myriad of higher directives that are common to any government organization. Suffice it to say that these directives or guidelines drive the organizations operations and strategies.

Patuxent River is composed of a number of information systems with various capabilities, functionalities, and constraints. Due to the breadth of these systems and related issues, this information will be covered extensively in Chapter IV, Current Information Systems.

4. Patuxent River Naval Hospital User Profile

The two key users profiled at the Patuxent River Naval Hospital are the clinicians (the Medical Corps (MC) doctors) and the hospital administrators (the Medical Service Corps (MSC) personnel). By user we mean those key managers who access the various information systems.

The cognitive style of the clinicians interviewed is best generalized as people-oriented, excelling at solving undefined or ambiguous problem sets. There is a distinction here between people-oriented as a clinician and people-oriented as administrators of their directorate. The clinicians clearly view their major role as that of doctors first and managers second. Many of the administrative tasks are viewed as not their job, but that of the "bean counters". The clinicians expressed frustration at the structure and inflexibility of the existing computer systems. They desire a more innovative approach towards working on the computer systems via an ad hoc query capability.

The hospital administrators do not fit as nicely into a generalized cognitive style as the clinicians. The hospital administrators appear to be a mix between a people-oriented and a precision-oriented user. The administrators appear to be versed in dealing with well defined issues as well as the ambiguity associated with health care as a whole.

The blending of these different cognitive styles leads to inter-organizational dynamics among the user groups. The Commanding Officer (an MSC officer) of the Patuxent River Naval Hospital desires a greater role for the directors (MC officers) in

the day to day management decisions within their purview. Many of the directors admit that they view their management role as conduits where they receive directives from the CO, ensure their personnel execute the directives, and then report to the CO when the task is completed.

5. Analysis of Patuxent River Naval Hospital's Work Flows

In conducting an analysis of the organization's information systems, the desired information needs were identified as available or unavailable in these information systems. Each information system was then examined by identifying the inputs that feed into the system, how the system processes the data, and what outputs are generated by the process. This input-process-output analysis method is a logical modeling technique called Data Flow Diagraming.

The work flows for the information systems that provide the desired information needs are fully developed in Chapter IV, Current Information Systems.

III. INFORMATION NEEDS ASSESSMENT

A. INTRODUCTION

Maintaining quality health care while adjusting to a reduced DoD budget is the biggest challenge to be faced in the near term by Patuxent River Naval Hospital. Diminishing budgets and resources oppose the goal of achieving quality health care. The overriding hospital goal remains to provide timely access to quality health care. The reality of the budget forces more efficient utilization of available resources. This chapter attempts to identify the information needs of Patuxent River Naval Hospital in pursuit of efficient and effective operation.

The scope of this effort targets identification of the information needed to manage by managers at various levels of management in the hospital. The information needs are a direct reflection of the manager's articulated functional needs. Their accuracy is determined by:

1. The managers' ability to describe what they need, and
2. The analyst's ability to elicit and comprehend the need, and frame it in an understandable format.

Developing information needs is not an exact science. It is an iterative process. The information needs presented here are the first iteration.

This thesis attempts to provide a framework for the organization to collect and format actual information, set targets to measure effectiveness, analyze gaps between actual measures and target values, and develop a course of action to improve effectiveness.

The organization must continually evaluate the validity of effectiveness measures. There is nothing sacred about the measures presented here. Management must revise and improve the measures as needed. The following Figure depicts the flow path of this effort.

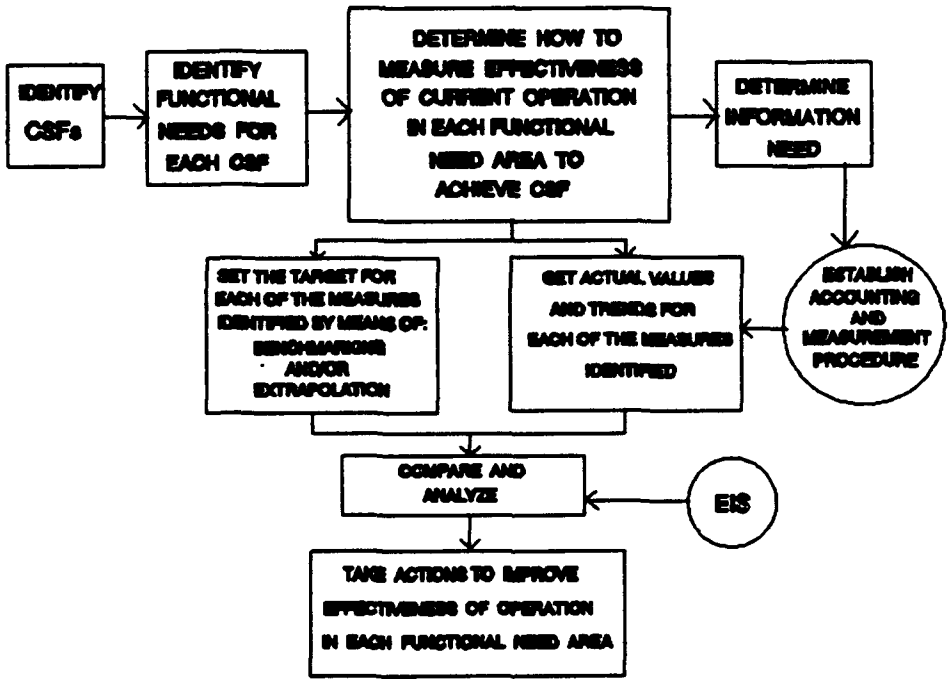

Figure 2. Information Need Identification Flow path

B. DEFINITION OF TERMS

Critical Success Factors are a limited number of areas in an organization, in which results, if satisfactory, will ensure successful competitive performance for the organization. They describe the most important activities in the organization.

A **Functional Need** is an improvement expected to meet a Critical Success Factor.

A **Functional Goal** states the functional need improvements as results to be achieved. Management must set these goals with specific quantitative values or a level of improvement desired.

Effectiveness Measures are the defined criteria for qualitative judgement of meeting the functional goal. The list of effectiveness measures presented here is not meant to be complete. It is merely a suggestion requiring further refinement. Some measures may be impractical to implement. Use of "proxy" or "surrogate" measures (measures which come close but do not measure exactly what is desired) is the practical recommendation. Targets must be set by hospital management.

Information Need is that information required to produce the performance measures.

C. CRITICAL SUCCESS FACTOR SELECTION

To identify medical executives' information needs, it is necessary to define what it is that makes the hospital successful. We proposed this question of what constitutes success to a number of the major administrators at the hospital. Success was generally defined as patients' timely access to care and their satisfaction. In this environment of

declining resources, however, timely access to care and patient satisfaction must be accomplished in an efficient manner. Effective resource allocation of money, manpower and facilities is critical to efficient operation.

Patuxent River Naval Hospital is unique in the DoD health care arena. It's size, capabilities, beneficiary population, and geographic location all combine to define a distinctive health care operation. Although many critical success factors exist for Patuxent River Naval Hospital, interviews with the key managers identified a few select areas that are pivotal in the management of this particular health care facility. Those critical success factors are:

1. Access to Quality Care and Service
2. Management of Human Resources
3. Management of Financial Resources
4. Management of Physical Resources

Access to quality care was the one factor consistently mentioned as needed for hospital success. It means that a patient is able to get the right care. Access to quality service means that each patient is treated fairly and promptly. Customer service is the essence of this factor.

Management of human resources is particularly crucial in a downsizing environment. Making the best use of available personnel enhances access to quality service. The decision of when and how to implement empanelment is a question of human resource management. Empanelment can be described as breaking up the

population into groups and attaching each group to a specific provider or group of providers.

Management of financial resources is particularly important in an era of declining budgets. Financial information, then, is critical to management decisions. Most of the key managers, however, find little or no utility with the financial information presented to them. Possible causes of this may be lack of training and/or poor information presentation.

Management of physical resources was chosen as a critical success factor because consolidation of the physical plant is a significant management consideration. Decisions must be made with respect to space allocation, however, managers are unsure of their current and future space allocation needs. Information is required which delineates current space allocations and permits evaluation of alternatives. This is also crucial to the correct allocation of overhead costs and minimizing the cost of care.

Satisfactory performance in the four critical success factors identified should ensure successful competitive performance for Patuxent River Naval Hospital.

D. DEVELOPMENT OF INFORMATION NEEDS

Each Critical Success Factor engenders one or several functional needs. Functional needs were chosen as the specific areas pursuant to the Critical Success Factor that if met will safeguard the fulfillment of that critical success factor. To evaluate the organization's performance at meeting the functional needs, effectiveness measures need to be established. Functional goals must be determined by management as the

effectiveness measure target. Effectiveness measures can be compared with this standard to evaluate organization performance. Selection of meaningful effectiveness measures and goals to meet the functional needs is the crucial element in the path to effective attainment of the critical success factor. In some cases it is extremely difficult to extract measures that will be useful. Once the effectiveness measures are selected, however, the information needs to make the measurements are logically derived. The measures presented are not complete. They are suggestions to be further refined.

Each critical success factor is addressed to provide an explanation of how the information needs were derived. The functional goals should be chosen as values of performance measures that should be strived for. Actual values are not provided here but should be developed by hospital managers and evaluated on a continuing basis. A summary table is provided for each critical success factor. The information needs identified are the needs derived from an evaluation of the organization. No attempt is made at this time to identify how these information needs are to be satisfied. This will be addressed in subsequent chapters.

1. Critical Success Factor #1: Access to Quality Care and Service

a. Functional Needs

The functional needs associated with this critical success factor involve:

1. Providing timely access to care
2. Providing quality care

3. Providing quality service

Evaluation of these needs must be reviewed for all services provided. One single grouping of service provided presents a view with little meaning. The managers at Patuxent River, MTF indicated that using an index to group related procedures was crucial to meaningful information. Diagnostic grouping is chosen, for our purposes, to indicate the need to categorize related information (e.g., Diagnostic Related Group (DRG) (for in-patients) or Current Procedural Terminology (CPT) (for out-patients)).

(1) Timely Access to Care. Timely access to care means that a beneficiary is able to schedule and receive an appointment in a timely manner. The current system requires a phone call to make an appointment. Even if a patient is physically present at the hospital, he or she cannot go to the window of the appropriate clinic and request an appointment. It has been deemed more fair to require all patients, even those unable to physically come into the hospital, to equally compete for appointments via the telephone system. Additionally, there are a limited number of personnel to answer telephone requests for appointments. Patients may call in and receive a busy signal, get through and make an appointment , or get through and be told that all appointments are filled. This methodology restricts the number of patients who get through and are told that there are no available appointments. If one aspect of success is measured by patient access to care (ability to make an appointment) then there must be a method to measure that.

In examining the appointment needs, two different categories of timeliness of appointments emerge. For our purpose, urgent requests are indicative of a medical condition which requires medical attention within a few hours or the medical condition may be aggravated or deteriorate. Non-urgent requests are those medical attention requests without the time sensitivity associated with urgent requests. They are indicative of a medical condition which does not necessarily require the immediate resources of an emergency medical services system. Hereafter these request categories will be referred to as urgent requests and non-urgent requests, respectively.

(2) Providing Quality Care. Providing quality care means that a patient leaves Patuxent River Naval Hospital having received the right care.

(3) Providing Quality Service. Providing quality service means that a patient leaves Patuxent River Naval Hospital feeling that he or she was well taken care of.

b. Effectiveness Measures

(1) Timely Access to Care. Several effectiveness measures were selected to permit evaluation of providing timely access to care. These include:

(1) A ratio of appointment demand to appointments available for each request category (the higher the ratio, the poorer the access to care; a ratio of one would mean that the demand is met). A logical time period for evaluation should be selected (e.g., per day, week, or month). It may be necessary to break down the measure into a ratio for each clinic.

(2) A measure of the average time between an appointment request and the actual appointment. For urgent need requests this may be better measured in hours, however, for routine requests it is more logical to measure this in days.

Obviously, the longer the delay time to schedule an appointment the poorer the access to care. Other facility information is based on their provided values. Appointment delay time is defined, for our purposes, as the time between an appointment request and the actual appointment.

(3) A measure of the percentage of patients who are seen in the emergency room for acute care vice emergency care. Patients who are unable to schedule an urgent need appointment or who perceive that such an appointment is unavailable, will get care in the best way that they know. The emergency room is seen by patients as a reasonable method to obtain care. This is then an indirect measure of access to care. A higher percentage of acute care patients who are seen in the emergency room may be an indicator of poor access to routine care.

(4) A measure of the number of beneficiaries who utilize CHAMPUS for treatment instead of MTF, Patuxent River. Patients may view CHAMPUS as providing better access to care. If this measure is high, it may indicate that access to care at MTF, Patuxent River is poor. This measure must be qualified by only measuring those champus utilizations that are potentially treatable at Patuxent River. Measurement within specific diagnostic groupings (Diagnostic Related Group {DRG}, procedure, or Current Procedural Terminology {CPT}) is the most probable qualification. Additionally, the time period of the measure must be specified (e.g., during the most recent month, quarter, or year).

(2) Providing Quality Care. Effectiveness measures to measure success at providing quality care are difficult to quantify. Utilization of internal and external quality reviews may be employed. However, there does not appear to be a single measure or group of measures that is indicative of quality. The development of these measures is left to the hospital staff.

(3) Providing Quality Service. Evaluating whether a patient leaves Patuxent River Naval Hospital feeling well taken care of may be impossible to measure on a realistic basis. However, one suggestion involves a measurement of patient

satisfaction level. This may be accomplished either through statistical interviews or a questionnaire.

c. Information Needs

Information needs to meet the performance measures logically follow. Each performance measure is in bold with its information needs listed after.

(1) Ratio of appointment demand to appointments available for each request category (per time interval (i.e., daily)).

(The number of appointments available is relatively easy to obtain. Appointment demand, however, must somehow measure the number of beneficiaries who want appointments, to include those who get appointments and those who are unable to get appointments.)

a) Urgent requests

- number of appointments available per time interval (i.e., daily)
- number of beneficiaries provided appointments per time interval
- number of beneficiaries who request an appointment but are denied access due to an unavailable or unacceptable delay per time interval
- number of beneficiaries who are unable to access the appointment system to request an appointment per time interval

b) Non-urgent requests

- number of appointments available per time interval (i.e., 2 weeks)
- number of beneficiaries provided appointments per time interval
- number of beneficiaries who request an appointment but are denied access due to an unavailable or unacceptable delay per time interval
- number of beneficiaries who are unable to access the appointment system to request an appointment per time interval

(2) A measure of the average time between an appointment request and the actual appointment. The information need is to capture appointment delay time for

every appointment at Patuxent River, MTF. There must be a separate category for other facilities capable of providing service (i.e., Bethesda, Walter Reed, St. Mary's, etc.) and for each diagnostic grouping (Diagnostic Related Group {DRG}, procedure, or Current Procedural Terminology {CPT}).

a) MTF Patuxent River

Urgent Requests
- appointment delay time for each appointment (categorized by clinic, by diagnostic grouping, or overall) (delay time can be averaged over a desired time period to obtain the performance measure)

Non-urgent Requests
- appointment delay time for each appointment (categorized by clinic, by diagnostic grouping, or overall) (delay time can be averaged over a desired time period to obtain the performance measure)

b) Other Facilities
(average appointment delay time needs to be provided by the facility) (indexed by diagnostic grouping)

(3) A measure of the percentage of patients who are seen in the emergency room for acute care vice emergency care.

- Total number of patients who are seen in the emergency room per day.

- Number of patients who are seen in the emergency room per day whose conditions require acute care vice emergency care.

This does not discriminate as to whether an attempt was made to schedule clinic care. That information may be valuable as another performance measure.

(4) A measure of the number of beneficiaries who utilize CHAMPUS for treatment instead of MTF, Patuxent River. There must be a separate category for

each diagnostic grouping (Diagnostic Related Group {DRG}, procedure, or Current Procedural Terminology {CPT}) treatable at Patuxent River.

- Number of patients who utilize CHAMPUS vice MTF Patuxent River (most recent month and historical monthly totals).

(5) Patient satisfaction level.

- Patient satisfaction feedback on quality of care.

Critical Success Factor #1: Access to Quality Care and Service

Functional Need: (1) Provide timely access to care

Functional Goal	Effectiveness Measures	Information Need

(1) Organization determined goal for ratio of appointment demand to appointments available
 	
Urgent Request Ratio (goal)
(maybe 1)
 	
Non-urgent Request Ratio (goal)
(maybe 1)
	(1) Ratio of appointment demand to appointments available:
	
	Urgent Requests
	$\frac{b+c+d}{a}$
	
	Non-urgent Requests
	$\frac{f+g+h}{e}$
		(1) (a) Urgent Requests
		(per appointment center or clinic)
		a = # appointments available (per time interval)
		b = # beneficiaries provided appointments (per time interval)
		c = # patients denied appointments (per time interval)
		d = # patients unable to access the system to request an appointment (per time interval)
		
		(1) (b) Non-urgent Requests
		
		e = # appointments available (per time interval)
		f = # beneficiaries provided appointments (per time interval)
		g = # patients denied appointments during this period
		h = # patients unable to access the system to request an appointment (per time interval)

(2) Organization determined goal for average time between an appointment request and the actual appointment (by clinic at MTF, Patuxent River and by facility, categorized for each DRG or procedure)	(2) Average time between an appointment request and the actual appointment (by clinic at MTF,Patuxent River for each diagnostic grouping or procedure) (by facility for each diagnostic grouping or procedure)	(2) Time between appointment request and actual appointment (in hours for urgent requests/ in days for non-urgent requests) - each clinic at MTF, Patuxent River (each appt delay time) - by diagnostic grouping - by procedure - each facility (average time) - by diagnostic grouping - by procedure

(3) Organization determined goal for percentage of acute care patients (vice emergency patients) compared to total patients seen in the emergency room	(3) Percentage of acute care patients (compared to total) seen in the emergency room $\frac{a}{b} \times 100\%$	(3) a=Acute care cases seen by emergency room in a month b=Total patients seen in emergency room in a month
(4) Organization determined goal for number of CHAMPUS utilizations for diagnostic groupings treatable at MTF, Patuxent River (most recent month,quarter, or year)	(4) Number of CHAMPUS utilizations for diagnostic groupings treatable at MTF, Patuxent River (most recent month, quarter, or year)	(4) Number of CHAMPUS utilizations indexed by diagnostic grouping for patients in MTF, Patuxent River catchment area (tabulated for most recent quarter & most recent year)

Critical Success Factor #1: Access to Quality Care and Service

Functional Need: (2) Provide quality care

Functional Goal	Effectiveness Measures	Information Needs

The development of effectiveness measures for this functional need requires expertise not available from the authors. The hospital organization should develop these measures.

Critical Success Factor #1: Access to Quality Care and Service

Functional Need: (3) Provide quality service

Functional Goal	Effectiveness Measures	Information Needs
A. Goal patient satisfaction level	A. Patient satisfaction level	A. Patient satisfaction feedback on quality of care

2. Critical Success Factor #2: Management of Human Resources

a. Functional Need

The functional need associated with this critical success factor involves optimal allocation of personnel. Optimal allocation of personnel means that personnel are effectively and efficiently utilized to conduct the business of providing health care. Some definitions are in order. Full-Time Equivalent (FTE) Work-Month is the amount of labor available to a MTF work center that would be available if one person had worked for one month in that work-center. The conversion factor is: total actual hours worked divided by 168 equals one FTE. Performance Factor is a measure of work produced by a function; i.e., occupied bed days, visits, procedures, square footage, etc. When this factor is divided into the corresponding dollars associated with the work center, a cost per workload unit is developed which permits a meaningful comparison among the operating expense accounts of the facility.

b. Effectiveness Measures

Several effectiveness measures are provided to permit evaluation of providing optimal allocation of personnel. These include:

(1) A ratio of the number of beneficiary population to the number of clinicians. Historical data, current data, and a five year forecast are needed to permit comparisons. This could be useful as a benchmark to evaluate trends and as justification to provide more or less clinicians.

(2) A ratio of the number of beneficiaries in a particular risk or morbidity category to the number of clinician specialists able to administer to them. Historical data, current data, and a five year forecast should be provided to permit comparisons. This ratio provides an indicator of the ability of MTF Patuxent

River to provide adequate specialty care with the personnel available or the basis with which to justify increased manning in a particular specialty.

(3) A ratio of the number of beneficiary population per staff personnel. Historical data, current data, and a five year forecast should be provided to permit comparisons. Separate ratios of population per nurse, population per administrative personnel, and population per corpsman may be useful as an indicator of the ability of MTF Patuxent River to provide adequate care with the personnel available or the basis with which to justify increased manning.

(4) A ratio of the number of patients seen per day per clinician. This must be normalized by diagnostic grouping and specified for a particular time period (e.g., most recent month, quarter, or year). This ratio provides a benchmark with which to compare individual clinicians. A high ratio may be indicative that quality is suffering to meet the required appointment goal or that more clinicians are required to lower the appointment load.

(5) A measure of the percentage of patients who are seen in the emergency room for acute care vice emergency care. Patients who are unable to schedule an urgent need appointment or who perceive that such an appointment is unavailable, will get care in the best way that they know, the emergency room. This is also an indirect measure of access to care, but can be an indicator that personnel resources are inadequately or poorly utilized. This is the same effectiveness measure utilized for Critical Success Factor #1.

(6) A measure of the number of beneficiaries who utilize CHAMPUS for treatment instead of MTF, Patuxent River. Patients may view CHAMPUS as providing better access to care. If this measure is high, it may indicate that access to care at MTF, Patuxent River is poor. The underlying cause may be poor human resource allocation. This measure must be qualified by only measuring those CHAMPUS utilizations that are potentially treatable at Patuxent River. Measurement within specific diagnostic groupings is the most probable qualification. Additionally, the time period of the measure must be specified (e.g., during the most recent month, quarter, or year). This is the same effectiveness measure utilized for Critical Success Factor #1.

(7) A measure of the number of support staff per clinician.

(8) A ratio of Full-Time Equivalents (FTEs) to the measure of workload (performance Factor)(for a particular clinic).

c. Information Needs

Information needs to meet the identified performance measures logically follow.

(1) A ratio of the number of beneficiary population per clinician.

- Total patient population (current)
- Total patient population (1-5 year forecast)
- Total patient population (1-5 year historical)
- Total number of clinicians (current)
- Total number of clinicians (1-5 year forecast)
- Total number of clinicians (1-5 year historical)

(2) A ratio of the number of beneficiaries in a particular risk or morbidity category to the number of clinician specialists able to administer to them.

Information must be collected for each risk or morbidity category.

Risk Category 1.

- Total patient population in this category (current)
- Total patient population in this category (1-5 year forecast)
- Total patient population in this category (1-5 year historical)
- Total number of clinicians specialized to treat this category (current)
- Total number of clinicians specialized to treat this category (1-5 year forecast)
- Total number of clinicians specialized to treat this category (1-5 year historical)

Risk Category 2.

etc.

(3) A ratio of the number of beneficiary population per staff personnel.

- Total patient population (current)
- Total patient population (1-5 year forecast)
- Total patient population (1-5 year historical)

- Total number of nurses (current)

- Total number of nurses (1-5 year forecast)
- Total number of nurses (1-5 year historical)

- Total number of administrative personnel (current)
- Total number of administrative personnel (1-5 year forecast)
- Total number of administrative personnel (1-5 year historical)

- Total number of corpsman (current)
- Total number of corpsman (1-5 year forecast)
- Total number of corpsman (1-5 year historical)

(4) A ratio of the number of patients seen per day per clinician. (most recent quarter and year)

Diagnostic Grouping 1

- Total number of appointments completed per day in this grouping.
- Total number of clinicians treating this diagnostic grouping during this time period.

Diagnostic Grouping 2

etc.

(5) A measure of the percentage of patients who are seen in the emergency room for acute care vice emergency care.

- Total number of patients who are seen in the emergency room per day.

- Number of patients who are seen in the emergency room per day whose conditions require acute care vice emergency care.

(6) A measure of the number of beneficiaries who utilize CHAMPUS for treatment instead of MTF, Patuxent River. There must be a separate category for each diagnostic grouping treatable at Patuxent River.

- Number of patients who utilize CHAMPUS vice MTF Patuxent River (most recent month and historical monthly totals).

(7) A measure of the number of support staff per clinician.

(8) A ratio of Full-Time Equivalents (FTEs) to the measure of workload (Performance Factor)(for a particular clinic).

- Full-Time Equivalents (FTEs) for each clinic.
- Performance Factor totals for each clinic.

Critical Success Factor #2: Management of Human Resources

Functional Need: Optimal allocation of personnel resources

Functional Goal	Effectiveness Measure	Information Need
(1) Organization determined goal for ratio of number of beneficiary population to number of clinicians $\frac{\text{\# population}}{\text{clinician}}$	(1) Ratio of the number of beneficiary population to number of clinicians (forecasted for outyears 1-5, current data & historical data) $\frac{\text{\# population}}{\text{clinician}}$	(1) Total patient population 1-5 yr forecast current # 1-5 yr historical Total number of clinicians 1-5 yr forecast current # 1-5 yr historical
(2) Organization determined goal for ratio of the number of beneficiaries in a particular risk or morbidity category to the number of clinician specialists able to administer to them Goal # population per $\frac{\text{category}}{\text{specialized clinician}}$	(2) Ratio of the number of beneficiaries in a particular risk or morbidity category to the number of clinician specialists able to administer to them (e.g., 1000 children per pediatrician) (forecasted for outyears 1-5, current data & historical data) # population per $\frac{\text{category}}{\text{specialized clinician}}$	(2) Numbers of beneficiary population categorized by risk or morbidity category 1-5 yr forecast current # 1-5 yr historical Number of clinicians specialized to treat the identified risk or morbidity categories 1-5 yr forecast current # 1-5 yr historical

(3) Organization determined goal for ratio of number of beneficiary population to number of staff personnel **# population(goal)** nurse **# population (goal)** administrative personnel **# population (goal)** corpsman	(3) Ratio of number of beneficiary population to number of staff personnel (forecasted for outyears 1-5, current data & historical data) **# population** nurse **# population** administrative personnel **# population** corpsman	(3) Total patient population 1-5 yr forecast current # 1-5 yr historical Forecasted/current/historical total number of staff personnel -total number of nurses -total number of administrative staff personnel -total number of corpsman 1-5 yr forecast current 1-5 yr historical
(4) Organization determined goal for ratio of the number of patients seen per day to the number of clinicians (normalized by diagnostic grouping)	(4) Ratio of the number of patients seen per day to the number of clinicians (normalized by diagnostic grouping) (most recent quarter and most recent year) For diagnostic group #1: a/b	(4) a=number of appointments per day per diagnostic grouping b=total number of clinicians treating each diagnostic group 1-5 yr forecast current # 1-5 yr historical
(5) Organization determined goal for percentage of acute care patients (vice emergency patients) compared to total patients seen in the emergency room	(5) Percentage of acute care patients (compared to total) seen in the emergency room $\frac{a}{b} \times 100\%$	(5) a=Acute care cases seen by emergency room in a month b=Total patients seen in emergency room in a month

(6) Organization determined goal for number of CHAMPUS utilizations for diagnostic groupings treatable at MTF, Patuxent River (most recent month,quarter, or year)	(6) Number of CHAMPUS utilizations for diagnostic groupings treatable at MTF, Patuxent River (most recent month, quarter, or year)	(6) Number of CHAMPUS utilizations indexed by diagnostic group for patients in MTF, Patuxent River catchment area (tabulated for most recent quarter & most recent year)
(7) Organization determined goal for the number of support staff per clinician.	(7) Number of support staff per clinician.	(7) Number of support staff available to a particular clinician.
(8) Organization determined goal for the ratio of FTEs to Workload (Performance Factor).	(8) Ratio of FTEs to Workload (Performance Factor) for a particular clinic. $\frac{\text{Full-Time Equivalents}}{\text{Workload (Performance Factor)}}$	(8) Full-Time Equivalents (for each clinic) Performance Factor (for each clinic per month)

3. Critical Success Factor #3: Management of Financial Resources

a. Functional Needs

The functional needs associated with this critical success factor involve:

(1) Ensuring reasonable cost of care and minimizing overhead costs, and

(2) Training key managers in the efficient use of funding.

(1) Reasonable Cost of Care/Minimizing Overhead. Ensuring reasonable cost of care and minimizing overhead costs means that quality care is provided at the lowest cost possible. Minimizing overhead prevents unnecessary costs from inflating the cost of care.

(2) Training Key Managers in the Efficient Use of Funding. Training key managers in the efficient use of funding means that these key managers are provided with sufficient fiscal management tools to perform their jobs with a high degree of effectiveness.

b. Effectiveness Measures

Two effectiveness measures can provide evaluation of ensuring reasonable cost of care and minimizing overhead costs. These include:

(1) Unit cost per procedure. Measurement of unit cost per procedure is a method to gauge whether the care provided is done so in an economical fashion. Comparison of this measure with a standard (functional goal) may identify that unwarranted costs are being expended. Those procedures which are more costly can be examined to obtain better control of allocation of resources.

(2) Unit cost per patient (indexed by diagnostic grouping). Measurement of unit cost per patient is a method to gauge whether the care provided is done so in an economical fashion. Comparison of this measure with a standard may identify that unwarranted costs are being expended.

Measurement of training key managers in the efficient use of funding is an area that may be impractical to implement. One surrogate effectiveness measure can permit an approximation for evaluation of training key managers in the efficient use of funding. This is a measure of the amount of management training completed by each Director and Department Head. It is acknowledged that measuring amount of training does not measure quality of training.

c. Information Needs

Information needs to meet the performance measures logically follow.

(1) Unit cost per procedure.

Procedure 1

- labor costs per procedure
  - clinician time (hrs)
  - staff time (hrs)
  - clinician cost per hour
  - staff cost per hour
- supply costs per procedure
- overhead costs
  - total overhead cost per QTR
  - total hours per QTR
  - total # hours of procedure 1 per QTR

Procedure 2

etc.

(2) Unit cost per patient (indexed by diagnostic grouping).

Diagnostic Group 1

- labor costs per patient
  - clinician time (hrs)
  - staff time (hrs)
  - clinician cost per hour
  - staff cost per hour
- supply costs per patient hour
- overhead costs
  - total overhead cost per QTR
  - total # patient hours per QTR

Diagnostic Group 2

etc.

(3) Management training in specified areas (per manager)

Manager #1

Topic 1 training level (formal training & experience)(# hours/# courses/course performance)
Topic 2 training level (formal training & experience)(# hours/# courses/course performance)
etc.

Manager #2

etc.

Critical Success Factor #3: **Management of Financial Resources**

Functional Need: (1) Ensure reasonable cost of care and minimize overhead

Functional Goal	Effectiveness Measures	Information Needs

(1) Organization determined goal for unit cost per procedure (at MTF, Patuxent River)
 	
Procedure 1 unit cost goal
 	
Procedure 2 unit cost goal
 	
etc.
	(1) Unit cost per procedure (at MTF, Patuxent River)
	
	Procedure 1 unit cost
	
	=a+f+g
	
	=[(bxd)+(cxe)]+f+(h/i)xj
	
	Procedure 2 unit cost
	
	etc.
		(1) Cost Information associated with a procedure:
		
		<u>Procedure 1</u>
		a= labor costs per procedure
		b= clinician time (hrs)
		c= staff time (hrs)
		d= clinician cost per hour
		e= staff cost per hour
		
		f= supply costs per procedure
		
		g= overhead costs
		h= total overhead cost per QTR
		i= total hours per QTR
		total # hours of
		j= procedure 1 per QTR
		
		<u>Procedure 2</u>
		etc.

(2) Organization determined goal for unit cost per patient (indexed by diagnostic group)	(2) Unit cost per patient (indexed by diagnostic group)	(2) Cost information associated with a patient (indexed by diagnostic group)
Diagnostic group 1 unit cost goal (per patient) Diagnostic group 2 unit cost goal (per patient) etc.	Diagnostic group 1 unit cost (per patient) =a+f+g =[(bxd)+(cxe)]+f+(h/i)xj Diagnostic group 2 unit cost (per patient) etc.	<u>Diagnostic group 1</u> a= labor costs per patient b= clinician time (hrs) c= staff time (hrs) d= clinician cost per hour e= staff cost per hour f= supply costs per patient g= overhead costs per patient h= total overhead cost per QTR i=total hours per quarter j= total # patient hours per QTR <u>Diagnostic group 2</u> etc.

Critical Success Factor #3: Management of Financial Resources

Functional Need: (2) Train key managers in efficient use of funding

Functional Goal	Effectiveness Measures	Information Needs
(1) Organization determined goal for management training level in specified areas (per manager)	(1) Management training level in specified areas (per manager) (this is a surrogate measure; amount of training does not equal quality of training; it is impractical to measure quality of training) Manager #1: # hours,# courses, course performance	(1) Management training completed by each director in specified areas (including formal training and experience) Manager #1 # hours, # courses, course performance Manager #2 etc.

4. Critical Success Factor #4: Management of Physical Resources

a. Functional Need

The functional need associated with this critical success factor involves optimizing the use of physical plant assets. Optimal use of physical resources means that space is effectively and efficiently utilized to conduct the business of delivering health care.

b. Effectiveness Measures

Several effectiveness measures can permit evaluation of providing optimal allocation of personnel. These include:

(1) Average time and average distance of movement of documents and people. This measure may be tabulated per procedure, per patient, or per diagnostic grouping. This can be useful to show areas where the most interactions occur and where the interdepartment movement occurs. Optimizing physical resources can work to minimize the identified interactions.

(2) For each service or procedure provided, a ratio of current space allocation to the needed space allocation can normalize the space allocation for services provided. Priority services can be preferentially allocated space. Future needs can be evaluated by looking at a ratio of current space allocation to the future needed space.

(3) A ratio of the maintenance cost per square foot. This can provide an across the board measure of overhead. Trends can be evaluated or estimates can be obtained for cost savings associated with space closure.

(4) A ratio of the maintenance cost per building per square foot. This could potentially identify spaces with unusually high overhead. These could then be targeted for either repair or shutdown.

c. ***Information Needs***

Information needs to meet these effectiveness measures logically follow.

(1) Average time and average distance of movement of documents and people.

flow (time & distance) per procedure:
for documents, clinicians, staff and patients
flow (time & distance) per patient:
for documents, clinicians, staff and patients
flow (time & distance) per DRG:
for documents, clinicians, staff and patients

(2) A ratio of the amount of space allocated per service to the needed space for that service.

current actual space allocation per service
current space need per service
future space need per service

(3) A ratio of the maintenance cost per square foot.

total maintenance costs (per quarter or month)
total space available (ft^2)

(4) A ratio of the maintenance cost per building per square foot.

maintenance costs per building (per quarter or month)
total space available per building (ft^2)

Critical Success Factor #4: **Management of Physical Resources**

Functional Need: Optimize use of physical plant assets

Functional Goal	Effectiveness Measures	Information Needs
(1) Organization determined goal to minimize interdepartment movement Average time and average distance of movement per procedure per patient per diagnostic group	(1) Average time and average distance of movement per procedure per patient per DRG	(1) Flow (time & distance) per procedure: for documents/clinicians/staff/patients Flow (time & distance) per patient: documents/clinicians/staff /patients Flow (time & distance) per DRG: documents/clinicians/staff /patients
(2) Maximize space allocation of priority services	(2) For each service identified: $\frac{\text{current actual space allocation}}{\text{needed space allocation}}$ $\frac{\text{current actual space allocation}}{\text{future needed space allocation}}$	(2) For each service identified: current & future space needs current space allocation
(3) Minimize physical plant overhead	(3) $\frac{\text{total maintenance cost}}{\text{total } (ft^2) \text{ available}}$ maintenance costs (ovhd) per $\frac{\text{building (per qtr or month)}}{\text{total square feet per building}}$	(3) Total maintenance cost (overhead) total sq. ft. available total sq. ft. per building maintenance costs (overhead) per building (per qtr or month)

IV. CURRENT INFORMATION SYSTEMS

A. INTRODUCTION

In Chapter III, the information needs of the Patuxent River Naval Hospital were identified. In this chapter, the information system at the Patuxent River MTF are examined to match those systems that provide the identified information needs. Each information system is described with a brief summary of the system's purpose and what information needs the system provides. It is not the intent of this chapter to identify the many information systems utilized at the Patuxent River Naval Hospital but only those systems that were identified during the information gathering phase and that provide the information needs identified in the previous chapter. In the next chapter, Analysis of Information Gaps, those information needs that do not reside in one of these information systems are identified.

B. INFORMATION NEEDS PROVIDED BY PATUXENT RIVER NAVAL HOSPITAL'S COMPUTER SYSTEMS

The information systems described here are the Composite Health Care System (CHCS); the Expense Assignment System, Version III (EAS III); the Microcomputer Worldwide Outpatient Reporting System (MICRO-WORS); the Standard Personnel

Management System (SPMS); and the Managed Care Query Application (MCQA) CHAMPUS Module.

1. The Composite Health Care System (CHCS)

The Composite Health Care System (CHCS) is a computer system designed to support key processes in the administration and delivery of care for both inpatients and outpatients.

CHCS is composed of seven modules: Outpatient Administration, Inpatient Administration, Direct Care, Inpatient Nursing, Pharmacy, Laboratory, and Radiology. The two modules that provide data for the identified information needs are the Outpatient Administration Module and the Inpatient Administration module. The Outpatient Administration Module provides 1) a centralized entry point for outpatient appointment processing and 2) outpatient workload and morbidity data. The Inpatient Administration Module will provide inpatient workload and morbidity data upon a configuration change to Patuxent River's module.

The Patient Assignment and Scheduling (PAS) function, a subset under the Outpatient Administration Module, is utilized at the Patuxent River MTF by all clinics that schedule outpatient appointments. The PAS function serves as a central database for appointments at the Patuxent River MTF. Appointments are currently scheduled by the respective clinic in which the patient will be seen. Referrals to other military facilities, such as Bethesda or Walter Reed, are currently scheduled via facsimile. This

method of scheduling referrals is a short term measure as the PAS module has the capability of scheduling referrals via CHCS. This function has not yet been implemented at the Patuxent River Naval Hospital.

The Patient Administration Department uses CHCS in the collection of outpatient workload and morbidity data. This data is then forwarded to the Financial Department for inclusion in the processing of the Medical Expense and Performance Reporting System (MEPRS) report. The MEPRS report is generated on the EAS III computer system, which will be covered in the next section. The AQCESS system currently provides the inpatient work load and morbidity data. The AQCESS system is scheduled to be phased out in September 1994 with CHCS taking over this function. CHCS is configured to process inpatient data but due to a configuration conflict with Patuxent River's Inpatient Administration Module this functionality is not yet available.

CHCS provides the following information needs listed by Critical Success Factor (CSF). The CSFs for the Patuxent River MTF are:

- CSF #1: Access to Quality Care and Service
- CSF #2: Management of Human Resources
- CSF #3: Management of Financial Resources
- CSF #4: Management of Physical Resources

The information needs provided by the CHCS Outpatient and Inpatient Administration Modules are as follows:

- CSF #1: Access to Quality Care and Service. The CHCS Patient Assignment and Scheduling (PAS) function provides a central database for scheduling appointments. From this database, the following information needs are available: 1) number of appointments available, 2) the number of patients provided appointments and 3) the time interval between when an appointment is scheduled to when the patient is seen.

- CSF #3: Management of Financial Resources. The Outpatient Administration module currently provides 1) the outpatient workload data and 2) the outpatient morbidity data. The AQCESS system, which is presently being phased out, currently provides 1) the inpatient workload data and 2) the inpatient morbidity data. CHCS will ultimately supersede the AQCESS system in fulfilling this function. Note: Though this information is not an identified information need, this data is central to the Financial Resources issue.

The work flow for the information needs provided by the CHCS system is included as Figure 3 and Figure 4.

2. The Expense Assignment System, Version III (EAS III)

The Medical Expense and Performance Reporting System (MEPRS) is a standardized format used in expense data collection, processing, and reporting practices of the DoD medical facilities. MEPRS provides for the accounting and reporting of expenses, manpower, and performance measures by facility. EAS III's primary function is the generation of the MEPRS report. EAS III is designed for the processing of expense and manpower data by the hospital staff and enables the computation of expense and performance data for submission to higher authority on a monthly basis.

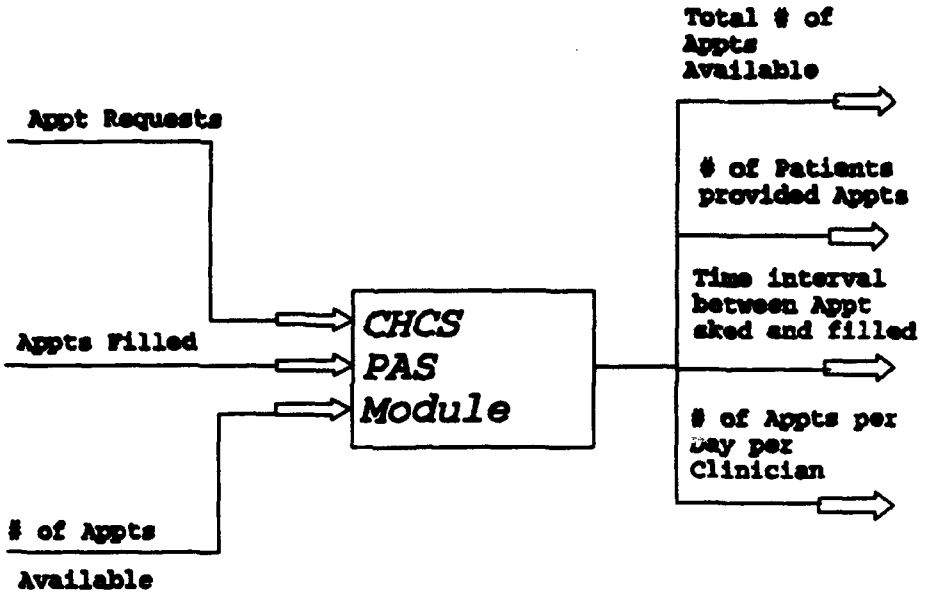

Figure 3. CHCS PAS Module Data Flow Diagram

EAS III is used by the Financial Department in the processing of the MEPRS report. The data collected from the various hospital clinics is entered into the EAS III system by the Financial Department personnel in the generation of the MEPRS report.

EAS III provides the following information needs listed by CSF:

- CSF #2: Management of Human Resources. EAS III provides the workload by clinic to total FTE (Full Time equivalent) by clinic. FTE is defined as a worker who completes 168 hours of work per month. Additionally, the number of support staff per clinic is available in EAS III for comparison workload productivity comparisons.

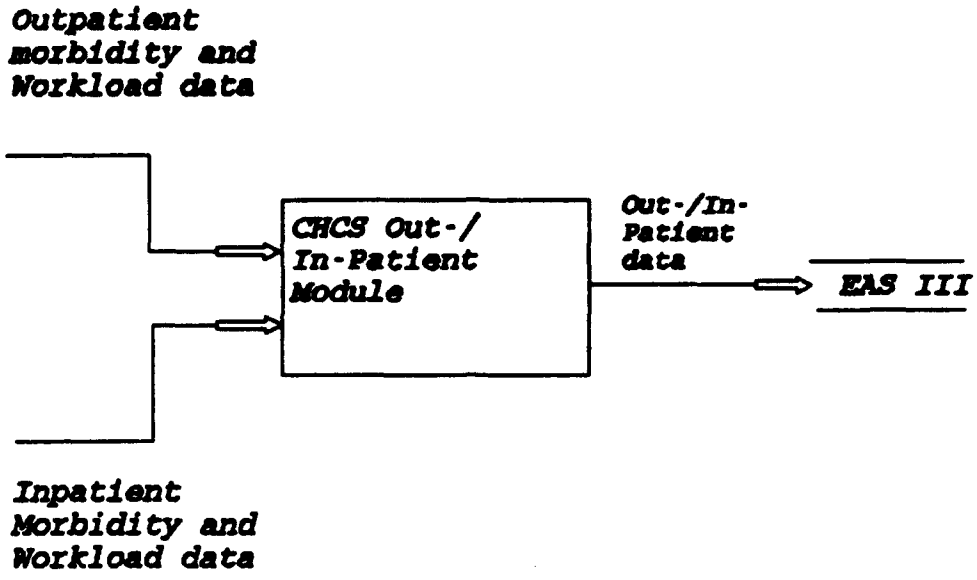

Figure 4. CHCS Outpatient and Inpatient Administration Modules Data Flow Diagram

- CSF #3: Management of Financial Resources. The EAS III system processes data provided by the following information systems in the generation of the MEPRS report: the man hour summary reports and the minutes of service report from the SPMS MML3 module (this system will be covered later in this chapter); the outpatient morbidity, the ancillary/medical services data, and the outpatient workload report from the MICRO-WORS system (covered in the next section); and the inpatient workload and morbidity data from the CHCS system. Note: Though this information is not an identified information need, this data process is central to the Financial Resources issue.

The work flow for the information needs provided by the EAS III system is included as Figure 5.

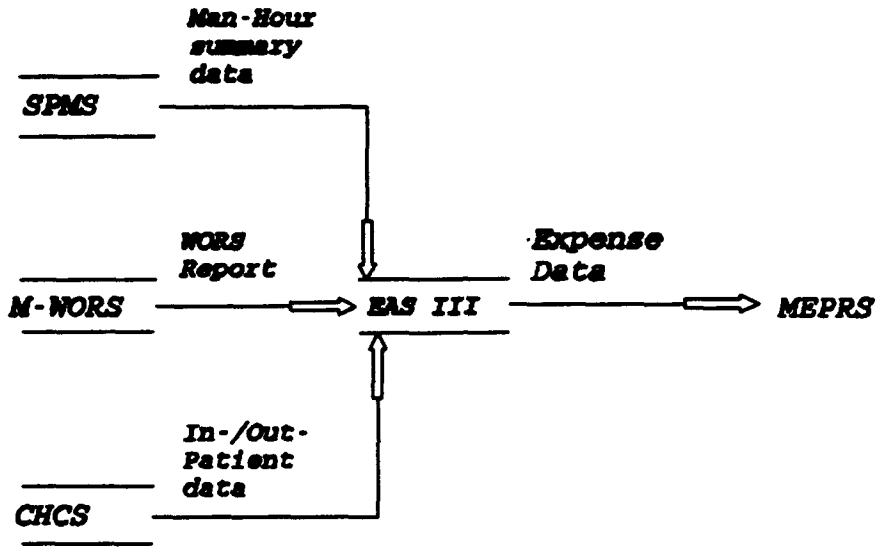

Figure 5. EAS III Data Flow Diagram

3. The Microcomputer Worldwide Outpatient Reporting System

The Microcomputer Worldwide Outpatient Reporting System (MICRO-WORS) is a microcomputer based software system used in the reporting of outpatient visits, ancillary workload data, and outpatient morbidity data. This system is designed to streamline the accuracy, completeness, and timeliness of this data. The accuracy of this data cannot be overstated as it is essential to effective hospital administration in the

preparation of budget estimates, the analysis of personnel authorizations and requirements, and in determining the size of additions to existing facilities.

The Patient Administration Department provides the outpatient data from the CHCS system to the Financial Department. The Financial Department enters this data into the MICRO-WORS system. MICRO-WORS takes this data and generates a WORS report, which provides summary data on outpatient activity for the MTF. The WORS report is then submitted to higher authority and is an input into the EAS III system in the generation of the MEPRS report.

MICRO-WORS provides the following information needs listed by CSF:

- CSF #3: Management of Human Resources. The primary inputs into the MICRO-WORS system are 1) the outpatient visits report, 2) the ancillary workload report, and 3) the outpatient morbidity report. MICRO-WORS takes this information and consolidates it under a WORS summary report. Note: Though these are not identified information needs, they are data processes that are central to the financial resources issue.

The work flow for the information needs provided by the MICRO-WORS system is included as Figure 6.

4. The Standard Personnel Management System (SPMS)

The Standard Personnel Management System (SPMS) provides a number of modules in the management and tracking of personnel assets. Three modules are of interest in examining the identified information needs, these modules include:

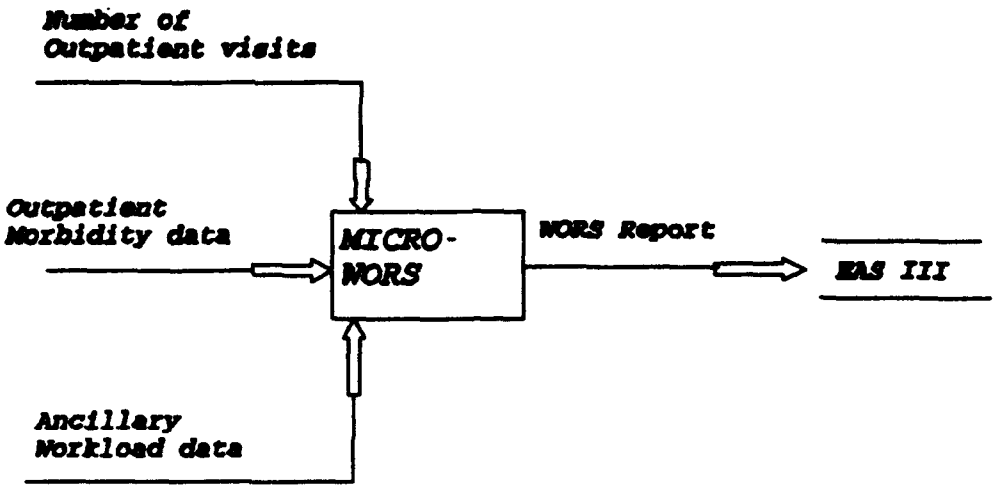

Figure 6. MICRO-WORS Data Flow Diagram

- The Manpower/Personnel Management (MP) module which maintains staff assignment information and tracks vacant/overmanned billets
- The MEPRS/Military Labor 3 (MML3) module produces the MEPRS summary reports and the military labor summary reports for the Navy Accounting System (IDARMS)
- The Education and Training (ET) module provides individual and group training records and provides documentation for staff credentials and continuing education requirements.

The Financial Department collects the man hours and minutes of service sheets from the various hospital clinics and enters them into the SPMS MML3 module where they are consolidated for submission into the EAS III system.

The SPMS MP module tracks the number of personnel assigned to the hospital and their respective ratings. The Manpower Department maintains this database.

The SPMS ET tracks the training received by hospital personnel. The Education and Training Department maintains this database and schedules the required training.

SPMS provides the following information needs by CSF:

- CSF #3: Management of Financial Resources. SPMS MML3 module consolidates 1) the man-hour summary sheets and 2) the minutes of service reports as inputs to the EAS III system. The SPMS ET module provides the status of management training. Note: Though these are not identified information needs, they are processes that are central to the financial resources issue.

- CSF #2: Management of Human Resources. SPMS MP module provides 1) the number of clinicians at the hospital, 2) the number of family practitioners, 3) the number of nurses, and 4) the number of administrative support staff.

The work flow for information needs provided by the SPMS system is included as Figure 7.

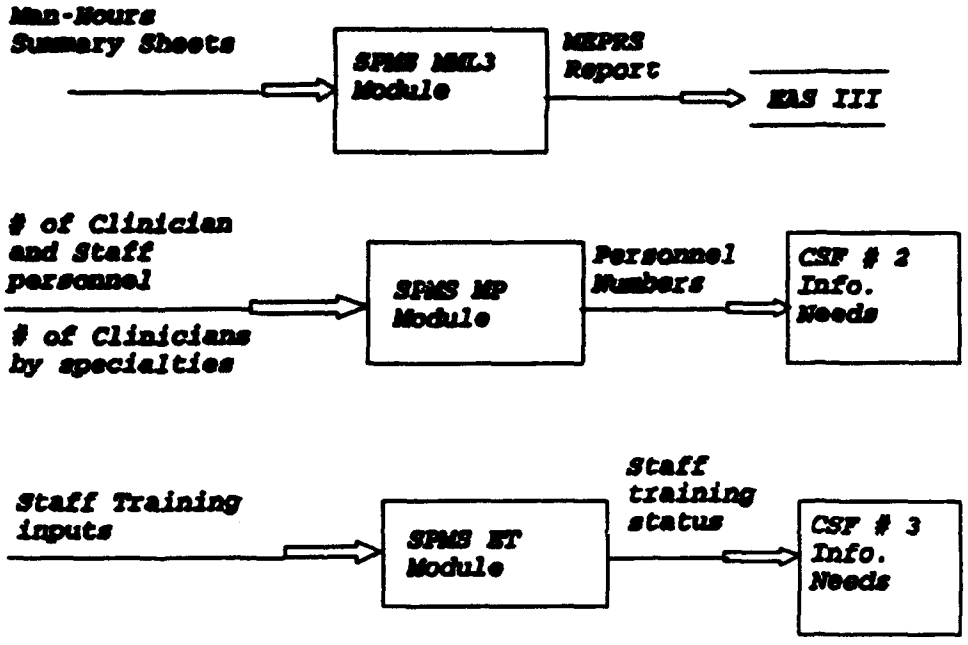

Figure 7. SPMS Data Flow Diagram

5. The Managed Care Query Application (MCQA) CHAMPUS Module

The CHAMPUS module is part of the MCQA online query system and resides on a mainframe managed by the Navy Medical Information Management Center (NMIMC) in Bethesda, Maryland. The CHAMPUS Module provides information on outpatient and inpatient visits through CHAMPUS.

The CHAMPUS Module is currently available via modem to the Patuxent River MTF. The Financial Department has access to the CHAMPUS module but does not incorporate this data in its current expense management practices. The following information needs are provided by the CHAMPUS module:

- CSF #1: Access to Quality Care and Service. CHAMPUS information by DRG or CPT). This information is available for the beneficiaries that reside in the Patuxent River MTF catchment area.
- CSF #2: Management of Human Resources. The number of patients using CHAMPUS over Patuxent River MTF care (normalized by diagnostic grouping).

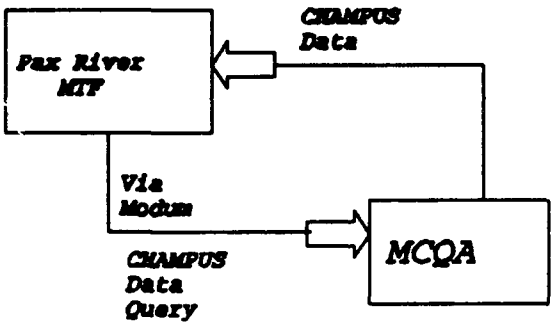

Figure 8. MCQA Data Flow Diagram

V. ANALYSIS OF INFORMATION GAPS

In Chapter III, the Critical Success Factors (CSFs) for the Patuxent River Naval Hospital were identified. Each CSF was broken down into a number of functional needs, with a number of corresponding effectiveness measures and information needs. In Chapter IV, the major information systems resident at the Patuxent River Naval Hospital were profiled and the information outputs from each were identified. It is the purpose of this chapter to identify those information needs, by CSF, that are not captured by the information systems at Patuxent River MTF (e.g., the "gaps" in the current information systems).

In the following sections, the information needs that are not resident in the existing information systems are grouped by CSF. A number of recommendations are then offered to fill this information gap.

A. CSF #1: ACCESS TO QUALITY CARE AND SERVICE

The following information needs are not provided by the existing information systems and are required to properly measure the Access to Quality Care and Service provided by Patuxent River Naval Hospital:

- Number of patients denied appointments

- Number of patients unable to access the appointment scheduling system to request an appointment
- Patient Satisfaction on the quality of service provided by the Patuxent River MTF
- The total number of acute care cases seen by the emergency room
- The total number of cases seen by the emergency room

In determining the total appointment demand, three factors must be known, the total number of patients provided appointments, the number of beneficiaries that are denied appointments and the number of beneficiaries that attempt to access the appointment scheduling system but are denied access. Currently, the last two factors are not captured in any of the existing information systems or in the appointment scheduling logs.

Feedback on patient satisfaction currently exists in the form of a questionnaire that is aimed at eliciting patient comment on the quality of service provided. This information is manually collected and is currently unavailable from any information system. This data requires timely processing in the analysis of comments.

The emergency room keeps logs on the number of patients seen by the emergency ward and has data on the number of acute cases seen through the emergency ward. However, none of this information resides in any of the existing computer systems. Extraction of this data would require manual compilation of emergency room logs by weeks, months, etc. and tallying of the data elements into some correlated form.

In order to fill these information gaps, the following actions are recommended:

- Install a communication device to capture data on those beneficiaries who were unable to access the appointment scheduling system. Patuxent River MTF is utilizing a phone sequencer on a limited bases but specific information (name, how many attempts to access the system were made, etc.) about the party that is calling is unavailable.

- Use a questionnaire to query beneficiaries that are seen by the emergency room for acute care needs to determine if they went to the emergency ward because 1) an appointment was not available or the waiting interval was unacceptable, or 2) they were unable to access the appointment system. Additionally the questionnaire would have to normalize this data by asking if 1) an attempt was made to make an appointment or 2) if the patient was unsure as to whether their ailment was an acute problem or a valid emergency.

Table 1 provides a listing of all the identified information needs and the information sources by the CSF, Access to Quality Care and Service. This table is a summary of the data needs that 1) are provided by the existing information systems at Patuxent River MTF, 2) are currently available in the logs or other paper media within the hospital, or 3) are not in existence in any form within the hospital.

INFORMATION NEEDS	INFORMATION SOURCES
Number of patients provided appts for Urgent requests.	CHCS Patient Assignment and Scheduling (PAS) module
Number of patients provided appts for Routine requests.	CHCS PAS module
Number of Appointments available for Urgent requests.	CHCS PAS module
Number of Appointments available for Routine requests.	CHCS PAS module
Number of Patients denied appointments for Urgent requests	Info not provided by existing systems
Number of Patients denied appointments for Routine requests	Info not provided by existing systems
Number of patients unable to access the system to request an appointment for Urgent requests	Info not provided by existing systems
Number of patients unable to access the system to request an appointment for Urgent requests	Info not provided by existing systems
CHAMPUS info by DRG and CPT	Managed Care Query Application (MCQA)
Acute care cases seen by the emergency room.	Emergency room logs and the 24 hour nursing reports
Total number of patients seen by the emergency room.	Emergency room logs and the 24 hour nursing reports

INFORMATION NEEDS	INFORMATION SOURCES
Time between when an appointment is sked and a patient is seen at Patuxent River (normalized by DRG or CPT).	CHCS PAS module
Time between when an appointment is sked and a patient is seen at another military hospital. (normalized by DRG or CPT).	The various Military facilities (Walter Reed, Bethesda, etc.)

B. CSF #2: MANAGEMENT OF HUMAN RESOURCES

The following information needs are not provided by the existing information systems and are required to properly measure the Management of Human Resources at the Patuxent River Naval Hospital:

- Total Patient Population: 1 to 5 years forecasted, currently, 1 to 5 years historical
- Total number of clinicians: 1 to 5 years forecasted
- Morbidity profile of total patient population: 1 to 5 years forecasted, currently, 1 to 5 years historical
- The number of clinicians with specialties to meet the population morbidity profile needs: 1 to 5 years forecasted
- Total number of staff personnel (nurses, administrators, corpsman, etc.): 1 to 5 years forecasted
- Number of appointments per day by DRG and CPT
- Total number of clinicians treating each DRG and CPT
- Total number of patients visiting the emergency room
- Total number of patients visiting the emergency room for acute care needs
- Number of support staff per clinician

There currently is no data provided by the existing information systems to project the future clinician manning requirements based on the anticipated patient population size and their morbidity profile.

It is anticipated that the number of active duty personnel will grow at the Patuxent River Naval Air Station as a number of DoD activities are expected to relocate to this Southern Maryland site. If, for example, 500 more active duty and civilian personnel are assigned to the area, there currently is no data available to show how hospital manning must adjust to meet this increased demand.

The forecasted number of clinicians with given specialties to the anticipated population morbidity profile is currently unknown. This data is vital in determining the optimal mix of specialized clinicians as, for example, a population with a greater number of retirees requires a type of care much different from that of a population of 20 to 45 year old active duty personnel.

The present and 1 to 5 years historical data on population size and the morbidity profile are currently not available in an information system at Patuxent River Naval Hospital. This information is available from demographic surveys and various hospital records. This information must reside in an information system to facilitate comparisons in the forecasting of population size and morbidity to future staffing requirements.

Another information need currently not provided for is the total number of appointments seen by DRG and CPT; and the total number of clinicians treating each

DRG and CPT. This data does not reside in any existing information systems but may be extracted from the various appointment logs and clinician treatment records.

The number of support staff (by staff we mean those with some medical expertise or specialty) per clinician is currently unavailable in any information system. If such data were accessible, projections could be made on that clinician's workload productivity if his/her number of support staff was increased or decreased.

In order to fill these information gaps, the following actions are recommended:

- Manning levels are currently independent of the population profile and size. The forecasted number of clinicians (normalized by specialty) and staff personnel must be tied to the forecasted population size and morbidity profile.
- Explore CHCS PAS capability for creating an ad hoc facility that will sum the number of appointments by DRG and CPT; and the number of clinicians treating each DRG and CPT.
- The capturing of emergency room visits for acute care needs was discussed under CSF #1 recommended actions.

Table 2 provides a listing of all the identified information needs and the information sources by the CSF, Management of Human Resources. This table is a summary of the data needs that 1) are provided by the existing information systems at Patuxent River MTF, 2) are currently available in the logs or other paper media within the hospital, or 3) are not in existence in any form within the hospital.

Information Needs	Information Sources
Total Patient Population:	
-1 to 5 yr forecast	Information not provided by existing information systems
-current population numbers	From demographic surveys and the Base Loading Plan for active duty
-1 to 5 yr historical	From historical demographic surveys
Total number of clinicians:	
-1 to 5 year forecasted	Information not provided by existing information systems
-current number of clinicians	SPMS Manpower (MP) module
-1 to 5 historical	Historical data and SPMS (MP)
Morbidity profile of Population:	
- 1 to 5 yr forecasted	Information not provided by existing information systems
- current population morbidity profile	Approximate numbers are known
1 to 5 yr historical	Historical data exists
Number of clinicians with specialties to meet population morbidity profile needs:	
- 1 to 5 years forecasted	Information not provided by existing information systems
- current numbers	SPMS (MP)
- 1 to 5 years historical	Historical data and SPMS (MP)

INFORMATION NEEDS	INFORMATION SOURCES
Number of staff: Nurses, Administrative, corpsman, etc.	
1 to 5 yr forecast	Information not provided by existing information systems
Current number	SPMS (MP)
1 to 5 yr historical	Historical data and SPMS (MP)
Number of appts per day per DRG and CPT	Currently not available
Total number of clinicians treating each DRG and CPT	May be available but probably piecemeal throughout the organization
Total # of patients visiting the emergency room	Emergency Room Logs and Nurses 24 hour report
Total # of patients visiting the emergency room with acute care needs.	Emergency Room Logs and Nurses 24 hour report
# of patients using CHAMPUS over Patuxent care (normalized by DRG and type of procedure capable of being treated at Patuxent)	MCQA
# of patients using CHAMPUS capable of being seen at Patuxent (normalized by DRG and CPT)	MCQA

C. CSF #3: MANAGEMENT OF FINANCIAL RESOURCES

The following information needs are not provided by the existing information systems and are required to properly measure the Management of Financial Resources at the Patuxent River Naval Hospital:

- Labor cost per procedure: Clinician and staff time (in hours), Clinician and staff costs per hour
- Supply costs per procedure per quarter
- The total number of labor hours per procedure per quarter
- Labor cost per patient: Clinician and staff time (in hours), Clinician and staff costs per hour
- The total supply costs per patient hour
- The total number of labor hours per patient per quarter

Quantifying the cost of medical care is of ever increasing importance at the Patuxent River MTF. Currently expenses are being reported by the total costs incurred and not the cost of providing a unit of service. The Medical Expense and Performance Reporting System (MEPRS) currently does not provide a breakdown of the labor costs by procedure or patient. The labor costs per procedure and patient are effectiveness measures that will indicate the cost of providing a type of service or care. Those services that are costly can then be examined for possible cost cutting measures.

In order to fill these information gaps, the following actions are recommended:

- Create an on-line or paper document to capture the labor costs per procedure and patient. Explore the possible use of EAS III and MICRO-WORS to generate the on-line report. The paper document could be an additional data sheet in the generation of the MEPRS report. The use of additional paper documents should be considered a short term measure as the organization should make every effort to eliminate paper media to the greatest extent possible.

Table 3 provides a listing of all the identified information needs and the information sources under the CSF Management of Financial Resources. This table is a summary of the data needs that 1) are provided by the existing information systems at Patuxent River MTF, 2) are currently available in the logs or other paper media within the hospital, or 3) are not in existence in any form within the hospital.

INFORMATION NEEDS	INFORMATION SOURCES
Labor costs per procedure:	
- Clinician Time (hrs)	Information not provided by existing information systems
- Staff time (hrs)	Information not provided by existing information systems
- Clinician cost per hour	Information not provided by existing information systems
- Staff costs per hour	Information not provided by existing information systems
Supply costs per procedure	Information not provided by existing information systems
Overhead Costs:	
- Total ovhd cost per quarter	MEPRS Report
- Total hours per quarter	Calculated from any Calendar
- Total number of hours per procedure per quarter	Information available by visits in EAS III but not by patient

INFORMATION NEEDS	INFORMATION SOURCES
Labor costs per Patient:	
- Clinician time (hrs)	Information not provided by existing information systems
- Staff time (hrs)	Information not provided by existing information systems
- Clinician costs per hour	Information not provided by existing information systems
- Staff costs per hour	Information not provided by existing information systems
Supply costs per patient hour	Information not provided by existing information systems
Overhead Costs:	
- Total ovhd cost per qtr	MEPRS
- Total # patient hours per quarter	Information available by visits in EAS III but not by patient
The number of hours a director receives in training by specified area	SPMS (ET)

D. CSF #4: Management of Physical Resources

The following information needs are not provided by the existing information systems and are required to properly measure the Management of Physical Resources at the Patuxent River Naval Hospital:

- The flow time and distance per procedure: by documents, clinician, staff personnel, and patients.
- The flow time and distance per patient: by documents, clinician, staff personnel, and patients.
- The flow time and distance per DRG: by documents, clinician, staff personnel, and patients.
- Current and future space requirements by departments
- Total maintenance costs broken down by building

The Patuxent River MTF is a conglomeration of various buildings of different sizes, ages, and distances from the main hospital complex. The need to consolidate and optimally allocate these physical resources requires information that is not provided by the existing information systems. The flow time and distance per procedure, patient, and DRG/CPT is needed as an indicator of what services require the greatest cost, in time and distance, to provide. There is currently no information available to the Commanding Officer at Patuxent River MTF on how to optimally configure his facilities.

The current space required by each Director and the associated clinics is an unknown quantity at the Patuxent River MTF. The Directors require information on what factors to consider when determining space needs. These factors currently are unknown or do not exist.

In order to fill these information gaps, the following actions are recommended:

- Hire an outside consultant to conduct a work flow time and distance analysis.
- Utilize a digital mapping system to detail the facilities dimensions and characteristics. This would allow the exploration of various facility configurations prior to implementing changes.

Table 4 provides a listing of all the identified information needs and the information sources under the CSF Management of Financial Resources. This table is a summary of the data needs that 1) are provided by the existing information systems at Patuxent River MTF, 2) are currently available in the logs or other paper media within the hospital, or 3) are not in existence in any form within the hospital.

INFORMATION NEEDS	INFORMATION SOURCE
Flow time and distance per procedure:	
- by documents	Information not provided by existing info systems
- by clinician	Information not provided by existing info systems
- by staff personnel	Information not provided by existing info systems
- by patients	Information not provided by existing info systems
Flow time and distance per patient:	
- by documents	Information not provided by existing info systems
- by clinicians	Information not provided by existing info systems
- by staff	Information not provided by existing info systems
- by patients	Information not provided by existing info systems
Flow time and distance per DRG/CPT:	
- by documents	Information not provided by existing info systems
- by clinicians	Information not provided by existing info systems
- by staff	Information not provided by existing info systems
- by patients	Information not provided by existing info systems

INFORMATION NEEDS	INFORMATION SOURCES
Total space available	Facilities manager maintains this information
Current space requirements by departments	Information not provided by existing information systems
Future space requirements by departments	Information not provided by existing information systems
Current space allocation	Facilities Manager maintains this information
Maintenance costs per building per time interval (monthly, quarterly)	Facilities manager maintains this information
Total maintenance costs	Facilities manager maintains this information
Total square footage available per building	Facilities manager maintains this information
Total square footage available	Facilities manager maintains this information

VI. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this project is identification of Patuxent River Naval Hospital's information requirements and a comparison thereof with current information available from existing systems. The information requirements were determined from interviews with the Commanding Officer, the Executive Officer, directors, and key department heads at MTF, Patuxent River. These information requirements can be captured within a select group of critical success factors (CSFs). It is understood that these CSFs are not the only key processes of the organization. They are, however, the areas identified by the managers at MTF, Patuxent River as needing attention. Some results are unique to MTF, Patuxent River and are not intended to be universally applicable to any Medical Treatment Facility.

The scope of this effort targeted identification of the information needed by managers at various levels of the hospital, to manage. The information needs are a direct reflection of the managers' articulated functional needs. Their accuracy is determined by:

(1) the managers' ability to describe what they need, and

(2) the analyst's ability to elicit and comprehend the need, and frame it in an understandable format.

Developing information needs is not an exact science. It is an iterative process. The information needs presented here are the first iteration.

It is hoped that this thesis will provide a framework for the organization to collect and format actual information, set targets to measure effectiveness, analyze gaps between actual measures and target values, and develop a course of action to improve effectiveness.

The organization must continually evaluate the validity of the effectiveness measures. There is nothing sacred about the measures presented here. Management must revise and improve the measures as needed.

A. CONCLUSIONS

The project revealed that a number of the information needs, identified as required by the organization in meeting its functional needs, are currently not provided for by the information systems available at MTF, Patuxent River today. The most critical unavailable information needs are:

- **Information used in forecasting future needs.** These future needs include the expected medical needs for the population in the next 1 to 5 years, and the number of clinicians required in the next 1 to 5 years based on projected medical needs. This contrasts with current methods that employ an analysis of completed workload.
- **Information about appointment demand.**
- **Detailed costing information.** This includes data required to calculate unit costs of procedures, or diagnostic category patient costs.

- **Physical space needs (current and future).**

Some other information needs are available in accessible systems, however, the information is not in a useable or understandable format. These information needs include, but are not limited to:

- **CHAMPUS utilization information for procedures that Patuxent River could do but are currently being treated via CHAMPUS.** This information is of value to the manager as he examines how efficiently or effectively he is providing quality access to care. It may identify areas that are more economical to treat at MTF Patuxent. (available via MCQA)

- **General financial information.** A plethora of data is collected for external reporting requirements. It is man hour intensive to collect, format, and input the data, and is only done monthly. There is negligible use of the raw data on site. External reports are of little use to on-site managers (e.g., MEPRS). An ad hoc report capability using this information would be helpful.

B. OBSERVATIONS

There is a great deal of data produced for submission to higher authority. Very little of the collected data is being used within the organization. An example of this is the MEPRS report. The MEPRS report captures operational data on how the organization is performing compared to BUMED standards. The managers at MTF, Patuxent River use very little, if any, of this data in their management decisions. The reason for this may be due to poor presentation format of the information (hard to read) and/or manager's perception that the data is not useful in their day to day management decisions.

The information presented in the Navy Medical Executive Information System is not particularly useful due to its time late nature and its emphasis on the comparisons between MTF, Patuxent River and other facilities with different capabilities, patient population size, and population medical needs (i.e., comparing apples with oranges). The information identified in Chapter III is representative of the kind of information that key managers would like to have available to support decision making through EIS.

C. INFORMATION SYSTEMS MANAGEMENT RECOMMENDATIONS

In addition to the information gaps that have been identified, some other management observations are provided in information systems management. These are purely the suggestions of the authors to help improve information technology implementation at Patuxent River Naval Hospital.

1. Information Systems Strategic Planning

Information systems and software have been implemented at Patuxent River Naval Hospital in a seemingly random manner. Several discrete systems exist with little thought toward compatibility issues or coordination of effort to meet the overall organization goals. Without clear direction, it is unreasonable to expect anything but disorganization and frustration in system implementation. As the old saying goes, "If you don't care where you're going, any road will take you there."

Information systems have increased significantly in their role within organizations. They now provide some of the most important tools for influencing an

organization's future. Information systems planning must provide direction for how to achieve the organization's future.

> ...the majority of health care institutions either don't have an I/S [Information System] strategic plan or have only a marginally useful plan. Those without a plan use the excuse that the parent organization lacks a plan, or the culture is too informal and fast-moving to have a multiyear plan. Those with a massive [plan] end up allowing the plan to gather dust on a bookshelf. Only during major hospital or I/S department management changes is it revised. The problem with not having a strategic plan is that I/S investments are by definition long-term commitments. In addition, each application and technology decision is both enabling and constraining - it opens some doors and closes others. Without an overall blueprint, however, it is hard to justify investments in infrastructure such as enterprise networks, system or network administration tools, spare systems, capacity acquisition, disaster recovery arrangements and staff training. [Ref. 1]

The "delicatessen" information systems that are deployed at MTF, Patuxent River individually solve some problems. In the long run, however, they limit the types of service that can be provided.

Training plays a crucial role in the I/S strategy. Currently, systems and software are implemented without adequate planning for training requirements. No continuing overall training plan for information systems exists. Many currently installed systems may provide some of the capabilities desired. However, the total capabilities of some systems are not well understood and so are not fully utilized. In some cases, there is no one on site with even a working knowledge of a system (e.g., MCQA). It takes significant time and effort to learn the capabilities of the systems and software, so there is an investment required. With proper strategic planning that investment is worthwhile.

2. Information Systems Leadership

There is no one single point of contact for all information systems management issues at Patuxent River Naval Hospital. System implementation appears to be externally driven, and there is no high level executive within the organization (other than the CO or XO) to resolve internal information systems conflicts. The Management Information Division (currently staffed with two people) does not provide, nor should it be expected to provide, the management necessary to direct the hospital's information strategy.

The crucial role that information systems play in an organization's performance warrant an executive level information leader.

> This leadership may come from existing upper level managers, but it is likely to require a "chief information officer" (CIO) with a set of executive roles and responsibilities. The CIO must be high enough in an organization to relate and adopt organizational goals, and assume the responsibility of harnessing the technology to pursue those goals. [Ref. 2]

A Chief Information Officer caliber individual (probably at the director level for the hospital) is necessary to be the hospital's "single voice" in discussions with external organizations. This leader provides the foresight to look out for the hospital's overall interests. Additionally, resolution of information systems conflicts within the organization can best be accomplished at a level equal to directors. Individual system

experts or managers are still necessary, but there must be a strategic position tying the organization together.

APPENDIX A. RESEARCH METHODOLOGY

A. INTRODUCTION

A pragmatic method is needed to capture the information needs of an organization, specifically in those functional areas of greatest priority to that organization. The research methodology outline here is designed to develop a frame work for capturing these information needs.

B. RESEARCH METHODOLOGY

The research methodology is composed of the following areas:

- Preparing the information gathering plan
- Identification of the organization's information needs
- Profiling the organization
- Profiling the users
- Work flow analysis

The objective of the research methodology is the identification of the organization's information needs. Once the organization's information needs are identified, those

information needs that are available from the existing information systems are noted as "provided for" and those information needs that are not available are noted as "gaps".

1. Preparing Information Gathering Plans

a. Information-Gathering Strategies

The information gathering plan can be divided into five broad stages:

- Identify research questions and information sources
- Conduct research to gather raw data to process
- Derive meaningful information for information needs
- Verify that the research questions are answered
- Confirm that your conclusions are correct

These broad stages are executed through an iterative process described below:

1. Start by interviewing key managers to determine important organizational factors and background information.
2. Interview a small sample of users to outline how they work within the organization and then observe the users to validate if they work as described.
3. Derive a first-cut summation on key processes based on accumulated data.
4. Users provide feedback as to the accuracy of the first-cut summation.

5. Repeat the above steps probing for greater detail and refinement.

6. Derive expanded information requirements.

7. Repeat the above steps with a broader population to validate the expanded information requirements.

8. With the more detailed information requirements known, the scope and constraints of the information gathering plan are defined. The scope are boundaries or areas within the organization that will be examined. The constraints are those budgetary limits and existing systems utilization requirements.

b. Information-Gathering Techniques

There are a number of information gathering methods that can be employed in determining user requirements. These are questionnaires, personal interviews, telephone surveys, observation techniques, and focus groups. These methods can entail any level abstraction from the very general to the very specific. The fundamental goal of the information gathering process is to get the users to explain what they want without telling them what they need. Questionnaire surveys are designed to elicit responses from managers and users on various research questions. The advantages of questionnaires are that they can reach a large population, at less cost, and without interviewer bias. The shortcoming of such surveys are that respondents cannot seek clarification and an adequate sampling of the population is not guaranteed.

Personal interviews can be either structured with predetermined questions and no latitude for ad hoc queries or unstructured with a few stimulator questions and the interviewers skill determining the areas needed to be probed in greater detail.

Structured interviews are quick to administer, easy to process, and are good for a large number of interviews, but don't allow exploration of user's feelings or beliefs. Unstructured interviews allow for comprehensive answers and when little prior information is available, but this technique is time consuming and requires a skilled interviewer.

Telephone surveys are best suited to structured, open-ended questions, allowing quick access to a select group and promise high response rates, but requires skill in holding the respondents attention and limits the opportunity to probe for details.

Observation of the work environment is an effective way to compare variances from questionnaire and interview responses to what actually occurs in the work place. Observation can however appear intrusive to users, is costly, and contains a degree of observer bias.

Focus groups are made up of an ad hoc set of individuals representing a sampling of the target users. They allow for percolating of new ideas, discussion of "hard spots" with the current system, and confirmation of conclusions. Focus groups do, however, require a skilled moderator, are costly, and are not useful in providing precise quantitative information.

2. The Information Needs of the Organization

With the pertinent raw data collected and the organization's information needs outlined, the Critical Success Factors (CSFs) for the organization are developed. The

CSFs are the limited number of areas for an organization, in which results, if satisfactory, will ensure successful competitive performance for the organization. Each information need is a subset of a CSF. As the information-gathering strategy is executed, functional needs will be identified. A functional need is a general statement as to an activity that requires improvement. This may be the functional need to increase system interoperability or to minimize the time required to complete a particular procedure. Once a functional need is determined, a functional goal must be defined by the organization. A functional goal is the type of improvement expected to meet a functional need (i.e., increase system interoperability by 15% or reduce procedure time by 2 hours).

With each functional need made realizable through the achievement of a number of functional goals, a number of effectiveness measures must be determined. Effectiveness measures are indicators as to whether a functional goal has been met. Effectiveness measures are composed of a number of data needs. These data needs are the information needs of the organization.

3. Profiling The Organization

The purpose of organizational profiling is to provide insight into the organization's operations, strategies, and constraints.

The first step in organizational profiling is to determine the mission or purpose the organization serves. This information can be found in the organizational

charter or equivalent document. Once the mission is defined, the strategy the organization is using to achieve its mission is identified.

The next step is to define how the organization operates. This is done by examining how the user organization functions internally and with the various external entities with which it interfaces.

Identification of applicable guidelines determines the bounds within which critical activities must be accomplished. Guidelines are management directives, regulations, standards, and union rules that dictate the latitude within which requirements must be met.

The final step in organizational profiling is to examine the existing information systems purpose, capabilities, functionality, and constraints. Based on these attributes, the existing systems are examined to determine if they provide the identified information needs.

4. User Profile

The user-profiling process is critical to determining the characteristics of the target population of users. A user is defined as any one who will interface with a computer system to extract or manipulate the information needs that are identified. User profiles provide insight as to the best development of user requirements. User profiles are developed based on the users various cognitive abilities and a number of work environment issues.

Users can be categorized by their respective cognitive styles. A user may be precision-oriented, like engineers and accountants, accustomed to details and well defined problems. Such users adapt readily to structured computer systems. People-oriented users, like those in human resources, social services, and sales, are use to ambiguity and undefined problem sets. Many of these users are easily frustrated by the structure of computer systems and often would like a greater ad hoc capability. Analytic users shun standard computer command structure and would like the ability to manipulate their user systems creating solutions to problems based on their innovative style. The last cognitive user category is the creative user with artistic ability. These users are often graphic artist or 3-D designers use to solving problems with a free form approach.

Once the cognitive style of the user is determined, issues impacting his/her work environment can be identified. Issues affecting the work place are hidden agendas, inter/intra-organizational conflicts, cultural dynamics, and adaptation to change.

Hidden agendas are the ambitions of individual users that may be contradictory to the mission of the organization. Throughout the endeavor to compile user requirements, the researcher must be attentive to underlying dynamics that may or may not be explicitly addressed.

Organizational conflicts among managers and front line workers can erode the best laid plans. It requires a skilled researcher to work through conflicts and identify functional needs that if met could possibly reduce their impact.

Cultural issues can drive users requirements. As the research methodology is executed, functional needs based on "we've always done it that way" are weeded out. Cultural issues however cannot be overlooked as they can sabotage the best intended system structure.

The final issue is the impact users will face based on any implemented changes from the requirements analysis and new business processes. Change may take on the form of learning curves for new systems, increased user responsibility, loss of prestige, and turnover or reallocation of users.

5. Work Flow Analysis

The method for evaluating the various organizational functions is through work flow analysis. Work flow analysis uses a top-down analysis technique to decompose the organization into specific functional activities. Once the business processes are broken down by functional activity, information needs are analyzed using input-process-output modeling, specifically a structured analysis technique called Data Flow Diagraming.

A method for capturing the business processes is through top-down analysis. Top-down analysis is a technique in which top-level problems are divided into two or more smaller problems then subdivided again, the purpose of which is to define and compartmentalize the problem as clearly as possible. The advantage of this approach is that it facilitates the development of detailed requirements specification readily lending

itself as the basis for the design process. One important factor should be included here and that is the importance of traceability. As the top-down process is worked through, requirements will proliferate. It is essential that no requirements are lost and that no "gold plating" is added. Traceability should be viewed as a bookkeeping process where requirements are identified by its original source and within the different levels of the hierarchy. Input-process-output modeling clearly defines the three characteristics of any information processing function. It defines what inputs feed into a particular process, what the process does to manipulate the inputs, and changes them into some form of output. This technique is easy to understand, readily mapping information into design specifications and separates user activities from machine functions.

Logical modeling is a graphical technique used to capture the business process at various levels of details. Data Flow Diagrams (DFD) are often used in logical modeling to describe the current system or a proposed new process without considering the physical environment in which the data flows (i.e., mail, e-mail, telephone, etc.) or the physical environment in which the data is stored (i.e., tape, disk, etc.).

Work flow analysis utilizes the models and analysis techniques described above to define the business processes and the effectiveness of the existing system. A goal of requirements analysis is to highlight any gaps in the existing process and determine the new functionality required to be added to fill these gaps. DFDs are used to develop the desired system processes with this added functionality.

6. User Participation

An important part of the information-gathering process is to provide a continuous feedback loop to the users for validating identified requirements. The users have an active role in identifying and confirming requirements. It should be recognized that the user is an expert in what he needs but it is up to the analyst to tailor those needs towards goals of the whole organization.

APPENDIX B. MANAGERS QUESTIONNAIRE

A. TELEPHONE INTERVIEWS QUESTIONNAIRE

1. What are the top priorities/objectives in your command/department?
2. What part of the job do you feel is most important?
3. What part of the job do you get the most satisfaction from?
4. What are the key decisions you make in meeting your objectives?
5. How do you go about making those decisions?
6. What type of information do you need to make those decisions?
7. Where does this information come from both externally and internally?
8. How do you currently get that information?
9. What information would you like to have that is currently unavailable?

B. PERSONAL INTERVIEWS QUESTIONNAIRE

1. What is your role in this organization?
2. What are the top priorities/objectives in your command/department?
3. What do you see as your major obstacle to success?
4. What are the key decisions you make in meeting your objectives?
5. How do you go about making those decisions?
6. What type of information do you need to make those decisions?
7. Where does this information come from both externally and internally?
8. How do you currently get that information?
9. How do you perceive your role as a manager?
10. How do your measure quality of care?
11 What do you believe are the Critical Success Factors for the organization?
12. In your management function, is there any information you would like that is currently unavailable?

APPENDIX C. LIST OF ACRONYMS

CHAMPUS: Civilian Health and Medical Program of the Uniformed Services.

CPT: Current Procedural Group

CSF: Critical Success Factor

DRG: Diagnostic Related Group

EAS III: Expense Assignment System, Version III

FTE: Full-Time Equivalent Work-Month

MCQA: The Managed Care Query Application (CHAMPUS Module)

MICRO-WORS: Microcomputer Worldwide Outpatient Reporting System

MTF: Medical Treatment Facility

NMIMC: Navy Medical Information Management Center

SPMS: Standard Personnel Management System

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