

# **APPENDIX A: BAY PINES VETERANS AFFAIRS MEDICAL CENTER**

## **A. Health System Overview**

The Bay Pines Veterans Affairs Medical Center (VAMC) is one of 165 centers owned and operated by the Department of Veterans Affairs. On their campus of more than 300 acres, they have an acute care hospital with an integrated rehabilitation facility and emergency department, pharmacy, laboratory, radiology services, and outpatient physician offices. The geriatrics and extended care service oversees a geriatric evaluation and management unit, transitional care unit, a nursing home care unit (divided into two units), a senior clinic, home-based primary care, contract home health programs, and a hospice. They also have affiliated physician clinics at other geographic locations and contractual relationships with non-VA community nursing homes. A pilot program at Bay Pines consists of the community care coordination service, which provides remote monitoring for home patients.

Veteran Health Information System and Technology Architecture (VistA)/Computerized Patient Record System (CPRS) fully extends into all VA-owned and operated provider sites. They are just beginning to establish EHR linkages with contracted clinics that are not part of the VA system (e.g., audiology, ophthalmology, and radiology where required). In these situations, the VA will provide the equipment and the user has to comply with VA rules. They also are developing pharmacy linkages with state veterans homes. With the expanding number of primary care visits in the region (more than 80,000 patients in 2003), there is increased pressure to strengthen EHR linkages with clinics not on the Bay Pines campus.

Each VAMC, such as Bay Pines, is part of the larger national system for processing and transmission of the data to a central repository in Austin, Texas. There are other, more specialized processing centers where data are submitted and analyses are conducted and sent back to the VAMCs. The national user groups, for both development and troubleshooting the VistA/CPRS, provide patches that are implemented locally but each VAMC has considerable flexibility in customizing VistA/CPRS at each health setting within specific operational parameters. Central mandates are responsible for certain key aspects of implementation. For example, physicians are mandated to do their own entry of orders and notes, despite resistance at some sites. Medication bar coding is another area in which processes are mandated, even when there is staff resistance.

## **B. Clinical Functions**

### **1. Structure/Content of EHR Used Across Settings**

The VAMC EHR used at BP and all other affiliated Bay Pines facilities is a uniform record that can be accessed from any setting on the campus. Every patient record in the EHR can be accessed by name, hospital ward, clinic, physician, or service, simplifying locating the record. The clinical record includes the following tabs: cover sheet, problem list, medication list, orders, notes, consults, discharge summary, labs, reports, and vital signs. Each of these tabs then can be opened to view the designated aspect of the record. Postings are accessible in the upper right-hand corner of the screen, including crisis notes "C," warning notes "W," allergies "A," and advanced directives "D." The cover sheet is a distillation of information including a summary of the active problems, allergies, specific postings, clinical reminders, active medications, labs, vitals, and appointments. The problem list includes active and inactive problems entered by any provider, and an ICD-9 code is assigned; however, there is considerable question about the consistency of coding in the problem list, and the list is not edited in a systematic fashion. A single medication list is maintained that includes active and inactive medications. Entries into this list follow a structured format. Consults use structured templates typically designed by the consulting service, and lab orders, reports, and vital signs also are structured. Vital signs include blood pressure, pulse, respiratory rate, pain, and weight gain. These can all be graphed for viewing.

Local or individual templates are used for orders, notes, and discharge summary. On some services, the template is highly structured, providing a guideline for care, whereas in others, it is a broad outline of topics into which free text is typed. Variation exists in the use of templates such that some clinicians invest substantial time in developing templates to import objects from other portions of the record and other clinicians start fresh each time they type in a note. Clinicians that used more structured templates, by importing information from multiple locations, were often more enthusiastic about the system and the time saved.

Regardless of setting, clinicians were enthusiastic about the ability to access records from prior stays both at the VAMC in Bay Pines and other VA centers. Although it was sometimes difficult to access all aspects of the EHR from another setting, local information was readily available and most information from other settings also tended to be available. Thus, information necessary for transitions across settings (such as hospital to nursing home or home health care, or rehospitalization from inpatient rehabilitation unit) benefited from complete information transfer. The only problems occurred in relation to information about patients from providers who were not part of the VA. Because veterans also used Medicare services and/or purchased medications from other pharmacies, lack of extension outside the VA represented a problem for some patients. In particular, entering non-VA data was a workload problem and medication data were incomplete at times, even when other non-VA settings had electronic systems.

The EHR became the communication vehicle for clinicians and all ancillary services. Physicians, for example, would spend substantial portions of their day at the terminal entering assessment and order information, and reviewing the numerous messages/action items received from nursing staff, laboratories, pharmacies, radiology, and consults. Physicians and other clinicians also dictate a significant amount of information (annual dictation costs exceeded \$400,000 in 2003) that is then given to a third party firm for transcribing. Transcribed information is then electronically downloaded into CPRS. The action items indicated when new findings were available to view or when a response was needed. Physicians needed to become facile in the use of the computer. Some were experimenting with word recognition software to expedite information input. A concern among some physicians was that they were spending more time at the computer and less time with patients. Others were favorably impressed by the system because of both instant communication and fewer problems interpreting handwriting. One major gap in the use of the EHR was noted as being recognized and was being addressed at the highest levels: during computer downtime (scheduled or unscheduled), staff in the Emergency Room or a clinic do not have access to the EHR. The current downtime contingency system stored pertinent clinical and administrative data on those veterans in an inpatient status or those with a scheduled appointment. This system did not account for emergencies or "walk-ins." A proposed "fix" is to move data for veterans seen within the previous 25 months to a secondary database to serve areas such as the ER and clinics.

## **2. Nursing Homes**

**Sites.** Nursing home care units include the following:

1. Two Nursing Home Care Units (NHCU) have a bed capacity of 206. Previously there were more beds available, but now they have a geriatric clinic there as well as the home health programs. These units treat very complex and relatively short-stay patients as well as some longer-term patients that have been residing there for multiple years. In one unit, there is a heavy emphasis on wound care and the most seriously ill patients, and on the other unit there is respite care, oncology, and a mix of clinical problems.
2. The Geriatric Evaluation and Management (GEM) unit is an eight-bed unit that is used for triage. A majority (approximately 75%) of the patients are admitted from the hospital, and the remaining caseload is admitted from the community or nursing homes. GEM patients require complete evaluations and longer stays than those in the NHCU.
3. The Transitional Care Unit (TCU), which has 22 beds, admits patients from the VAMC. All post-acute nursing home patients with IV orders are assigned to this unit (the IV support team is located in the TCU), and all requiring intense pulmonary care are seen in TCU.

Each nursing home unit has a network connection to the EHR with read/write access. Laptops are used at the point of care, and terminals are located in hallways and nursing stations.

Geriatrics and extended care service are completely separate. There are three physician FTEs, and they are recruiting a fourth physician. All admissions to the extended care service begin with a screening, which is ordered as a consult in acute care, ambulatory care, inpatient rehab, home care, etc. They review the discharge summary, evaluate the patient, and determine what is the most appropriate extended care location. Both the physician and nurse are involved.

**Admission.** The referring hospital is asked to complete the discharge summary and a paper transfer form also is sent, including medication list, diagnosis, and both nursing and social work updates. Physician orders come first in the nursing home admission process. These orders activate the admission, alerting the Nurse Practitioner who then completes the H&P subsequent to the physician orders and develops a more complete plan of care. The physician admission process cannot begin until a clerk assures that the discharge occurs from the prior setting and another clerk assures that the admission to the NHCU has occurred.

Even though patient information can be accessed from another setting or from a prior admission to the same setting, the clinicians always conduct a reassessment for a new admission. The reasons are that geriatrics and extended care have a different perspective on the H&P than prior information may contain, and they need to become familiar with any patients that they will be treating.

**Orders.** Physicians enter orders into the system using standard order set (or non-order set) options, which involve admission templates regarding advanced directive status, social work, medication, and consultation (e.g., dietary, PT, and OT). The system reportedly takes twice as long to write the physician orders than when orders were written by hand. Urgent medication orders take approximately 25 minutes to be filled when called to the pharmacy; otherwise, the electronic pharmacy order process takes several hours to be completed. Bay Pines radiology results are obtained through electronically transmitted imagery and actual images as well as by text reports. Elevated lab results are called to the physician, in addition to the electronic message.

A problem for physicians is separating important messages from less important messages. Every day, approximately 200 action items can be sent to a geriatrician for review and sign off. The items are not clearly prioritized so that at times a nurse on the unit will leave the physician a message that a patient's temperature is elevated and the physician will not see the message until the end of the day, when it is more difficult to work up the problem. These situations can be handled by phone and not electronically, but the electronic system sometimes provides a false sense of security.

**Narrative.** Physician/NP notes used templates with free text. The Nurse Practitioner H&P can import objects from the physician orders such as problem list,

medications, advance directives, labs, and other orders. Nursing progress notes are entered in the EHR using free text.

**Clinical Decision-Making.** The drug interaction flags and other alerts upon entry are valuable but potentially too simplistic. If a patient is on one painkiller like Percocet, a flag will appear if a second painkiller like acetaminophen or Tylenol is added. Flags can be dispensed with easily by typing anything in the response field, so they are not overly burdensome.

**MDS Integration.** The MDS is completed in a completely different system called AccuMax. Only nurses utilize the AccuMax. The assessments are conducted by the nursing staff, social workers, and therapists. These are followed by a team conference involving this group to determine what should go into the MDS and also to choose the RAPs. The nurse goes through and manually pulls information from both the physician admission note and the H&P conducted by the Nurse Practitioner that is the basis for the treatment plan. Everyone at the care conference signs the care plan based on the RAP sheets. Data are manually documented and entered into the EHR by a nurse. The MDS is used in the Nursing Home Care Units, Transitional Care Units, and Geriatric Evaluation and Management Unit. The MDS is submitted to Austin and used for MDS QIs and to determine FTE allocation to each NH. Nursing MDS care plans and weekly ADL sheets are on paper.

**Access.** All staff can read all EHR data (e.g., admission information, prior admission information, ED information, physician narrative and orders, nursing narrative and care plan, therapy narrative and care plan, lab results, and radiology results). However, only MDs and GNPs can write orders.

### **3. Home Health**

**Sites.** Bay Pines has three home healthcare programs.

1. Home-Based Primary Care (HBPC) has an 11-member multidisciplinary team including GNPs who conduct patient visits, nurses, dietary, therapists, social workers, and MD care if needed. All VA patients qualify for admission to the program, which provides short- and long-term care (after which the patients are turned over to primary care). Nurse practitioners provide oversight within a 50-mile radius and visit at least monthly. Dietary and therapy are available as consultants. HBPC created its own criteria for assessment, but will begin using the MDS data for home care. Nurse managers integrate records electronically with physicians. RNs visit at least every two to three weeks; the NP, at least monthly.
2. The Homemaker program is designed to divert patients from community nursing homes. This program includes almost 90 patients with more than 70% having a service-connected disability. To continue care, the agency needs to recertify the care plan and fax both referrals and recertifications. Referral and recertification

assessments (every six months) are conducted by the home health manager, who is a nurse. A community agency is contracted for personal care services (e.g., daily activities, plan of care, and supervisory visit responsibility of the agency). They typically visit two to three times per week. The agency sends a visit log, which is tracked in the EHR. The plan of care is not in the EHR.

3. The fee-for-service home program includes home IVs. It is a contracted service that is covered by Medicare. This program provides care to patients outside the 50-mile radius or provides services different than the other Bay Pines home care programs.

**Admission.** If a person was previously in the system, her/his information is brought up from eligibility data. Reasons for admission to agency, medications, allergies, advanced directives, etc., can be brought up on the EHR, but are always confirmed by the agency. This information is reviewed on the EHR to initiate admission. A team meeting takes place in which verbal communication is conducted for each patient. Paper referral documents also are provided for the actual referral. Beyond that, everything is electronic.

**Orders.** For HBPC, the nurse practitioner conducts the initial visit and does a history and physical. S/he writes or dictates the H&P and orders, both of which are co-signed by the physician. Prior to co-signing by physicians, the orders are not active. Immediately after the orders are entered, a message is sent to the physician indicating that the orders need to be reviewed and co-signed. Orders that are not yet co-signed cannot be viewed by the staff. Orders are electronically entered by the nurse practitioner for HBPC.

For contract home care under fee-for-service, the orders are not entered directly by the agency. Instead, they are faxed to the coordinator who reviews them and the H&P. S/he enters the orders and a summary into the system, either directly or using dictation. Assessment information and orders are obtained from other sources if possible. For the fee-for-service program, there is no access to notes from outside agencies, and all information is entered by the coordinator, who communicates with the agency by fax.

**Narrative.** With regard to clinical documentation in HBPC, a provider spends four to five hours providing care and then comes back to the office and enters notes for about four hours. NPs might type or dictate notes. In addition to the structured fields described in the uniform record, templates are used for the following: initial nursing assessment (H&P), care plan, and treatment. Under treatment, there are templates for neurological, mobility/falls, safety, respiratory, mental status, cardiac, diabetes, dysphasia, skin, and other conditions. Templates are locally (and sometimes individually) developed. Some templates are just broad outlines into which text is added. The team does the treatment plan. Vital signs can be plotted.

Nurses and social workers also see veterans in contract NHs, every 30 days and 60 days respectively. Their notes are entered into CPRS and orders written by community physicians (except pharmacy) are completed by BP clerical staff.

**OASIS Integration.** The OASIS data set is not required within the VA system. However, the MDS-HH data set will be incorporated into the system in the near future.

**Access.** Most home health staff have read-only access to the patient EHR information, although some also have write access. The MD, GNP, and acute care hospital staff have full access.

#### **4. Rehabilitation Facility**

**Sites.** The 154-bed inpatient rehabilitation facility unit at Bay Pines is fully integrated with the acute care hospital.

**Admission.** One of the rehabilitation medicine physicians conducts all admissions to the unit. S/he uses a template for the admission, which covers diagnoses, allergies, vitals schedule, medications, advanced directives, consults, and laboratory orders. The history and physical is completed from scratch using a template designed for physical medicine and rehabilitation, or dictation is used. Nursing staff and therapists are notified of the admission electronically and receive the physician's admission note.

**Orders.** During admission and throughout, the physician writes orders electronically for medication, supplies, laboratory, therapy, consults, x-rays, or any service as needed. Urgent medication orders can be verbally communicated for rapid receipt of medication, but the electronic medication ordering generally provides the medicine to the rehab unit within an hour. Procedures for ordering, notifying of orders, notifying that a blood draw is required, and documenting results are all electronic for laboratory data. Abnormal values, however, are communicated verbally.

**Narrative.** Progress notes are provided by individual disciplines and also weekly by the interdisciplinary team. The MD is the secretary for the interdisciplinary team and uses a template for the team's assessment and notes. Physical medicine rehabilitation has been working (with some difficulty) on how to structure this template. They can import information from other notes, but the note is largely free text. All members of the team co-sign the note. Notes are largely free text within broadly structured templates.

**Clinical Decision Making.** Medication orders for drug interactions and dosing are provided as part of the medication ordering procedure. These issues are checked further by the pharmacy. Allergies and warnings are included in the warning tabs and serve as flags. They have a specific inpatient rehab template relating to prevalent conditions such as stroke, hip fracture, and amputation care.

**Functional Independence Measure (FIM) Integration.** Although the VAMC is not required to use the IRF-PAI for payment, it does use the functional scales from the FIM

that are maintained by the Uniform Data System (UDS). A separate FIM coordinator from the therapy department maintains these measurements which are submitted to UDS. Also, the change of scores are calculated for individuals to track functional changes.

**Transition.** Transfer of veterans from the hospital to IRF requires a complete change in focus from acute care to rehabilitation. As a result, the EHR orders need to be completely changed with different activities and diet, for example. Sometimes this leads to confusion because hospital discharge summaries are out of date at the time of rehabilitation admission and when an individual is discharged from rehabilitation. The rehabilitation discharge summary to home care or HBPC is electronic, but a hard copy is used when the discharge goes outside the VA.

**Benefits.** Physical medicine and rehabilitation physicians suggest that the EHR has resulted in decreased lengths of stay. This has resulted from direct access to labs and radiology results, which expedites those activities. They have also benefited from prior hospital information that has improved screening and the ability to initiate care. Physicians indicated that they are spending more time on the computer and less time with patients.

## **5. Pharmacy**

Bay Pines pharmacy has interconnectivity across all sites, and a single medication list including active and inactive medications; they use bar coding to identify and track drugs. The process for filling a prescription is mainly electronic, including transmission of the prescription, checking allergies, checking for drug-drug and drug-food interactions, clarifying the order with the prescribing physician (if indicated), labeling the drug container, recording controlled substance distribution, delivering to unit notification, and tracking drug orders. For ambulatory care prescriptions at Bay Pines and pharmacies at other VA clinics, the process is also electronic, yielding ambulatory prescription labels and an educational sheet for the patient with side effects, interactions, etc. The only step in the process that is not electronic is the manual preparation of the order. BP has been testing automated technology for storage and dispensing using robotics that sort packaged medications and maintain their inventory. CPRS does not have an effective electronic system for ordering nutritional supports (e.g., parenteral nutrition). These orders are still paper.

Interconnectivity permits the pharmacy staff to provide increased support to clinicians and enhanced communications across the health system, including PAC/LTC. These benefits are possible because pharmacy staff spend less time at the computer and less time trying to locate and decipher orders. For example, prescriptions are clearer so there is less need for pharmacy staff to call physicians regarding medication orders.

The medication bar code, patient wristband, and the provider bar are used code to uniquely identify each administration of a medication in the hospital and nursing home



settings. Medications are provided in unit doses by patient and stored in a cart that includes a wireless laptop with a bar code reader to be used for administration. For each dosage, the electronic medication administration record is used and the codes read for the medication, the patient, and the person administering it. Any conflicts between medication or dosage and patient are noted electronically, and the medication administration is ceased until resolved. Missed doses and refusals are recorded electronically in the electronic record, and all documentation of administration is electronic. Controlled substances also are signed out electronically.

Although time-consuming (some staff claim that it more than doubles the time needed to administer medications), this system reduces errors in medication administration. Quality monitoring in the VA has noted a great reduction in actual errors and near misses. Efficiency could be improved, according to staff, if the bar code reader could more consistently read doses and particularly tubes of topical agents. Sometimes several attempts are necessary with the current technology. Current tests by robotic systems are being conducted to eliminate incorrect medication administration as a result of damaged bar codes.

The care provider enters the initial medication orders, providing the first line of checks relating to dosing, diagnosis, contraindications, and interactions. The clinician has the opportunity to override these checks, which surface again in the pharmacy, but with the clinician's notes when a check has been overridden. Relevant lab results are accessed (e.g., creatinine, potassium) when ordering medications. Physicians are discouraged from creating complex orders for only administering a drug under certain situations or holding a drug under certain situations. Rather, a crisis note is preferred that is triggered when a certain sign or symptom occurs and then the decision can be made to stop the drug or initiate the drug as appropriate. Any drug change is instantaneously reported on the system. However, it is indicated as pending for one or two hours until pharmacy picks up the result and conducts a review. Communication with physicians can occur largely electronically. Generally, clinicians find the medication function one of the most beneficial aspects of the EHR.

## **C. Organization, Culture, and Impact**

### **1. Business Plan**

**Business Agreements/Community Extensions.** The VA does not extend its VistA/CPRS into non-VA facilities except under rare circumstances. For example, even though a business relationship exists with community nursing homes (where the VA pays for veterans), CPRS does not extend into any of these facilities. However, CPRS has been extended into a physicians' radiology group, because this group provides a critical service that cannot be provided at Bay Pines. One of the seven VA Community Based Outpatient Clinics (CBOC) is a privately-owned clinic that also uses CPRS via a direct connection to the Medical Center's Local Area Network.

**Business Goals.** Eliminating paper both in day-to-day operations and as a patient record is a primary goal at the VA. All clinical and administrative staff must use CPRS in real time and do most, if not all, of their own data entry. Although there is a substantial amount of dictation that is given to a third-party vendor for transcribing, this information is electronically downloaded into CPRS at a later time. Widespread access (at a read-only level) to CPRS by all employees is common. The patient record is not health setting- or episode-oriented, but rather it is a current record containing historical information. A Windows graphical user interface (GUI) with ease of multiple screen viewing and functions such as cut and paste is a high priority. Overall system speed is less than sub-second at times with wait times for some items quite long (tens of seconds) and others a few seconds. While important, achieving sub-second response time is a lower priority. Security of the patient record is a high priority. All patients and non-VA staff must go to the Document Release Office to get any part of a patient record.

**Culture.** The VA typically uses top-down mandated deployment of internally developed systems. Vista/CPRS is a national EHR application that was mandated for all VAMCs. However, it allows for local innovation and has been in place in some form for about 10 years. Systems are typically piloted (alpha and beta tests) at one or a few VAMCs to test for problems and then deployed to all locations once the system achieves an acceptable functional level. With CPRS, a variety of problems are known, but implementation has gone forward. As problems are identified, they are prioritized and addressed. Local staff can build in extensions to an application and, if successful, request a change to the Class-One code of the application. Local VAs do not have the discretion to change code; this is the responsibility of the development staff only. There is both a local organization and a national counterpart called the Clinical Application Coordinator (CAC) group that is responsible for local and national changes, maintenance, and training for CPRS. CACs assist clinical staff in both using the CPRS and also help clinical staff develop and implement modifications (templates) that facilitate the utilization and customization of the CPRS in various health settings. Budgeting is done by looking at the number of patients treated two years previously. Also, payment is by number rather than specific costs so each VAMC receives essentially a lump sum to run the facility. For a rapidly growing operation, the two-year lag can create some budgetary problems as expenses for the entire facility are underestimated as a whole.

**Drivers/Vision.** Kenneth Kaiser was the initial driving force at a national leadership level for implementing CPRS. Linda Reed, nurse in charge of the CACs, and John Williams, IT manager, provided significant leadership at the Bay Pines facility to move the mandated implementation forward. It was a middle-out effort that reached down to users and up to management. The IT group is closely associated with the CACs.

**Vendors.** There were no commercial systems (either hardware or software) that could meet the needs of the VA. Vendors were used at Bay Pines to help evaluate initial hardware and maintenance needs for budgeting, design, and implementation.

**Payors.** Billing of non-service related treatment is done by paper, but it is made possible by the CPRS system because information can be tabulated and sent to payors in a timely way. Billing for non-service related treatment given to patients but paid for by Medicare or other payors had gone from essentially zero to millions of dollars per year.

**Planning.** Selected health settings were implemented one or two at a time. There were two criteria for selecting the first settings: ease of implementation and potential for success. Some groups were more open to the idea, and some operations (workflow) were more conducive to the process. Nursing homes and outpatient clinics were implemented first. Acute care, especially surgery and ICU, were implemented last.

## **2. Organization Structure**

**Business Units.** The implementation of CPRS affected several business units. Of greatest significance is the Clinical Application Coordinator (CAC) group, both in terms of numbers and responsibilities. The CAC group is present in every VAMC and is mandated at a national level. There is also a national CAC group with various interfaces such as national conferences. Both at the national level and local level, the CAC groups are essentially IT support groups with clinical training that are responsible for CPRS upgrades, maintenance, and user training. The CAC group is critical to the successful operation of the CPRS.

**Healthcare Setting Implementation.** Once there was a national mandate to implement, a local steering committee developed an implementation and training plan. As mentioned earlier, the two criteria for determining the order of implementation for different healthcare settings or groups were ease of implementation and potential for success. Some groups were more open to the idea, and some operations (workflow) were more conducive to integrating with an EHR. Nursing homes and outpatient clinics were implemented first. Acute care, especially surgery and ICU, were implemented last. Some areas such as the emergency department are not fully integrated in real time, although all information eventually is entered into the CPRS.

**Enhancement Implementation.** The CPRS is in a constant state of innovation and enhancement. Until just a few years ago (1997), CPRS had no GUI and was accessed (and still can be) through a mainframe command line type interface. The GUI was put on top of the mainframe system. For those staff experienced in the original system, some tasks can be completed faster if the old interface is used. Recent enhancements included automation using bar coding for medication management and dispensing, and use of Picture and Archiving System (PACS) in radiology. Bar coding of medication (staff and patients as well) has been in the implementation process during the last several years. These implementation efforts are generally under a central mandated process in which one or more facilities are used to develop/pilot a particular process under the direction of national VA policy.

**Resource Allocation.** The Bay Pines VAMC receives a lump sum of money based on the number of patients that is lagged by two years. Different business units (such as

IT) then create budgets and lobby upper management for various programs or operations. Funding sources for IT are from two sources; the first is from a medical center equipment fund and the other is the overall funding source for all departments. In each case, IT is in competition for funds with all other departments. Unlike in the private sector where there is a pre-ordained percentage given based on the total, IT must justify its needs against other important priorities. There is competition for funds between health settings to some extent, but the CAC group appears to support each health setting for individual needs. In addition, the IT group that supplies terminals is mandated to provide the patient record throughout the system. Because each setting must use CPRS and no paper record exists, allocation of resources is fairly even throughout the VAMC for basic access. Allocation for major innovations, such as the bar coding of medications and the development of a PACS in radiology, are mandated generally from a national level.

### **3. Staffing/Training**

**Staffing Levels.** Levels of clinical staff such as nurses and physicians changed very little, if at all. The shift of data entry from administrative staff to clinical staff has reduced the number of staff in administration that were transcribing dictation. The number of staff working in medical records (paper) decreased (35 to 16), while the number in information release increased (partially due to HIPAA). As pharmacy operations have been automated and brought into the CPRS, the number of pharmacy staff has increased. There was an increase in IT staff, both VA and contract, to maintain hardware systems. The number of CACs increased with the CPRS implementation.

**Staffing Skills.** The CAC group was critical not only for the initial implementation of the CPRS but also in ongoing maintenance, CPRS enhancements, and training. The CAC group is trained both in clinical skills and in IT. The CAC group interfaces between IT and clinical users to make sure users become proficient with CPRS and to help with innovation, either by developing system enhancements or helping clinical staff to develop enhancements (templates). The role the CAC group plays is essential for the successful operation of the CPRS. Clinical staff also needed to develop new skills to integrate the CPRS with clinical care. Data entry skills and integrating the terminal into patient interaction, as well as skills using the CPRS for team processes, needed to be developed. Pharmacy staff needed to have more skill sets relative to IT to deal with bar coding and medication handling that uses automated equipment and processes.

**Training.** Training was a major issue when CPRS was first implemented, and continues to be an issue. The CAC group is responsible for most training (other than a new employee orientation session lasting a couple of days that also covers other topics, including HIPAA). Training and support of clinical staff are ongoing processes. Various methods have been tried, including manuals, luncheons, personal tutoring, etc. No "right" method appears to have emerged. In addition to the initial employee orientation, clinical staff go through a tutoring period (one to four weeks) in which they have an experienced CAC or clinical person closely monitoring their input. After that, CACs are available for questions. The CAC group also has ongoing training, including national

conferences and a national user support group. With patches and innovation occurring on a routine basis, there appears to be a need for continued training.

#### **4. Communication**

**Channels.** With the implementation of CPRS, communication channels changed in a number of ways. While traditional communications methods are still used widely (telephone, fax, e-mail, two internal systems, VistA and external, Outlook, paper, and face to face), CPRS creates a one-source location for large amounts of patient information that is available anytime from multiple locations. Clinicians often will start with the terminal to begin learning about a patient or to prepare for a team meeting rather than talking to a patient or other staff. Patients used to carry around part of their paper records; this is no longer done. Instead of routing a piece of paper to various staff to create a home healthcare plan, the process is now done simultaneously online. No specific examples of urgent communications were observed, indicating that CPRS is probably used mostly for routine communication rather than urgent communication.

**Frequency.** With most providers having simultaneous read access to all patients within each VAMC, frequency of accessing patient records has increased. A name list of all patients in all VAMCs, alive and deceased, is provided as a starting point when accessing CPRS; however, only limited header information is available for all patients. Terminals are readily available within the facility, and CPRS is a one-stop location for much of the patient record. Clinical staff indicated accessing a patient's record is more frequent for a variety of tasks because of ease of access and complete information from one source.

**Nature.** The nature of communication is for reference, verification, or historical. There are some team interaction processes (e.g., patient screening for admission to inpatient rehab and in home health for creating a team care plan). However, CPRS is not built for team interaction and does not contain many communication functions. It mostly functions as a reference and storage tool, although there are alerts and a number of actions that can be initiated (from orders to medication). Decision support systems, care plans, and even alerts are minimally functional and generally outside of CPRS.

**Real-time.** Real-time, simultaneous access to a patient's record was mentioned often as one of the best features of the CPRS. Not having to hunt down a chart, having full access to a patient's record, and knowing that the CPRS contains the most recent information were all major advantages that improved both efficiency and quality of care. Having to enter information in real time had mixed reviews. Some indicated that it improved care, while others indicated that it interfered with patient care and disrupted the care process.

**Alerts.** Alerts were very much a part of the CPRS; however, the control and prioritization of alerts and also decision support appeared to not have been well developed. There appeared to be too many alerts, causing at least some of the clinical

staff to be "over-alerted" with unimportant messages and leading them to turn off the alerts. A physician may get hundreds of alerts in one day. Coupled with two e-mail systems, this "clinical spam" makes it difficult for staff to use alerts effectively. Staff reacted differently; some tried to cope with the overload of non-prioritized information while others simply ignored some or all of the electronic alerts. There did not appear to be urgent electronic alerts, either within CPRS or through some other mechanism (such as pagers or fax), but this issue was not fully explored.

**Quality.** Quality of communication is much better for several reasons. With handwritten paper essentially not present, problems with legible handwriting are eliminated. Also, there are a number of controls within the patient record that automate contents such as medication lists. Login authorizations limit those who can augment the patient record or create orders. With team review of records, mistakes are caught more easily. On the other hand, templates and especially boilerplates (pre-filled-in information) can result in information that is incorrect if not properly updated or customized.

**Content.** With cut-and-paste capability as well as auto-generated text such as medication lists, the patient record tends to have a lot of unstructured text that reflects the style of individual clinicians. Several staff indicated that patient records are much longer with more information. CPRS appears to have increased the size of the record (in areas of unstructured text such as progress notes) because of the ease in creating text.

## **5. Workflow/Process Changes Due to EHR Adoption**

**Management Functions.** Many paper processes have been eliminated. For example, sticky notes had been used extensively in acute care but now are no longer used. A major change in workflow is that staff no longer have to search for a physical record, but rather they have round-the-clock, simultaneous access to the CPRS. Clinicians now spend time with CPRS that results in better preparation for various activities, such as patient interaction or staff meetings. Simultaneous access creates workflow that is more integrated, in that there are real-time peer interview and checking processes. Home health indicated control of supplies for home care is more coordinated so that when the nurse visits the patient it is much less likely that there will be missing items to provide the needed care. Because patients are transferred rather than admitted to rehab, there are restrictions in how the CPRS can be updated that can cause some inaccuracies or delays. This is not fully understood. Also, because the CPRS has checks and balances, there are instances in which patient care moves faster than administrative record keeping. For example, a patient may be transferred physically to a new health setting but have no electronic transfer so there is no record-to-record care. Generally, when the CPRS is down or lags for some reason, care is recorded on paper and later input into CPRS.

**Patient Interaction.** Clinical staff mentioned that CPRS adds a terminal to the patient/physician/provider interaction. Some indicated this was good, as the terminal

could become a teaching tool with graphical display of information. In other cases, the terminal took away time with the patient in that the care provider would work with the terminal while the patient waited. Also, integrating computer skills into patient interaction requires additional skills that all care providers may not have. Login/log off procedures are too cumbersome in fast-moving environments, such as acute care. Rapid logon and mobile dictation equipment are two options being explored to mitigate this problem. In the past, patients would carry part or perhaps all of their paper records with them, but this is no longer allowed. While most patients do not ask, about 10% do request a copy of all or part of their health record after a visit. To get a copy, the patient now must go to a central source rather than get it from the care provider.

**Staff Interaction.** Team care processes have improved in that simultaneous, real-time access lets team members be better prepared and also allows for team processes that were not possible before CPRS. Staff are better prepared for meetings because they are able to review a comprehensive, legible, up-to-date record. Clinical staff spend more time at the terminal and less time walking around looking for information. While this is more efficient, there also is some loss of personal interaction with patients, other staff, and the facility itself. This reduction in face-to-face or other ways of communication, coupled with an alert system that is not sufficiently prioritized, may result in "the ball being dropped" (e.g., "Didn't you get my e-mail/alert?") There is better evaluation for care planning and next steps for care because of "virtual meetings." An example of this is in home health in which the process used to be the routing of a paper form to various team members, each adding her/his input. With CPRS, this form is completed electronically in a much shorter time and, even more importantly, each team member can see what others have contributed which may show the need for additional modifications. The old paper process sometimes had to be completely duplicated as various team members' input was evaluated.

**Care Implementation.** CPRS coupled with bar coding of medications has changed how medications are dispersed and also reduced medication errors. Drug interaction alerts are an integral part of the CPRS. Some staff indicated that the time to dispense medications has increased. There appears to be a number of problems such as scanners not being able to read bar codes, but these issues are being resolved with new technology or process changes. Care planning, both in the NHCU and home health, has changed with CPRS because there is more complete, legible, and up-to-date information. Care planning processes are still independent from the CPRS to a large degree. Customized templates direct processes, making patient care more uniformly implemented. Because the templates are localized innovations, they benefit only the local VAMC; however, these local innovations can be brought back to the national level for evaluation and implementation, if warranted. Using boilerplate templates also can cause care to be generalized for a special needs patient, driving care down a path that may not be as appropriate.

**Tracking.** CPRS has made it possible to track non-service related patient care in a timely manner, and to bill an outside payor for these services (which could not be done in the past). A comprehensive patient record allows for complete history review by

clinicians as well as the ability to historically track various items, such as a patient's vitals. Medication tracking using bar coding helps track proper dispensing as well as medication errors. A national electronic patient record of "core" standardized information is available from national data centers such as Austin, but not through CPRS locally. Because of this, national studies for a variety of areas can and are done and then sent back to VAMCs to review for potential action.

**Security.** Patients and others must now go to a central office, the Release of Information Office, to get a copy of their record. There also is a new national initiative, "My HealthVet," that will allow veterans to access some clinical information via access to the VA's intranet. Various controls are applied to individual users. While nearly all staff have read access at all health settings for all patients at a particular VAMC (and also a list and a few fields of information about all VA patients), each ID also has other specific attributes that allow for different write and view capabilities.

**Documentation.** Documentation requirements that are now in place are only possible with CPRS. It would not be possible to go back to paper and maintain the same requirements. All documentation must exist in the electronic form. For those items that do not "fit" in CPRS, such as diagrams or oversized paper, information is scanned into CPRS. Documents must be stored for 75 years after a patient's death; thus, storage of paper documents was a continuing problem.

**File Room.** Five years ago, the file rooms at Bay Pines and the Ft. Myers Outpatient Clinic delivered up to 2,300 records daily. Today, that number has dropped to 20 records per day. The delivery of those 20 records will end in May 2004. There also were 38 employees spread among three shifts. The shift work included gathering records from all locations, scanning the records back into the file room, reordering the records into terminal digits and returning to the shelves. Other work included sorting incomplete records, preparing for the next three days of appointment deliveries, fulfilling requests from other sites, and pulling death records and those for retirement and record repair.

The file room currently consists of 13 people, including the supervisor. Five of the staff support document scanners, and the remainder are support staff for traditional file room functions, support of medical coding, and work in completing JCAHO record requirements. BP expects the number of file room staff to drop even more by the end of 2004.



# **APPENDIX B: NORTH MISSISSIPPI HEALTH SERVICES**

## **A. Health System Overview**

North Mississippi Health Services (NMHS) is a private, non-profit corporation that is not federally funded. With an integrated delivery network (IDN) and more than 6000 employees, NMHS serves the majority of the population (487,000 out of 700,000) in a rural area that is roughly within a 100-mile radius of Tupelo, Mississippi, providing services to 33 communities in two states. NMHS serves approximately 70% of the population in this area even though there are no other competing health systems, an indication that the area is medically underserved.

The main campus at Tupelo (North Mississippi Medical Center, NMMC) consists of more than 50 buildings on a 125-acre campus. The NMMC has an acute care center that provides full function multi-specialty groups with the only exception being transplant surgery. The NMHS acute center houses the inpatient rehabilitation unit. About 50 more offices are located in the Tupelo municipality. There are five additional smaller campuses in the NMHS catchments, with acute care, pharmacy, radiology, and laboratory services, of which some have post-acute/long-term care (PAC/LTC) facilities. Three campuses have long-term nursing homes, and there is one stand-alone nursing home located in Baldwyn. Two campuses have post-acute skilled nursing facilities (SNFs). There are nine home health offices that are located throughout the NMHS catchments, but all are centrally directed from the Tupelo offices. The site visit included visits to the IT central offices, the Tupelo main campus (acute care, inpatient rehabilitation, pharmacy, radiology, lab), the Pontotoc campus (acute care, nursing home, NH, pharmacy), and the Baldwyn nursing home.

## **B. Clinical Functions**

### **1. Acute Care**

The NMMC Emergency Services Department (ESD) gives complete access to the EHR. However the ESD application is applicable only in the ESD. All other facilities use e7000. When a patient is discharged from ESD to the inpatient facility, the EHR will display all pertinent clinical data from the ESD episode, including I/O data, vital signs, and laboratory results for the last 24 hours.

We visited the main NMHS hospital in Tupelo, Mississippi, including the emergency, laboratory, radiology, and pharmacy departments, an inpatient rehabilitation facility, and a medical/surgical floor. All of the NMHS acute care facilities have access to the central EHR. This infrastructure and connectivity cost are borne centrally by the IT department.

Physician documentation at the hospital remains handwritten. Upon completion of the document imaging system implementation, these documents will be scanned into the system. Nursing and other staff documentation is nearly 100% online.

Physician orders are handwritten. About 50% of physicians have begun to write orders electronically into the computer-based provider order entry (CPOE) system. Otherwise, a nurse/clerical staff member transcribes handwritten orders into the EHR, which then performs some alerts and guideline checks. Alerts may prompt a phone call from nurse to physician for instructions. Medication orders are sent to the pharmacy; a pharmacist verifies these orders, and then delivers medication via courier, tube system or dispensing cart delivery to the unit. Laboratory orders are sent to the lab, where a requisition and a label are printed. The phlebotomist uses these papers to locate and identify the patient and double-check the order. Radiology orders are sent to radiology. Once the test is conducted, the result is viewed by a radiologist who dictates a note that prints on the ordering unit and is subsequently available in the EHR.

The Eclipsys E7000 system is the backbone of the clinical data repository. It is available and fully interactive in all owned, acute care and PAC/LTC facilities at NMHS including hospitals, clinics, nursing homes, the inpatient rehabilitation facility, and home health care. It allows clinical documentation by physicians, nurses, and other clinical staff, although most physicians handwrite their notes. It also allows physician order entry, which is accepted by about 50% of the physicians, and order management and transmission, fully implemented in the inpatient nursing units, in the IRF and the nursing homes. Additionally, the clinics use GE Logician to document outpatient encounters. NMHS has developed its own continuity database dubbed ACHE (Admission Clearinghouse Enterprise) that stores 220 data elements about the patient for ongoing use and synchronization between the various EHR systems. Physicians are using Logician. However, Logician is not yet integrated into the data warehouse (i.e., ACHE database), although this is to be accomplished within the next year. The ACHE 200-300 data elements are common across the continuum and include the home medication list and medical history.

NMHS has been effective at extending its EHR not only to the breadth of its internal enterprise, but also to non-affiliated healthcare organizations. There are several models of extending the NMHS EHR to non-owned practices. First, both the E7000 and Logician licenses have been extended to five private clinics (cardiology, GI, endocrine, OB/Gyn, urology) outside of the integrated delivery network and not affiliated at all with NMHS. NMHS serves in some sense as a "utility company," providing services for which the clinics pay. For the payment, the clinics use E7000 as their front-end registration system, with Logician as the electronic health record system. The clinics have full access to the entire longitudinal NMHS database, and all the functions of Eclipsys and Logician that NMHS has developed. Also, the main Tupelo medical center is one mile away and can send physician analysts to support their system, as if they were a local EHR systems vendor.

Cedars, a Methodist nursing home, is also a non-owned facility. NMHS resident physicians do practice there. NMHS extended a virtual private network connection to a PC at the nursing home where the residents can access patient data, write notes and record medication orders in Logician, and print out these papers to be filed in the official Cedars medical record. There is no charge to Cedars for this access, but the Cedars staff members have no direct access to the workstation or Logician software.

## **2. Nursing Homes**

**Sites.** Two NMHC-owned nursing homes were visited. The city of Pontotoc has a critical access facility composed of 19 swing beds, 10 subacute beds and 44 long-term care beds. On site there is an ER, a radiology suite, and a pharmacy. The city of Baldwyn has a 107-bed nursing home, which stands alone, with no attached acute care facilities. Both are in medically underserved communities.

**Admission.** The Pontotoc nursing home receives a phone call from the social worker at the hospital, referring a patient for possible admission. NH staff have full access to the EHR for the acute care episode in the Tupelo hospital and NMHS clinics. The social worker finds this to be very helpful. Instead of a long telephone conversation about the patient and her/his candidacy for the nursing home, the social worker at the NH only receives initials of the patient with a room number. The social worker and NH staff then can look up primary clinical information for themselves, and determine appropriateness for their setting. This can avoid a time-consuming visit to the hospital, which is more than 60 miles away. This entire decision can be made in 30 minutes.

Once the patient arrives, the patient's intake is done by nurses directly onto the EHR, using a mobile laptop on a cart. Similarly, nurses take a cart to the bedside to document their initial patient admission/intake data.

The physician does not interact with the computer on patient admission to NH. Physicians write their orders and documentation on paper, the nurse verifies them, and the clerk enters them into the EHR.

**Orders.** At both nursing homes, a small number of physicians (one at Baldwyn, three at Pontotoc) see all the patients. None of them currently enters orders into the computer system; they write them on the paper chart. The orders then are entered by the clerk into the EHR and transmitted to relevant departments (laboratory, radiology, pharmacy) where the orders are interpreted. The medication administration record (MAR) and other documents such as the patient care summary are generated by the EHR, based upon the medical orders and the patient's plan of care. These documents are used to conduct rounds and dispense medications. This printout also is used to conduct "sign-outs" to the next shift. This paper is ultimately destroyed as all new clinical data, medication administration notes and other findings are keyed by nurses into the computer.

At Pontotoc, a local pharmacist receives the scan of the written medication order, interprets the medication and dispenses a 30-day supply of medication and hand delivers this to the unit. At Baldwin, there is no local pharmacist. There, the order is transmitted to the central NMHS pharmacy in Tupelo, and the medication then is delivered on the next courier run.

Radiology orders are entered and x-ray films are taken locally, then transported daily for radiologist reading at the main NMHS site. Although NMHS anticipates adopting a Picture Archiving and Communication System (PACS) soon, it is not yet in place. Results are printed in the ordering location and are available in the EHR. Laboratory orders are similarly entered by clerical staff; phlebotomy is done locally and transported to the main NMHS laboratory. Results are printed at the ordering location and are also available in the EHR.

***Narrative.*** At both NMHS nursing homes, physicians handwrite their clinical narrative into the paper chart. Nurses, non-licensed staff and social workers all use the EHR (E7000 Eclipsys system) to document their care. In some cases, they type their narrative; in other cases, they have text templates built to accommodate their needs.

Nurses see significant benefit to using the EHR. They note that about four hours of a 12-hour shift are spent using the EHR. In the past, they would spend about half of their shift writing in the paper chart. At end of each shift, 30 minutes used to be allocated to "sign-out" and informing the next shift what was happening with the patient. With the EHR, that time is reduced to five to 20 minutes, and documentation is better and easier to read. They use paper printouts of their EHR documentation as a bridge between shifts, and a walk-around tool during shifts, then throw it away after all notes made on paper are transferred to EHR. Non-licensed personnel increasingly utilize the EHR in a variety of ways, including data input and information review. Certified Nursing Assistants (CNAs) take vital signs and enter them directly into EHR, which benefits other care providers. As a result, CNAs believe that the work they do and the data they gather are more important; RNs have less transcribing of someone else's work and are released to perform other higher level nursing functions; and physicians see a clean printout of entered data. At one NH, Cedars (an affiliated, non-owned nursing home), NMHS extended an EHR access point to the facility for the use of resident physicians who enter clinical notes using templates and typed narrative in Logician, and then print them to include in the patient's chart. The NH staff do not have access to the Logician system.

***Clinical Decision Making.*** CPOE is available on the EHR for NH, as for the acute care site. However, as physicians do not use the computer to a large extent, nurses/clerical staff enter the orders. When an alert (such as a drug-drug interaction or a drug-allergy alert) is triggered while the nurse is entering a physician's order, the nurse responds by paging the physician or the pharmacist based upon the indicated severity of the allergy/interaction. Nurses also have access to Micromedex for RN education and patient education handouts.

There are numerous guidelines specific to long-term care that nurses use and that are available in the EHR, including fall precautions, pain control, wound management, nausea management, and restraint guidelines. The nursing home staff have customized pathways.

Quality monitoring takes place separately from EHR on MDS software, which is not currently interfaced with the EHR.

**MDS Integration.** NMHS owns several nursing homes. One big achievement in the past year is that MDS data are now being collected in a uniform fashion on one software platform: American HealthTech. Although there are future plans for integration, this software is not integrated currently with the EHR. This produces double work on the part of nursing and clerical staff who enter data in slightly different ways for each system.

**Access.** All physicians and staff have access to the EHR. There are more than 260 levels of security, with different levels of access to patient data based on role. Several physicians indicated that they do not use the MIS to a large extent. Rather, they rely on staff to print information, as well as enter data on their behalf. Nurses have interactive access to the EHR, and nurse aides are beginning to input vital signs, linen changes, fluids, diapers, and oral care. Clerical staff find that access to EHR has reduced the amount of walking and being off the unit and unavailable to other staff, since orders and communications are transmitted electronically. Dietary, environmental services, and physical therapy also have access to the system, to track patient status and needs.

**Transition.** When sending a patient to an ER or hospital for acute evaluation, a nurse can generate a summary viewable at an NMHS-owned hospital. This includes a medication list, problem list, and therapy interventions. The transfer summary is generally printed for physician viewing: treating physician, primary care physician, or ER physician. This paper is printed and travels with the patient, regardless of whether s/he is transported to an owned ER or to a non-owned ER.

**Unique Characteristics.** The degree of access and interaction by the nursing home staff with the EHR is remarkable in its depth and scope. Not only do they have full access to the patients' previous clinical data from their acute care episode, thus reducing the likelihood of handoff errors, but they also have a functional information system to document clinical care relevant to long-term care goals. In particular, extending the EHR to CNA documentation of vital signs has proved effective and beneficial.

In one non-NMHS nursing home, a decision was made to provide a fully interactive EHR access point within the facility. This access point is for the exclusive use of resident and faculty physicians from NMHS; the NH staff do not have this access. The physicians enter their progress notes and orders and print them to put in the official paper chart. This serves to capture clinical information for longitudinal care of the

patient and improves the quality and legibility of the paper chart. To some degree this is double work for the physicians who are interacting both with the NMHS EHR and also handwriting some of this information in the patient's local chart. Because of the perceived value of EHR continuity, the physicians initially requested this access from NMHS and continue to document in this way.

### **3. Home Health**

**Sites.** The home health division was not included in the site visit due to time constraints. Visiting nurses had a choice of pulling up patient data at the central office, printing and carrying them to the scheduled visits, or taking a laptop to the patient's home and viewing patient data in real time. The second option was limited by phone line access and patient perceptions of phone line usage. In these cases, nurses could update records directly into the EHR system, using a desktop in the branch office post-visit.

**Admission.** Home health nurses have read/write access to the EHR (E7000). They are assigned a laptop computer and take it with them, but dial-up connections at the patients' homes have been problematic.

**Orders.** When patients being seen by a visiting nurse require a lab test, the lab orders are handwritten by the physician, then faxed or electronically sent to the home health agency. The visiting nurse takes the paper request, and draws the samples for laboratory testing on the patient at home; then the specimen is labeled and transported to the central lab. It is the central lab technician who inputs this order into the EHR and subsequently reports the lab result. This is done because neither the visiting nurse nor the physician has access to the registration system to create a new outpatient episode of care. As this is an outpatient, a patient has to be registered and an episode of care has to be started before any tests can be ordered. In the clinic, the clinic staff would register the patient. For the home health patient, the laboratory tech is the first person who has the access to do this information.

**Narrative.** Home health day-to-day visit notes are not online. The nurses encountered problems when using a dial-up from patients' homes to access MIS. Patients were concerned about the nurse using their telephone line (i.e., concerned that the calls were long distance). Sometimes telephone line did not work. Therefore, NMHS is moving to an upload and download system.

**Access.** Home health nurses have read/write access to EHR both from central office and from laptops, which have dial-up access to EHR at the patient's home.

**Transition.** The home health nurse has full read-only access to the EHR and thus can view the patient's problem list, medication list, allergies and clinical notes and discharge summaries from the acute care facility, nursing home and clinics.

#### **4. Rehabilitation Facility**

**Sites.** NMHS has a 30-bed, fully owned inpatient rehabilitation facility (IRF). There is full integration between the IRF and the acute care hospital in Tupelo; it is simply another floor in the physical hospital. There is full integration with the acute care EHR. There are templates for physician and nurse documentation in the EHR. Nurses use the templates and automated documentation extensively, and physicians are beginning to use the system for more than just looking up data. The majority of computers on the IRF unit are fixed desktop units. There are two wireless carts used by both nurses and physicians.

The IRF and NH settings within NMHS agreed to use the same nursing screens to document care. For example, they both use the Braden scale to automatically total a patient's risk for ulcers. They also can consult the multidisciplinary wound team online by submitting text information along with a digital photograph. The wound team then can reply with recommended treatment options.

**Admission.** To make a determination about a patient's admission to the IRF, the IRF staff are able to view the patient's entire acute care stay in the hospital, including therapy notes, nursing notes, and all orders. Using the EHR, the IRF staff are able to make a determination about the patient's appropriateness for the unit more quickly as compared to reviewing a paper chart.

IRF, NH, and inpatient units use the same EHR: the E7000 Eclipsys system. The IRF and NH have agreed also to use the same screens for admission assessments by RNs.

Similar to the acute care hospital, physicians handwrite notes. Information technology allows the physician to view the patient's full clinical data from her/his acute care stay. In addition, the admitting physician is frequently consulted by the inpatient medical team prior to the patient's admission to the IRF. This familiarity makes the actual process of admission more straightforward.

For admission to the IRF, there is a two-way exchange of information between ACHE (the Admission Clearinghouse Enterprise) and E7000. Upon a patient's admission to the IRF, a nurse documenting the intake history and physical pulls up a new "encounter" in the EHR. Doing so prompts the E7000 to query the longitudinal ACHE database for this patient, and populates the known data elements. The nurse then uses this baseline data to interview the patient, confirm the existing data and make updates to the information as needed for this episode of care. Any updates that affect ACHE data elements also are written back to the longitudinal ACHE database at that time.

Upon admission, there is an electronic nursing assessment that includes a pain scale, the Braden scale for wound assessment, emotional status, motor functioning, and balance. Based on various scores, a high-risk patient may generate an automatic

consultation with the wound care multidisciplinary team, and/or a fall prevention protocol, with arm bands and color coding on the patient's door.

Nurses document into an electronic care plan in the EHR, using templates and some limited typing. This template content was developed by local consensus and, at this time, does not link to the nursing intervention classification or the nursing outcome classification (NIC/NOC).

**Orders.** As in the inpatient hospital, about one-half of the physicians enter orders through the CPOE system; others handwrite orders and have them entered by clerical staff and transmitted to the relevant departments; and others have their orders entered directly into the EHR system. Because of the scarcity of physicians, they are being gently persuaded to move to online ordering; however, the system fully supports the physicians' choice to work on paper or electronically.

Clerks on the unit enter the physicians' orders into the EHR. For medication orders, the pharmacist views the scanned document, interprets the physician's order, and enters it into the pharmacy system. This system then prints instructions to fill a dispensing cart, which is subsequently delivered to the unit. For laboratory orders, the lab technician receives a printout of the order and a bar-coded label. The phlebotomist then draws the blood. The sample is scanned, run on the analyzer, and results reported by printout to the ordering unit. The result is available also in the EHR. For radiology orders, the technician similarly receives a printout request and performs the test. The radiologist reviews the films and dictates a report, which is then transmitted to the ordering unit and also is available in the EHR.

**Narrative.** Physician notes are handwritten. The notes will be scanned in the future, using the document imaging system once it is fully implemented. In the rehabilitation gym, physical, occupational, and speech therapists' notes are a combination of electronic and handwritten notes. Similarly, nursing notes are entered via template into the EHR.

**Clinical Decision Making.** Nurses and pharmacists in the IRF receive drug-drug, drug-food, and drug-allergy alerts via the EHR when they are entering the physician's orders. When this occurs, they page the physician/pharmacist as indicated by severity rating. The IRF follows a number of guidelines of care, including post-stroke care, hip fracture care, amputation care, and DVT prophylaxis. Quality monitoring is done through the IRF-PAI and FIM software, which is stand alone at this point (not integrated with the EHR).

**IRF-PAI Integration.** There is a separate stand-alone software system that captures information on IRF-PAI and its precursor, the FIM.

**Access.** IRF physicians and staff have full access to the EHR from desktops throughout the unit as well by wireless laptop. Physicians also have access from their offices and homes. NMHS finds this access so critical, that it will send analysts to the



physician's offices and to their homes to set up their computers and connections for no charge.

**Transition.** Transfers from the acute care side of Tupelo hospital to the IRF side are greatly facilitated by access to the common EHR. The IRF can view the orders and full reports of therapies (PT, respiratory) conducted in the inpatient setting. All the data from the acute care episode of care are available for review by IRF faculty and staff. The allergies and medication list also is shared.

## **5. Pharmacy**

**Overall.** The pharmacy has three to four primary focus areas: (1) four to five hospital affiliates (one is online and will be bringing the others online); (2) home infusion (home care patients); (3) ambulatory care -- about 1,200 patients/month (about 40 patients are walk-ins); and (4) staff model pharmacy for employees and dependents. The system intends to use Pyxis at all sites (except nursing homes). Pyxis is a unit dose dispensing system. The Pyxis (medication dispensing device) is linked to the E7000. On the other hand, nursing home medications are dispensed 30 days at a time. The medication and interaction database is from First DataBank (FDB). NMHS is considering bar coding for drug administration, but this is not likely to be implemented for the next five years. A transport tube goes between pharmacy and ER, ICU, and CCU to facilitate delivery of orders and medications. A quality control process is in place to track errors, but it is not a punitive system. This electronic system tracks medication errors, falls, and equipment problems and allows internal monitoring.

The ACHE database helps provide medication continuity despite the episode-based nature of the main EHR (E7000). For example, upon hospital discharge, a patient's discharge medications are entered into the E7000 by the nurse. This list also is written to the automated discharge summary (ADS). When the patient is subsequently seen in clinic, the clinical staff can view the medication list from that episode of care, and may elect to enter that information into the Logician system. Additionally, there are plans to fully integrate the Logician outpatient medication list with ACHE in the coming year, so that this data entry no longer will be necessary. If the patient is subsequently re-admitted to the hospital, the nurse starts a new admission assessment for that episode of care. S/he has access to the medication list from the previous episode of care. As the nurse creates an admission assessment in the EHR (E7000), the system pulls in the most recent information from the ACHE that will contain the most recent medication list. The nurse verifies the list with the patient, and types in any medication changes noted by the patient. The physician then can view the nursing notes, and handwrite or enter into the EHR the patient's admission medications. This list then is scanned or electronically sent to be reviewed by the pharmacist. The pharmacist verifies accuracy, checks for drug interactions or alerts, and then sends the medication by courier, tube system or the routine dispensing cart delivery.

**Acute Care and Physician Offices.** The Tupelo main hospital houses both an inpatient and outpatient pharmacy. The outpatient pharmacy is also the primary

pharmacy for employees of NMHS. The inpatient pharmacy has both a centralized location as well as satellite pharmacies on the floors. Because the physician orders are mainly on paper and nurses cannot interpret medication orders, drug orders are entered into the EHR by the unit clerk and scanned to the pharmacy using Pyxis-connect system. This scan then generates a trigger for the pharmacist that a medication order is pending interpretation by printing a notification on the pharmacy printer. The pharmacist then reviews the scan, interprets the medication and dosage, and verifies the order for that medication in the E7000 system. This triggers either a courier to take the medication to the floor, a tube transport of the medication to the ER, or a staff member filling a drawer on the Pyxis drug-dispensing cart that is later delivered to the floor. Often, if the medication is ordered stat, the nurse goes to the pharmacy to wait for the medication order to be filled. If the pharmacist has a question about an order, s/he notifies the floor nurse who then contacts the physician. This happens when a medication order is illegible, or if there are drug alerts or interactions that would require physician action. Once the medication is in the Pyxis on the unit, the nurse logs into Pyxis, enters the patient's name, and documents that a unit dose was withdrawn from the correct cabinet. NMHS does not yet have bar coding to fully close the medication loop. Drug alerts show up (as a piece of paper) to the person entering the drug and also at the pharmacy. Allergies and drug-drug interactions are in First DataBank (FDB); the nurse enters the type of reaction.

***Nursing Homes.*** The outpatient pharmacy also supports a number of NMHS-owned nursing homes that fax in physician medication orders. A pharmacist reviews that information and enters it into the pharmacy system, which has vendor-based drug-drug interaction and drug-allergy checks. For the nursing homes, a bottle is filled, labeled, and delivered by courier to the nursing home. This bottle of medication is placed in the patient's drawer on the medication cart. As nursing home patients are considered outpatients, the organization can only bill \$3.50 for a monthly dispensing fee, which is very different from being paid for unit dose dispensing (as is the case in acute care settings and IRFs). This financially limits the adoption by long-term care facilities of unit dose dispensing and bar coding and other patient safety technologies.

***Home Health.*** Not Applicable.

***IRF.*** The IRF is identical to the acute care hospital pharmacy. Medications are billed when they are charted as "given." Some nurses dispense medications with a wireless laptop at the bedside and chart in real time as medication is dispensed; others take a paper printout and make notes that are later transcribed into the EHR.

## **6. Radiology**

The next big NMHS IT project is PACS. Interest in such a system exists for several reasons, including improved patient care, reduced delays in reading films, and increased radiologist satisfaction. NMHS engaged a consultant to do a cost-benefit analysis, which showed that it would take 10 years before the costs of a full PACS system would accrue net cost savings. However, other considerations predominated.

Ordering physicians wanted immediate access to the radiology report. Radiologists wanted immediate access to the image to provide this report. Given the 100-mile geographic spread of the organization, this was becoming increasingly difficult. Ultimately, either an expensive courier delivery system or an expensive radiologist driving between sites would be necessary to interpret radiology films quickly. An investment in PACS would meet all of these needs: better clinical service by radiology, reduced delay in reading films, and increased radiologist satisfaction. It also would provide increased flexibility of location without driving or waiting hours for film arrival. Given the shortage of radiologists throughout Mississippi, PACS would be an attractive recruiting tool as well.

NMHS contracts with two different Alabama radiology practices for film interpretation at two of the NMHS affiliates. The x-rays are generated on film, then scanned into an electronic system for transmission. The Alabama practice also has read-only access to the EHR, given at no cost because the radiologists provide a consultation service to NMHS. The volume of x-ray films and need for radiologist services are anticipated to increase as NMHS takes over community radiology from the other campuses.

## **7. Laboratory**

The flow of physician orders for clinical laboratory is as follows: (1) orders are entered into the system electronically (by physician or by clerk); the laboratory requisition is electronically transmitted and printed to paper in the laboratory; (2) a label is generated and a phlebotomist comes to the unit to draw the blood; (3) the laboratory completes the test, and the results are transmitted to the ordering unit via an interface; (4) laboratory results either go directly into the EHR or are hand-entered; and (5) a paper copy of the laboratory results is delivered to the physician's office by mail, or electronically via Logician and also can be viewed with the EHR.

There are no automatic or electronic alerts for abnormal lab values, although values that fall outside ranges are flagged in the EHR (bold and with a # sign). An issue with having automatic alerts is how these should be distributed (i.e., who's on call, who has been switched to be on call). NMHS uses CPT codes, as they will be easily paid. It does not use LOINC. Bar codes are used for lab orders/results. Bar codes include patient name and test, and allow the ordered test to be automatically read and then run by machine with results automatically or electronically generated. Results are validated by the unit clerk and then sent electronically or faxed to the referring unit or physician. Pathology dictates results, which then are transcribed and then entered into the EHR. Cytology results are entered directly into the EHR electronically.

## C. Organization, Culture, and Impact

### 1. Business Plan

**Business Agreements/Community Extensions.** NMHS actively extends its EHR, referred to as MIS, into the community in various organizations affiliated with but not owned by NMHS. NMHS would consider putting read-only terminals in non-owned SNFs but it has never been asked. This is possible because NMHS maintains a system that is easily extended into any facility from a technical/hardware perspective (only a PC and communication line are needed). IT support staff can be mobilized to support geographically dispersed facilities (including training and troubleshooting). NMHS extensions to other organizations include the school nurse program at local schools, nursing school facilities during clinical rotations in the clinical setting, physicians' clinics, and a nursing home. Each of these extensions operates at different levels during clinical rotations at any NMHS facility, depending on the legal agreement with the organization. NMHS has an active marketing campaign that connects to the community through the media and community service. Local TV commercials were observed that stressed the availability of the patient record throughout the system. Outdated computers are donated to the local school system.

**Business Goals.** A business focus is to enhance and improve the existing system. NMHS has prioritized building data interfaces with other commercial software such as Logician that NMHS promotes for use in physician offices. NMHS provides IT technical support to these private physicians (i.e., will help define workflow and will provide onsite office support for one month). This business strategy strives to increase volume by expanding the catchment areas and to increase use of NMHS services (e.g., office visits and radiology services). The EHR at NMHS is fully integrated with the back office information system (MIS) and, in fact, back office systems are the foundation for all other systems. The next most critical items include medical records, document imaging, data warehouse, etc., and then are followed by results reporting such as pharmacy, laboratory, radiology, etc. Next comes much of the clinical data such as medical charting, notes, patient care plans, etc. Finally, emerging technologies are incorporated into the system. NMHS is in a position of near-monopoly. When NMHS grows, it is not competing with other health systems; rather, patients who previously did not have access to health care are being brought into the system. NMHS has a goal to increase market share by extending service to all of the population in its catchment area (about 100 miles around the Tupelo hub). NMHS does not seek to eliminate paper as part of the patient record. A complete paper duplicate record is maintained, and many aspects of patient care utilize paper for various clinical care processes. The change is that the paper record is completely computer-generated rather than hand-generated. NMHS maintains continuity with its information systems, minimizing systems upgrades. While all PCs observed were running Windows XP operating system, MIS is still the original mainframe system supported by Eclipsys. Optimizing rate of return and fully leveraging IT investments are high priority goals for NMHS. Migrating existing data and functional capability to a new hardware or software platform is under continuing evaluation, but no commercially available products are seen now or in the near future as being acceptable.

**Culture.** Philosophically, NMHS believes that fundamental to its achievements is a culture of sharing: "Our physicians have come to realize that if we can share information electronically, it's good for us and good for the patient. We will work together for the common good. It is the key to clinics linking together." Working relationships both within NMHS and within the community are important to cultivate and maintain. NMHS believes that a spirit of cooperation by all to improve health care is very important in design and implementation of its health network. NMHS annually writes off about \$20 million in charity care.

Mississippi's physician-friendly culture is driven by the physician shortage and concerns surrounding liability. The legal environment in which NMHS operates has made legal documentation a priority, and NMHS also provides umbrella protection for some affiliated organizations relative to HIPAA. The legal environment also appears to limit any consideration by NMHS to allow access by patients or the community to any part of the MIS. The EHR has had no impact on liability rates, which are still high due to the litigious environment in Mississippi.

Recruiting and retaining physicians is difficult. As a result, and also due to resistance by many physicians to using EHR systems (a nationwide issue), NMHS does not require physicians to use MIS (unlike all other staff who must use MIS). Rather, NMHS provides clinical and administrative staff to enter all information for physicians into MIS. About 10% of physicians use MIS at a substantial level; the remaining interact with MIS on a limited basis. For example, the majority may use it to access patient lists and retrievals, and up to 50% utilize CPOE features at some level. NMHS works with physicians to convince them that CPOE is the right method to use for physician orders. Physician peer pressure, gentle persuasion, and nursing/administrative support are currently used to increase physician usage, rather than mandating. Another incentive offered to physicians includes education and CME approval. New physicians to the organization are required, for admitting privileges, to begin entering information in the EHR within their first year. NMHS's main acute care hospital in Tupelo has implemented CPOE, but only about one-half of the physicians have entered an order online. The remaining doctors write on paper and have that scanned in and/or entered by other staff. There is a pilot study to have physicians in clinics followed by medical assistants who will enter information into the EHR as it is spoken aloud by the physician. This program has allowed physicians to increase the number of patients seen daily from about 14 to about 20 while documenting at point of care into the EHR. This study has proven to be a cost-effective strategy because of the increase in physician billing with the use of these assistants. Some doctors write, some dictate, and others type entries. Written or dictated entries are either scanned or transcribed into the EHR. It takes on average 24 hours to transcribe.

**Drivers/Vision.** In 1979, the goal was to develop order entry at nursing stations. Dan Wilford, CEO and Linda Gholston, Nursing Vice President, provided support and vision. Visionary leadership from top executives seems to have been most important, both in getting started and in further enhancement. Tommy Bozeman, CIO, is an

enabler and an integrator to achieve enterprise-wide, patient-centered, longitudinal care. NMHS has begun to envision a community health network with private practices using a common data exchange that is based out of the NMHS EHR. The IT group with clinical analysts (nurses with IT training) is the front line in the continuation and enhancement of MIS. A group of 30 clinical analysts that operate out of the IT group provides broad support for system maintenance, ongoing employee training, and system enhancement.

**Vendors.** NMHS works with a number of vendors utilizing a number of systems. It conducts a careful review of product features and contractual vendor support. An important component to NMHS success is structuring strict IT vendor contracts. NMHS does not change its IT vendors/products very readily. Request for Proposals for IT products are large and detailed, approaching 200 pages. NMHS has found that larger vendors (e.g., Cerner and McKesson) generally are not able to meet its needs. The need to find a vendor willing to become a co-development partner drives NMHS to smaller vendors.

Also important is the way a contract's payment plan is structured. For example, NMHS limits its payments to a 1% down payment until the vendor produces 25% of functions. The payment structure is based on a functioning system. Payments are weighted towards the back end of the contract period (i.e., 40-50%) after the system "goes live." The contract also builds in requirements concerning uptime/downtime/response time. NMHS seeks a clause stating that the IT system or product must be stable for five years (i.e., a functioning system for five years); otherwise (if, for example, there are hardware problems), reimbursement is prorated. NMHS generally uses its own contracts to ensure vendor compliance. NMHS prohibits the "sun setting" of products contractually to ensure continued vendor support (although NMHS recognizes this is not an enforceable permanent ban). Because of this, NMHS continues to receive support from Eclipsys on the E7000 (the core system mainframe system for MIS) even though this product has been discontinued in the marketplace. Two other software packages were identified in use. These were GE Logician, used in physician offices, and American HealthTech, an application used to capture and send MDS data to CMS.

**Payors.** Patient composition by payor at NMHS is about 10% NMHS PPO, 45% Medicare, 8% Blue Cross, and 7% Medicaid. The remaining 30% is a mix of self-pay and other commercial insurance payors. As mentioned earlier, back office applications are the backbone of MIS and have been in place the longest. NMHS has the capability to analyze and track many statistics, both administrative and clinical. NMHS is a nonprofit facility that receives no federal or state funding, so accurate budgeting and tracking are of high importance.

**Planning.** Because all administrative and clinical applications are integrated into one system, NMHS has substantial capability to track costs and clinical processes. There are always ongoing enhancements; some recently have been completed, others are in progress, and others are in planning stages. Local committees meet weekly to

review and prioritize problems and potential enhancements. NMHS is currently focusing efforts to implement a PACS for radiology; also, bar coding for medication management is under review. NMHS rarely appears to be "leading edge" in what it is doing; rather, it waits for new technology to be tested by others and then carefully evaluates what would work best by implementing "tried and true" processes and technology.

## **2. Organization Structure**

**Business Units.** Since the initial implementation of E7000 for back office application in 1975, the MIS has expanded to include many clinical and data warehouse functions. While some changes in administrative and clinical staff likely resulted as various clinical components were implemented, the largest impact has been in the growth of the IT department and, in particular, the creation of the clinical analyst group. The clinical analyst group within the IT department is a support group that interfaces between IT and clinical staff.

**Healthcare Setting Implementation.** Implementation of the MIS occurred in the following order: acute care settings, inpatient rehabilitation, home health, and nursing homes (two years ago). The above capabilities operate differently in some health settings today and vary by facility as well. Geographically, facilities on the main Tupelo campus were targeted for implementation and then other campuses, such as Pontotoc, were connected. The implementation of MIS functions has been a fairly complex mix of features vs. health setting vs. geography.

**Enhancement Implementation.** Financial and back office systems first were put into place in 1975. Order entry nursing notes were implemented in 1979. CPOE was implemented in 1985, but it remains optional for use by physicians to date. Physicians are encouraged and supported to use MIS, but they are not required to use it. Laboratory and radiology components were implemented in 1993. In 2004, initiatives in pharmacy (bar coding) and radiology (digital imaging over T1 lines) are under review. Clinical analysts are in an ongoing effort to develop new templates for various health settings. For example, a series of templates recently were developed for nursing home clinicians that mirror selected parts of the MDS to help both in completing MDS regulatory requirements and clinical care plans.

**Resource Allocation.** IT expenses are 2.1% of total corporate expenses with maintenance costs of \$271,000 per year. Telecommunication expenses for high speed T1 lines are about \$600,000 per year. MIS enhancement and maintenance are done both at a local level with weekly project committees comprised of both IT and clinical staff and also at the executive level for major initiatives such as radiology digital imaging. The "Project Team," which has been in existence since 1983, is responsible for the change control process. This body is the keeper of the EHR. For example, the Project Team will help clinicians (e.g., nurses) if they need additional screens built or data elements added to the EHR. Financial analysis of cost and revenue centers, workflow efficiency, quality improvement, patient safety and satisfaction, technology, and other factors are all considered as a whole and determine which initiatives are

funded. The DRG capitated payment method drives increased efficiency. NMHS is an integrated delivery system and has had visionary leadership for the last 30 years. Loss leaders include air ambulance, ambulance, ER, and ICU. The core billing and back office functions of MIS are set up to capture and record clinical process (e.g., therapy billing in 30-minute increments), so that clinical data supports billing functions and the reverse. Revenue enhancers are radiology and rural clinics (40), all of which are staffed with physicians with admitting privileges to NMHS.

### **3. Staffing/Training**

**Staffing Levels.** Most clinical and administrative staff have not changed due to MIS implementation; however, the IT department staff and especially the clinical analysts within the IT department have increased. The clinical analyst group currently has grown to a staff of 30 (13 physician analysts, 15 nursing analysts, and two clinical analysts). These analysts have clinical training (many began their careers as nurses), but they also have substantial IT training. They not only provide an interface between clinical users and the IT group for planning and prioritization on MIS issues, but they also are expert users, trainers, and system innovators. The IT department also has grown as the MIS expanded and data exchanges between other software packages have been developed.

**Staffing Skills.** The clinical analyst group that operates out of the IT department has a critical skill set that is essential for maintaining and enhancing the MIS. This group has clinical and IT skills that provide critical functions of interfacing with clinical and IT staff for troubleshooting, planning, and system enhancement. Clinical analysts also train other staff in the use and optimization of MIS. Finally, clinical analysts provide ongoing MIS enhancement by developing templates for customized use in various health settings. Other staff, both administrative and clinical, have acquired specialized skills related to workflow and data entry. IT staff have developed data interface building skills (logician and ACHE) that have allowed a number of innovations from the core E7000 system.

**Training.** Nearly all NMHS staff must work closely with MIS, using terminals or paper output from MIS in a variety of clinical and administrative functions. The main exception to this is physicians who have support staff that provide system access and data entry. NMHS has tried a number of efforts to increase physician use of MIS, with the most successful being peer modeling. Successes by physicians who do use the MIS are highlighted to other physicians. Initial training is provided for new employees in one to two day employee orientation sessions. After that there is a mentoring period of one to three weeks in which employees might have limited system access and/or be assigned a clinical analyst or a peer staff to assist them. Clinical analysts train clinical staff in the use of MIS both in an expert advisor role and also in implementation of training teams. For example, when MIS was introduced to the nursing homes, clinical analysts came as a team and worked intensively with the nursing home staff to implement, staying a number of days until all nursing home staff were comfortable and fully functional with the implementation.



#### **4. Communication**

**Channels.** Workstations for accessing MIS are widely distributed at all facilities. Some users have their own personal computers (PCs), generally managerial or administrative staff, but shared workstations are a more typical scenario. Some PCs are mobile. The use of paper to communicate information and drive clinical care is prevalent. There are a number of special work processes to handle paper, such as special paper that does not allow copying and shredding protocols so that paper generated by MIS is properly handled. Printers are widely distributed as paper protocols are integrated with MIS for patient care. Paper is used both for alerts to staff and to facilitate workflow process for patient care. One example of this is the use of printers for "Mis-o-grams." Using MIS, messages can be sent to one or more printers. The content of these messages can be to one or more individuals and cover administrative or clinical topics. Traditional methods of communication such as telephone, fax, and e-mail outside of MIS also are used. Clinical staff use handwritten notes to collect information and then transfer it into MIS (there is not much time lag between these processes), but there also is direct entry into MIS with no paper intermediary (e.g., nurses' progress notes). Handheld devices are used in the acute setting to electronically download information directly into MIS (e.g., blood sugar levels).

**Frequency.** MIS has increased communication frequency. For example, nurses indicated that they spend about 30% less time entering their progress notes. Laboratory results are processed electronically and are usually available on MIS within a few hours after tests have been completed, while paper copy is supplied (through Logician) within 24 hours. The goal to shorten time for availability of radiology images is one of the primary drivers for implementing a PACS.

**Nature.** MIS has been built primarily for historical storage and review of the patient record. The E7000 record also serves as a legal record. MIS has the potential to provide alerts and process control. Functions such as team collaboration are minimal. MIS provides a wide range of reports, both electronic and paper.

**Real-Time.** A high priority at NMHS is to maintain sub-second response time so that information is quickly accessible from terminals. Simultaneous, one-stop access to the patient record has improved the care process by giving clinical staff more time with the patient or other activities rather than physically search for patient records. Real-time access of some information has highlighted the need for real-time access in those areas where it is not available (e.g., with digital images from radiology).

**Alerts.** Two electronic alerts generated by MIS were observed. The first was a passive alert in that an item was flagged on the patient record. For example, results from a laboratory test would appear with associated normal parameters. The second alert related to laboratory results. If they fell outside the normal parameters, the pound character, #, was placed next to the laboratory result and the text was accented in bold.

**Quality.** Quality of communications has improved most in terms of legibility. Converting handwritten notes into electronic form (either through transcription or direct entry into MIS) has made review easier by other staff. Processes are in place to ensure accuracy of transcription. For example, medication orders handwritten by physicians are scanned in as well as typed in by nurses. A pharmacist then compares the two versions; if there are discrepancies, the physician is consulted before finalizing the orders into the patient record. Another aspect of quality is the structure of information. MIS forces certain information patterns that reduces missing information and also structures information including text. Text entries, such as nursing notes are often built from list selections that generate standard text. Graphical content is not possible in MIS. Interaction is solely text based with toggle selection of screen menus and only viewing one screen at a time (some recent innovation has provided limited multiple screen viewing). Screens are difficult to view and menus are difficult to navigate compared to a graphical user interface (GUI).

**Content.** Because there is no graphical content and no cut-and-paste capability, and because data entry templates force structured input that minimizes text, content is very distilled but contains a great deal of information. Various limitations are overcome or at least mitigated by a number of strategies. For example, a method was developed to display the information in the ACHE database in a separate window along with the E7000 information. Text strings on multiple rows are used to create simple graphical images to make screens easier to use. Analysis of images from radiologists in text form is provided rather than the image. The mainframe, command line oriented nature of MIS clearly imposes some limitations on content and functionality.

## **5. Workflow/Process Changes Due to EHR Adoption**

**Management Functions.** Because back office applications are the foundation of the MIS, there is opportunity to do many types of analyses to improve processes for planning, administration and clinical. NMHS utilizes cost and revenue center information to do cost/benefit analysis. One example is a major project to both streamline and put quality control measures into the admission process. NMHS has standardized electronic admission, discharge and transfer information and an electronically generated transfer summary. The template includes addressing procedures such as medications upon discharge, follow-up appointments (e.g., laboratory testing) and medication instructions. These are the discharge instructions sent home with the patient. There is also a physician discharge summary that includes the above plus more detailed recounting of the patient's stay. Patient satisfaction has been increased because patients no longer had to supply information repeatedly as they moved to different care settings. Also, NMHS reduces inefficiency by assuring that patient records are not duplicated with admissions by having a rigorous cross-checking capability and process to check for previous admissions using a unique patient identifier. Paper generated at printers often initiates some type of action. For example, laboratory tests are initiated by a paper printout that is requested via MIS by a physician. Results provided to the physician are provided electronically in MIS, and also a paper report is automatically generated and delivered to the physician's office. MIS-generated paper often is used directly in patient

care. After admission, a paper document accompanies the patient to entry into the appropriate health setting. Nurses use daily MIS printouts to dispense medication.

**Patient Interaction.** Patients are aware of computer terminals because they are visible but staff indicated patients are not that aware of MIS. Because paper is still widely used (although computer-generated to a great degree), patients do not see the computer interaction. Finally, NMHS resisted the idea of allowing patients or informal caregivers even limited access to the EHR.

**Staff Interaction.** Clinical and administrative staff have many processes that are predominately electronic team interactions. For example, pharmacy and lab tests are handled by MIS. Computerized paper that appears at printers often starts a process. Staff interaction may center around a paper output, such as a care plan in nursing homes or medication dispensing in acute care. Clinical staff spend less time looking for a patient record or verifying handwritten notes, resulting in less staff-to-staff interaction and more time with patients. Clinical analysts from the IT group interact with clinical staff on a weekly basis in team efforts for planning, training, prioritization, implementation and other activities to optimize the use of MIS and patient care. Efforts at NMHS to standardize nursing practices initially were difficult because there was no consensus among nursing units and staff. Implementation of the EHR in all facilities pushed the issue of standardization of schedules and terminology.

**Care Implementation.** Simultaneous, real-time, legible access is a significant benefit that is often mentioned by staff. Clinical staff reported they spent less time spent walking around looking for a chart, which results in more time with the patient. Less time is spent entering notes so, again, there is more time to spend with patients or other activities. Patient care is more organized and efficient with legible computer printouts of various activities. There are automatic reminders, and task lists are available daily. Processes to transfer information and care during shifts from one staff group to another are easier, take less time, and have fewer errors because information is more organized, clear, and structured. It was reported that the average length of stay has decreased with EHR implementation.

**Tracking.** With back office functions as the foundation for the MIS, various financial analyses such as cost/benefit analyses and inventory tracking are possible. NMHS tracks a number of clinical and patient processes, including customer satisfaction and medication errors. The QMS Quality Management System is a risk management process that focuses on near misses, missed dose, falls, pressure ulcers, and monitors effectiveness of interventions. Data are pulled monthly from EHR to ID problems and track trends. This system was created by NMHS's previous liability insurer. Allocation of resources is very important. Substantial effort is made to target those areas most beneficial to the organization for improvement or modification. Historical patient information can be tracked, such as vital signs. NMHS does a significant amount of process improvement, such as a major effort recently completed to streamline and standardize the patient admission process throughout the organization.

**Security.** NMHS stated that essentially an unlimited number of access levels are possible, but that roughly 200 are most commonly used, with 400 levels covering nearly all users. Exceptions to access levels can be approved by the project team. Different tasks such as read/write authorization and various template access are allowed depending on the user's profile. There is an audit of who accesses what information. Staff have been terminated, suspended or reprimanded for access violations. Thus, privacy is better protected with the EHR than with the paper record. Processes to shred paper on a daily basis have also been implemented. NMHS has tried Internet-based EHR registration, but there were concerns about privacy and security issues. School nurses register students via E7000. There was some concern about privacy issues, but HIPAA has helped them with the privacy issues that emerge from EHR. Parents have to sign a waiver. NMHS had a small study on using an EHR terminal at the patient's bedside to see the impact on the patient and nursing staff. There was a negative outcome in that, among other things, there was a security problem with an unauthorized patient access of the system. It was difficult to get the State Boards of Nursing and Physicians to accept electronic signatures.

**Documentation.** More than 34,000 screens (typically 500-600 in a given setting) are in use in various workflow processes (e.g., patient admission screens). Entry is structured to minimize long blocks of text, although free-form text entry is allowed. NMHS maintains a fully duplicated electronic and paper patient record, although the paper record is mostly computer-generated. Staff enter information directly into MIS (e.g., nursing notes), and handwritten information will eventually be scanned into the Sunrise Record Manager (SRM), the document imaging system, as it becomes fully implemented. Therapists' clinical documentation is mostly handwritten, but some physical therapists and speech therapists are beginning to use electronic templates to capture clinical narrative.

# **APPENDIX C: PEACEHEALTH**

## **A. Health System Overview**

PeaceHealth is a not-for-profit healthcare delivery organization that serves medium-sized communities in Oregon, Washington, and Alaska. It is made up of six community hospitals (ranging from 20 beds to a 420-bed tertiary care facility), medical groups, regional laboratories, pharmacies, and home health agencies. Inpatient rehabilitation facilities are physically located within the acute care hospitals. For the purposes of this report, the focus will be on the PeaceHealth Oregon Region (PHOR), Eugene, Oregon. The site visit was conducted in Eugene, which operates a 420-bed tertiary care hospital, one rural critical access hospital, and 14 medical group clinics within its West-Central Oregon service area.

The two-day site visit began with presentations by staff in the Healthcare Improvement Division (HID), PeaceHealth's system-wide division focused on information technology and quality improvement/safety. This half-day session provided the site visit team with an overall picture of the features and capabilities of PeaceHealth's Community Health Record (CHR), which is fully implemented at all six PeaceHealth hospitals, including hospital-based inpatient rehabilitation units, as well as a number of PeaceHealth outpatient clinics and medical groups. In addition some regional laboratories and pharmacies are interoperable with the PeaceHealth electronic health information system. An increasing number of physicians without a formal affiliation with PeaceHealth are beginning to contract with the organization to have access to the CHR for a modest fee. The main system used to collect clinical information is IDX LastWord®; throughout the document, the terms LastWord® and CHR will be used interchangeably when describing PeaceHealth's electronic health information system. The second half of day one was spent at the inpatient rehabilitation facility, which is physically located within the Sacred Heart Medical Center (PeaceHealth's Eugene hospital).

Day two began at Eugene Rehab, which is a privately owned, contracted, skilled nursing facility (SNF) where PeaceHealth-employed practitioners (physicians, nurse practitioners) are contracted as Medical Directors and have full read/write access to LastWord®. In addition, the SNF contracts with PeaceHealth to have read-only access to the CHR after patients have been accepted for admission. The site visit team then went to Sacred Heart Home Health, Hospice, and Home Infusion, which is a PeaceHealth-owned agency. Home healthcare clinicians have read-only access to some acute care and clinic information in LastWord®.

The remainder of the second day was spent at the Senior Health and Wellness Center, an outpatient clinic for seniors that has had access to CHR since it opened four years ago. The site visit team was able to witness some of the benefits of the PeaceHealth CHR at this setting.

PeaceHealth's vision is to expand the CHR into all care delivery systems. The first "roll-out" occurred in the acute care and physician office settings, but the commitment to have a patient-centered longitudinal electronic health record that spans the continuum of care is evident. PeaceHealth is looking into expanding the CHR to community providers, including non-PeaceHealth practitioners. This group potentially could include practitioners in post-acute and long-term care. PeaceHealth is starting with a large, independent, general surgery group practice. The model is likened to the utility company where groups can gain access for a monthly fee that includes information technology support.

PeaceHealth is beginning to provide patients access to their medical records via the Internet. With a software called PeaceHealth *PatientConnection*® (based on IDX *Patient Online*®), patients are able to schedule appointments, pay their bills online, look at test results, and get assistance with their medication management. This type of access could be shared with, for example, a home healthcare nurse. Using "My Shared Care Plan," practitioners across a community can gain access to essential information (problems, allergies, medications, etc.), which could have important applications in post-acute and/or long-term care. The Shared Care Plan is being piloted in the Whatcom Region as part of the Robert Wood Johnson Foundation (RWJF) Pursuing Perfection Project, Bellingham, Washington, and is not currently available in the Oregon Region.

## **B. Clinical Functions**

### **1. Nursing Homes/Skilled Nursing Facilities**

**Sites.** The site visit team went to Eugene Rehab, a private, for-profit, 112-bed SNF that has recently contracted with PeaceHealth (April 2003) to have a PeaceHealth MD/GNP as Medical Director which allows her/him the opportunity to view and modify the PeaceHealth CHR, including a feature called RxPad® that facilitates outpatient medication ordering. More recently, the facility has contracted with PeaceHealth to have read-only access to the CHR for its own staff after patients are accepted for admission. The facility cares for both PeaceHealth and non-PeaceHealth residents, and the staff are employees of Eugene Rehab.

**Admission.** Few clinicians outside of the SNF routinely access information about what transpired in the SNF beyond what is contained in the discharge or transfer summary. However, PeaceHealth-employed GNPs and MDs routinely access information regarding what transpired in the hospital or outpatient clinic. Practitioners emphasized that the value of an EHR to a patient's SNF stay is greatest at admission and discharge. Obtaining laboratory reports and radiology images and/or reports is an additional benefit.

When a patient is admitted into the SNF, the PeaceHealth GNP and MD can pull up the following information from the PeaceHealth CHR: patient's history and physical from the acute care episode; nursing notes, consultants' notes, case management

notes; advance directives, comprehensive problem list, allergies, the medication list from the hospital and PeaceHealth outpatient clinics, and wound care. Hospital discharge summaries generally are not available for approximately 24 hours; discharge summaries from specialists can take a week or more. The hospital discharge orders (a standardized care transfer form) are completed on paper forms.

At admission, the GNP and MD look up the patient's outpatient medication list in RXPAD®, but the list may or may not have been updated since the last time the patient was in the clinic. During a resident's stay in the SNF, the medication list is maintained on paper, and RxPad® is only updated by the GNP when the patient is transferred or discharged from the SNF. The SNF Admissions Coordinator and Nursing Director can review the patients' LastWord® record prior to arrival from the hospital. The information is useful in preparing for the transfer and in their MDS assessment of the patient.

At SNF discharge or transfer, the medication administration record (MAR), physician's orders for life-sustaining treatment, and nursing notes accompany the patient (on paper) and/or are faxed to the appropriate provider. If a patient is transferred from the SNF to a PeaceHealth hospital, the GNP can dictate a stat note which will be available in LastWord® within one to two hours of hospital admission.

**Orders.** During the SNF stay, orders are written by either the PeaceHealth MD or GNP on paper and taken off by the ward clerk. The flow of order is largely independent of the CHR, with the exception that laboratory and radiology results, which are reported in LastWord® if they are processed by a PeaceHealth-owned or operated facility.

**Narrative.** Clinical narrative dictated by either the PeaceHealth-employed MD or GNP are entered into the CHR and are accessible by the SNF Director of Nursing and her/his designees (read-only) and to any PeaceHealth or non-PeaceHealth physicians/clinicians who have permission/security clearance to access LastWord®. Dictations primarily occur upon admission or discharge/transfer. Periodic progress notes generally are recorded in the paper chart.

**Clinical Decision Making.** The PeaceHealth MD and GNP have access to the CHR's general decision support. This includes access to MedLine, Up-To-Date, formulas for adjusting medication dosing for an individual's kidney function, and evidence-based guidelines developed for other settings.

**MDS Integration.** Eugene Rehab staff collect the MDS data on paper and enter the information as well as available information from the hospital stay into a niche MDS point-of-service software.

**Access.** Eugene Rehab, the SNF affiliated with PeaceHealth, is a privately owned institution. Therefore, it pays a modest fee of \$95/month for the SNF clinical staff to have read-only access to the PeaceHealth CHR.

**Transition.** Having the ability to access detailed information regarding what transpired in the hospital allows the PeaceHealth-employed GNP and MD to be less reliant on hospital staff for transferring the essential information needed to manage the patient in the SNF. Although all area SNFs have agreed to a common transfer data set, practitioners in the "sending" institution do not always necessarily know the specific information needed by practitioners in the "receiving" setting. For PeaceHealth, the sending hospital transfers standard core information that the SNF MD and GNP can supplement through their own efforts. This applies not only to new admissions but also when SNF patients are transferred to the hospital and back. A standardized transfer form and dataset are used for all transfers to community SNF facilities.

## **2. Home Health**

**Sites.** The site team visited Sacred Heart Home Health, a PeaceHealth-owned HHA. LastWord®, including RxPad®, is not formally integrated with HHA clinical documentation. Prior to PPS, plans were underway to achieve such integration. However, IDX was not interested in adapting the CHR to comply with the new PPS rules; therefore, PeaceHealth decided not to support home health within LastWord® but rather to go with an "off the shelf" niche vendor software that would meet the new regulatory requirements. According to the Director of Patient Services, the plan is to expand the use of the home care niche software to include clinical documentation that will interface with the CHR.

**Admission.** Upon a patient's admission to home health, the PeaceHealth intake staff are able to access, on a read-only basis, information about the patient's recent hospital stay and clinic visits. They frequently use this information as the initial basis for determining acuity, assigning staffing levels, and for beginning their clinical assessment. This use of the CHR is very similar to what is described above for the GNP and MD in the SNF. Following assessment, PeaceHealth home health staff occasionally access the CHR from the office at the start or end of the day, but currently they cannot access LastWord® in the field. PeaceHealth home health staff do not enter any clinical information collected during the home health episode into LastWord®.

**Orders.** Physician home health orders are not entered into the PeaceHealth CHR. The results of laboratory tests, assuming they are processed at a PeaceHealth laboratory, are entered by the laboratory into LastWord® and can be accessed by PeaceHealth home health practitioners (at the agency, but not remotely). The same is true for radiology results.

**Narrative.** At this time, clinical narratives related to home visits are charted on paper and are not entered/scanned into the PeaceHealth CHR.

**Clinical Decision Making.** PeaceHealth home health clinicians have access to the PeaceHealth CHR's general decision support. This includes access to MedLine, Up-To-Date, formulas for adjusting medication dosing for an individual's kidney function, and evidence-based guidelines developed for other settings. This is not specific, however, to



home health *per se*. Home health clinicians also can monitor use of the emergency department for patients they are following.

**OASIS Integration.** OASIS data are not entered into the PeaceHealth CHR; rather, Sacred Heart Home Health uses a niche OASIS software (Novius) to enter and report these data to the state to meet regulatory requirements as well as to calculate home health resource groups (HHRGs). As noted above, home health clinicians occasionally will abstract pertinent information from the CHR to enter into OASIS information, but the reverse flow of information does not occur.

**Access.** If the intake coordinator and home health nurses are physically at the home health agency, they are able to read and print out information on PeaceHealth patients in the CHR, which is then placed in the patient's paper chart. In general, home health records are not part of the PeaceHealth CHR. Very little, if any, information collected while the patient is receiving home health services is entered into LastWord®.

**Transition.** The information access at PeaceHealth's HHA is similar to the SNF. That is, staff have the ability to read detailed information regarding what transpired in the hospital or in the clinic. This allows PeaceHealth home health clinicians to be less reliant on hospital staff for transferring the essential information needed to manage the patient.

### **3. Rehabilitation Facility**

**Sites.** Peace Health's rehabilitation facility is physically located within the main acute care hospital (Sacred Heart Medical Center), and is fully integrated into Peace Health's CHR. It is an 18-bed, JCAHO-accredited unit, with an average daily census of 14.

**Admission.** The rehab physician is responsible for taking the complete history and physical and admission note, while the nurse conducts the nurse intake. Physicians dictate their notes, abstracting relevant information from the hospital stay and incorporating that in the corresponding section of the rehabilitation stay. Physicians type the majority of information they collect into the workstations that are located throughout the unit. Each user has her/his own login and password; permissions for accessing certain information are based on job responsibilities. All clinical staff in the rehab unit (nurses, therapists, physicians) have real-time access to all information that is in the acute care CHR, because they are accessing the same electronic record. In addition, they have access to the CHR's general decision support that includes access to MedLine, Up-To-Date, formulas for adjusting medication dosing for an individual's kidney function, and evidence-based guidelines.

The categories of information integrated into the CHR include patient demographics, history and physical, prior setting, diagnosis(es) and reason for admission, admission assessment, problem list, advance directives, allergies and social/economic status. It is important to note that this is the only setting where

Computer-Based Provider Order Entry (CPOE) is performed. (Future roll-outs of CPOE to other units are planned.) Integration of the hospital and rehabilitation records allows the clinician to abstract relevant information from the hospital stay and incorporate this in the corresponding section for the rehab stay (e.g., updated problem list, allergies, physical therapy goals and treatment plan, etc.).

**Orders.** On the inpatient rehabilitation unit, pharmacy, laboratory, radiology, nutrition, and therapy orders are electronically entered by the appropriate clinician. Results of laboratories, radiological studies, and current medication lists also are all available electronically.

The PeaceHealth inpatient rehabilitation unit volunteered to conduct a pilot study on CPOE. This trial, which has been running for nearly a year, included a time usage component. The CPOE trial showed that it took 36 seconds to write a single order on paper versus 41 seconds to type an electronic order. It took 14 minutes to write an entire set of admission orders, and seven minutes to type them electronically. PeaceHealth also reported that, with CPOE, it has reduced medication errors due to incomplete or illegible orders from 25% to nearly 0%.

**Narrative.** Each of the disciplines (nursing, LPN, physical therapy, occupational therapy, speech therapy, and social work) that are involved in the care of the rehabilitation patient electronically document progress notes. The only exception to this is physician and LPN notes. A combination of templates and free-form text is used. Templates have been encouraged more than free-form text. For example, templates are available for nurses and social workers to enter information such as bowel sounds, as well as functional status (activities of daily living and instrumental activities of daily living).

**Clinical Decision Making.** Within PeaceHealth's acute care setting, which includes the inpatient rehabilitation unit, there are many decision support tools available for the clinicians. Examples include expert rules; references; antibiotic assistance; rounds reports; and protocols, order sets, and guidelines. Peace Health's data warehouse also provides retrospective decision support.

**IRF-PAI Integration.** According to the Director of Inpatient Rehabilitation Services, PeaceHealth uses the UDS software to submit data to its fiscal intermediary. The data elements are integrated into PeaceHealth's clinical documentation in LastWord®. They have set up a view that pulls those data elements, which are then pulled and entered into the UDS product. PH has created the IRF-PAI worksheet in LastWord®, but it had difficulty doing a download into the UDS software. This was because, initially, the UDS software was not HL7 compliant, and more recently because PH does not collect all the demographic information on admission in the exact format needed for the IRF-PAI. Therefore, there is still some duplication of effort.

**Access.** Each of the practitioners in the rehabilitation unit have access to the CHR; some have read-only access and others have the ability to add to or modify the record.

The level of access is based on the person's role and position within the organization. Clinicians in the outpatient setting (clinic) can access information regarding what transpired in the inpatient rehabilitation unit.

**Transition.** Because the inpatient rehabilitation unit clinical staff have access to detailed information regarding what transpired in the hospital, they are less reliant on hospital staff for transferring the essential information needed to manage the patient.

#### **4. Pharmacy**

In all of the PeaceHealth acute care settings, including the hospital-based inpatient rehabilitation unit, 100% of medications are ordered online as a part of the CHR.

When a patient is discharged from the acute care hospital and admitted to the inpatient rehab unit, the medication lists are reconciled by the rehab physician. Specifically, the physician looks at what was active/inactive during the acute care stay, checks for duplications, adds or subtracts medications, etc. The rehab physicians use the inpatient pharmacy system (a LastWord® pharmacy module), which does not include over-the-counter medications. Upon discharge, the rehab physicians handwrite the take-home medications (or have the nurse do verbal orders for that).

In the PeaceHealth medical group clinics, a very high percentage of medications also are ordered using RxPad® (an outpatient medication ordering tool). This year, PeaceHealth will approach two million prescriptions ordered online using RxPad®, which is considered part of the PeaceHealth CHR.

PeaceHealth has a number of expert rules that impact the medication ordering process in acute care and in the outpatient clinics. These include: (1) alerts that identify ordered medications that conflict with a patient's allergy list; (2) alerts that automatically calculate creatinine clearance when medications are ordered; (3) alerts that identify drug interactions (e.g., warfarin alerts); and (4) alerts that retrieve a patient's active medication list from RxPad® for outpatient care providers.

With regard to non-owned SNFs, each facility has its own process. Eugene Rehab (the SNF we visited) contracts with outside pharmacies that "bubble-pack" and deliver their stock supply of medications. It is a paper process where most of the communication with the physician practices to get orders for medications is all done by fax. The exception might be when one of the PeaceHealth GNPs is in one of the four SNFs that have PC access to PeaceHealth's CHR; in this instance s/he may order discharge medications and reconcile the medication list through the PeaceHealth system. No information is available on how SNFs check for drug interactions and/or drug duplications, but pharmacies with which they contract do check for duplication and interactions.

Sacred Health Home Health does not have its own pharmacy. It faxes a request for a medication to the PCP who either calls in the medication to the patient's preferred

pharmacy or gives the order to the home health nurse to call into the pharmacy. If the patient is seeing a PeaceHealth PCP, then most of the prescriptions are prescribed through the PeaceHealth CHR (RxPad®). Home health keeps its own paper record of medication lists and allergies that gets reconciled at each home visit. Hospice, on the other hand, contracts with a few local pharmacies that deliver medications to hospice patients. Hospice also uses all paper processes.

## **C. Organization, Culture, and Impact**

### **1. Business Plan**

In 1991, the PeaceHealth CEO, with the blessing of the board of directors, hired an outside group to evaluate the current health delivery system and make recommendations for future developments. The initiative, entitled the "Mission 2000 Project," identified three main goals or visions for the future:

1. Migrate toward a more integrated and seamless form of care;
2. Establish a culture of quality improvement and safety; and
3. Implement an information technology and information management structure capable of supporting the above goals.

The success of PeaceHealth's community health record (CHR) is attributed to its strong leadership and clearly articulated vision. The Healthcare Improvement Division (HID), headed by John Haughom, MD, was borne out of the Mission 2000 Project. The HID is a centralized corporate information technology (IT) department that has worked closely with IDX during the past 13 years to design a single health information system that spans three states. A high-speed network is run to every PeaceHealth physician's wall. Although this approach was expensive, it has paid significant dividends in the long run for PeaceHealth. Access to clinical information outside of the hospital walls is seen as a significant benefit to clinicians, who then have been more forgiving when mistakes or delays occur. In addition, as the clinical workstation became the center of care, the physicians' reliance on the PeaceHealth electronic health system was cemented.

The goal of the CHR is to be a community asset, and one that can be used across the continuum of care. It includes (or will include in the future) a longitudinal medical record, a lab system, a financial system, and a practice management system.

The health information system was first implemented in 1996 at St. Joseph's Hospital, Bellingham, Washington. Today the CHR database, IDX Carecast®, supports care for 1,333,183 patients in three states.

PeaceHealth has set up a separate subsidiary of the HID to address growing independent physician interest in its electronic health delivery systems. PeaceHealth offers technology services for a market-based fee, using an application service provider (ASP) model as the delivery vehicle. It provides three primary categories of service:

1. Access to PeaceHealth's network and applications
  - IDX Carecast®
  - IDX Flowcast®
  - IDX Imagecast® (radiology information system [RIS] and picture archiving and communication system [PACS])
2. High bandwidth access to the Internet
3. Medical practice technology consulting
  - Technology solutions to improve workflow

## **2. Organization Structure**

As noted earlier, in the early 1990s, PeaceHealth combined information technology (IT) and quality improvement/safety into one system-wide division, the Healthcare Improvement Division (HID), headed by John Haughom, MD. This division is distributed proportionally across the five regions.

The first "live" version of the EHR was implemented in 1996 at an acute care hospital in Washington. Since that time, the order of implementation has been:

1. Acute care and physician offices
2. Non-physician entry of
  - problems
  - medications
  - laboratory orders and results
  - patient demographic information
  - allergies
3. As of April 13, 2004, PACS will be implemented in approximately 75% of the organization (Bellingham, Cottage Grove, and Eugene regions). The remaining 25% of the health settings will have PACS implemented by the fall of 2004.
4. CPOE and progress notes for physicians are next in queue.
5. Extension into non-PeaceHealth physician offices appears to be next.
6. Read/write LastWord® access is currently available in four SNF facilities where a PeaceHealth MD/GNP geriatric services team provides care. This team currently attends to patients in all community SNFs and long-term care NHs as well as many residential care facilities (Alzheimer/dementia-related facilities) and assisted living facilities (ALFs). PeaceHealth anticipates that accessibility to the CHR in these facilities will continue to evolve during the next several years.

At the post-acute and long-term care settings visited during the PeaceHealth site visit, organizational changes, such as the creation or consolidation of departments, was not reported.

### **3. Staffing/Training**

**Staffing.** At Eugene Rehab (the non-owned SNF), there has been no change in the number or type of staff since the contract was initiated in November 2003. Because Sacred Heart Home Health has read-only access to IDX LastWord®, its staffing levels have not been affected by the implementation of the PeaceHealth EHR. We were not able to ascertain if staff size and type have changed with time in the acute care or inpatient rehabilitation facility health settings.

**Training.** With regard to training, the HID spent an enormous amount of time preparing for the use of the EHR. Training to date has been limited to the six acute care hospitals, PeaceHealth-owned clinics, and contracted SNF staff. The strategy used was to first familiarize staff with other systems: e-mail, Web references, etc. Then, they assessed the skill level of end users, and tailored the training to the user. Training was not done too far in advance, and was completed in "bite sized" portions, rather than all-day sessions. Training focused on need to know vs. nice to know. The emphasis was on workflow change and the accompanying change in how patient information is documented or retrieved.

End users were not forced to use the electronic health system. They were given opportunities for practice on the unit, usually in "20-minute modules" versus two-hour sessions. The HID accommodated different learning styles and training tools, such as classroom style, CBT, printed "cheat sheets," and online manuals.

Once the system "went live," PeaceHealth was prepared for more re-training. Round-the-clock on-site support was provided and "super-users" answered most of the questions. There was a clear escalation strategy for questions, and a commitment to a rapid turn-around on issues and communication.

We were unable to determine if and when any training would take place or would be needed at any affiliated or owned post-acute or long-term care settings.

### **4. Communication**

PeaceHealth clinicians have real-time access to all information in LastWord®. According to Dr. Haughom, everything is online except physician progress notes and orders at all six PeaceHealth hospitals, (including any hospital-based rehabilitation units). The physician progress notes are all handwritten and kept in a paper chart. All routine information is online, including nursing, therapy, case management, and social work notes. Because the clinical workstation is the center of care, each type of staff enters her/his own information (or dictates it, and it is then entered by a dictation clerk shortly thereafter).

LastWord® has a number of alerts built into the system. For example, physicians are notified when their patients are admitted to the hospital or receive care in the emergency department.

The PeaceHealth IRF volunteered to conduct a pilot study on CPOE. This trial, which has been running for nearly a year, included a time usage component. The CPOE trial showed that it took 36 seconds to write a single order on paper versus 41 seconds to type an electronic order. It took 14 minutes to write an entire set of admission orders, and seven minutes to type electronically. PeaceHealth also reported that, with CPOE, they have reduced medication errors due to incomplete or illegible orders from 25% to nearly 0%.

Although most of the staff at the SNF and HHAs visited during the PeaceHealth site visit are limited to read-only access to LastWord®, staff commented on the value of being able to read clinical progress notes (with the exception of physician notes), medication lists, emergency department and outpatient notes, etc. Within these two post-acute care settings, the usual methods of communication regarding patient care between healthcare institutions are the telephone and fax.

### **5. *Workflow/Process Changes Due to EHR Adoption***

Eugene Rehab, the SNF with which PeaceHealth has a contractual arrangement, now has read-only access to the inpatient stay information on a potential patient. It can develop a care plan with the benefit of accessing a patient's recent hospital stay, including medications, laboratory results, therapy notes, and transcribed office notes. However, the workflow here has not drastically changed with the recent read-only access to LastWord®. Rather, all documentation is done on paper; the MDS data are entered into a niche software; there is a separate software for back office functions (which is not tied in with the PeaceHealth electronic system); etc. Patients at this facility have no electronic access to their health information related to their stays at Eugene Rehab.

Similarly, because Sacred Heart HHA is not electronically linked with the PeaceHealth EHR, workflow processes have not been affected, with one exception: a limited number of clinical managers have read-only access to LastWord® and print off information for their field clinicians (nurses, therapists, and social workers) to read and inform how they will provide patient care. This information is kept in a paper chart. OASIS data are entered into a niche software, and another software is used to support back office functions such as billing and scheduling.

The PeaceHealth inpatient rehabilitation facility has the same capabilities as the rest of the acute care hospital. Prior to the implementation of the CHR, the HID spent considerable time analyzing process and workflow. They determined that installing software is 80% process and 20% technical. Their goal was not to replicate the current paper processes, but rather to design desired processes first, which meant uncovering process variations that were not readily apparent. In reviewing the clinical documentation process, they first conducted an upfront clinical analysis of what was documented and why, including the documentation of care by multiple disciplines. They also identified unnecessary and redundant data items. The result of this upfront analysis

is a system that captures the most essential data elements to provide quality care, while at the same time capturing information necessary for tracking trends and meeting regulatory (e.g., JCAHO) requirements.

The impact on how management functions (e.g., back end business procedures, scheduling, staff meetings, case conferences, staff assignments to patients, etc.) has changed as a result of implementing the electronic health record was not discussed in any detail at any of the healthcare settings we visited during the PeaceHealth site visit.



# **APPENDIX D: DEACONESS BILLINGS CLINIC**

## **A. Overall Health System**

In 1993, Deaconess Hospital (not-for-profit) and the Billings Clinic (for-profit partnership) merged to become an integrated not-for-profit foundation (Deaconess Billings Clinic, or DBC). DBC is a multi-specialty physician group practice and hospital that is governed by the community with physician leadership at all levels. DBC is both a hospital where more than 300 physicians have hospital privileges, and the region's largest multi-specialty group practice with more than 200 physicians. The site visit was conducted primarily at the DBC campus in downtown Billings. The campus includes Billings Clinic, Deaconess Hospital, Psychiatric Center, Welch Heart Center, Occupational Health and Wellness, Orthopedics and Sports Medicine, and the DBC Foundation. Also located in Billings, but several miles from the main campus, are two additional primary care clinics, the Wellness Center and Aspen Meadows Retirement Community, which includes a 90-bed nursing home. This facility was visited by the team on the final day.

Seven additional DBC-owned regional clinics are located throughout Montana and in Northern Wyoming. These clinics serve the rural population of these two states as well as Western North Dakota residents.

DBC also provides management, information system, and ancillary support services to area hospitals and clinics. These are considered affiliate relationships. The site visit team visited one of these affiliated skilled nursing facilities, Bear Tooth Hospital and Health Center, in Red Lodge, Montana.

Montana's entire population is made up of more than 900,000 residents. Billings is the largest city in the state, with a population close to 90,000. A large percentage of DBC's subspecialty care patients come from its secondary or even tertiary referral bases. For example, 40% of its orthopedic consultations come from outside of its primary care network.

Deaconess Hospital is in direct competition with the other hospital in Billings. These two organizations are the major healthcare providers for Central and Eastern Montana plus Northern Wyoming. These facilities perform both in a competitive and cooperative fashion. Each has either owned practices or affiliates in most outlying towns and communities. The two hospitals have very different philosophies and underlying structures, and DBC has increasingly used its integrated information system and philosophy as a marketing tool.

Specifically, at DBC, physicians are DBC employees and therefore have read/write access to the 3M Clinical Workstation and HELP systems. DBC also has marketed to non-owned referring physicians by providing them with an Internet-accessed portal (DBCdoc.com, running on technology by a company called Health Vision), which allows

them to review clinical information collected while its patients are being cared for at a DBC hospital or clinic. This includes patient test results, radiology results, dictated progress notes, pathology, and microbiology. Finally, the DBC organizational culture has been geared toward group decision-making.

In contrast, the other hospital in Billings is an independent practice organization (IPO), where the central hospital employs the primary care physicians and is affiliated with a number of independent specialty physician practices. Each practice has its own medical record system, none of which electronically communicates with the hospital or each other. This hospital has invested in nursing bedside and bar coding technology rather than an integrated EMR. The hospital charts are paper.

The capitated care is very low (less than 1%), and there is no Medicare or Medicaid HMOs. DBC primarily has a discounted fee-for-service structure with some aggressive insurance company competitions to build restrictive provider panels.

DBC is in the process of changing its electronic health information system. 3M's Clinical Workstation currently is used to review the patients' clinical data and enter lists of problems, medications and allergies, and the HELP system is used to order laboratory tests and radiology tests. Outpatient medications are entered and printed by physicians in the Clinical Workstation system and inpatient medications are entered by pharmacists into the HELP system. DBC is implementing Cerner's Millennium system in the next three months in all DBC-owned clinics and at Deaconess Hospital. It is spending \$9 million in the coming year to implement Millennium's full suite of products in both the inpatient and outpatient settings, including the data repository, ambulatory charting, inpatient physician order entry and order management, emergency room documentation and tracking, pharmacy system, laboratory system, etc.

The drive to replace its current EHR in the acute care hospitals and owned clinics comes from a quality improvement, patient safety, and strategic marketing direction. It is hoped that the Cerner EHR purchase (often referred to as Clinical Information System or CIS) will result in improved outpatient physician productivity and increased inpatient market-share. Other components of implementing the Cerner IS project include Computer-Based Provider Order Entry (CPOE), which will enhance physician order entry and reduce medication errors. The computerized pharmacy system will provide online real-time tracking of inpatient medications, generate alerts on late or missing doses, intercept allergies and provide access to patient's outpatient medication lists especially at critical transition times between admission or discharge and hospitalization. This will result in an overall improvement in the quality of patient services and improve patient safety.

DBC has a developing Picture and Archiving System (PACS) (by General Electric) with a combination of digital radiography, computed radiography, and scanned film images. DBC reads all the films of its affiliates during the day and evening hours (6am to 10pm) and then outsources its night-time radiology interpretations to an Idaho-based company (NightHawk) that employs United States' physicians stationed in Australia.

This has allowed DBC to recruit and retain radiologists because aside from interventional procedures, the "on-call" responsibilities end at 10pm.

DBC's central laboratory serves as a reference laboratory for much of Northern Wyoming and Montana outside of the DBC care network, but the patient data are stored in separate silos due to HIPAA concerns and are not accessible even to DBC physicians; there is no "break-the-glass" capability to see all the patients' data.

On day one of the site visit, we visited the acute care hospital, the emergency department, and the DBC Downtown clinic. On day two, we drove 60 miles to visit an affiliated, non-owned nursing home (NH) in Red Lodge, Montana. The afternoon of the second day was spent with the Medical Director of Information Services for acute and ambulatory care in Billings. The final day was spent at Aspen Meadows, a DBC-owned NH in Billings.

## **B. Clinical Functions**

### **1. *Acute Care Hospital and Physician Clinics***

The DBC EHR in the acute care setting captured the vast majority of the patient's clinical data, achieving "anytime, anywhere" availability of information. This was not only a marketing advantage, but also an important clinical tool across the inpatient and outpatient settings, as well as in the emergency department (ED) and "Same Day Care." In fact, its Same Day Care department no longer requests that the paper chart be pulled and delivered. Internal medicine also stopped pulling charts for prescription refills and telephone calls unless more detailed information was required.

In the ambulatory setting, the 3M Clinical Workstation allowed physicians and staff access to patients' progress notes, laboratory results, radiology results, microbiology and pathology, demographics, scheduling information, problem list, medication list, and allergy list. Physicians dictated their progress notes, which then were transcribed and available in the Clinical Workstation. Physicians or her/his nurse entered medications into Clinical Workstation directly; this gave the added benefit of legible prescriptions and maintaining a centralized medication list. Other orders were handwritten and handed off to clinic staff. There were no alerts or clinical decision-support tools in the ambulatory setting at the time of the visit. The clinical staff did have access to Micromedex, an online medication interaction tool that also provided patient education materials.

The ambulatory clinic staff had access to 3M's HELP system for order management (staff entering physician orders for lab tests and radiology tests). These orders were transmitted electronically and had the added benefit of improved tracking for billing purposes.

For inpatient care, the physician and staff have the option of viewing patient data and results in the HELP system or Clinical Workstation. Inpatient documentation of

clinical narratives by physicians, nurses, and other staff were strictly on paper, except for the hospital discharge summary and ICU department. Orders were strictly handwritten by physicians, and entered by staff and pharmacists into the HELP system. The inpatient medication list (the source for printing a MAR: medication administration record) was different and not synchronized with the outpatient medication list maintained in Clinical Workstation. However, both inpatient and outpatient medication lists could be viewed in Clinical Workstation. Alerts on medications in the HELP system appeared to the pharmacist who then contacted the physician by phone or pager to discuss. Medications were delivered from the pharmacy to the nursing floors and were dispensed from a dispenser cart system (Omni-Cell), a unit dose manager. DBC does not yet have a bar coding dispensing system. An Omni-cell cabinet was located on each nursing unit where nurses obtained evening medications, including narcotics.

## **2. Nursing Homes**

**Sites.** There are seven nursing homes in the Billings area, one of which is owned by DBC. Within this market share, DBC manages approximately 60% of the nursing home patients. The other 40% of the patients are managed by other primary care physicians, most of whom are affiliated with the other hospital in Billings.

The DBC-owned Aspen Meadows Retirement Community provides three living options, depending on the resident's physical and healthcare needs. It has assisted living apartments, a transitional care unit, and a long-term care nursing home (NH). The site visitors focused their questions on what occurred at the NH. We spoke with the Director, the Director of Nursing, and the Clinical Coordinator.

We also visited an affiliate nursing home at Beartooth Hospital and Health Center, located 60 miles from Billings in Red Lodge, Montana. During this visit, team members spoke with a DBC-employed IT support person, the Director, and the Assistant Director of Nursing.

**Admission.** Aspen Meadows received a fax packet from Deaconess Hospital, which was reviewed at an interdisciplinary meeting every morning. There was a three-page transfer referral form with attached laboratory tests and consultation reports, including PT/OT/ST/nursing notes/physician notes. If anything was missing, a clerk could (but often did not) log into the DBC EHR and print out missing information. However, not all required information was in the EHR. Non-DBC physicians could view about one-third of the Aspen Meadows residents. These physicians generally had no access to the DBC EHR, but had full access to the papers printed from the EHR in the paper chart. The staff indicated that full electronic access to the Deaconess EHR would reduce the need to photocopy and fax and file, and would improve efficiency on both sides of the referral.

The affiliate NH (Beartooth) received data much the same way, as a fax packet, which was reviewed at a nursing conference each morning. The staff at this affiliate did

**not** have access to the DBC EHR; only DBC physicians and physician assistants (PAs) had access.

**Orders.** At Aspen Meadows, the physician wrote orders on paper. These orders were separated by category. Pharmacy orders were picked up by the pharmacist on a daily basis (they were hand carried) who then also entered the orders into the freestanding McKesson Pharmaserve for Windows system. The pharmacist used the HELP system for drug verification, and maintenance of the hospital medication list, which the pharmacist printed and gave to the nurses when the patient was admitted. If there were concerns about the medications due to alerts or interactions, the pharmacist contacted the physician directly and made changes online, as well as wrote out a verbal order to be signed later on paper. The system printed a 30-day medication administration record (MAR) for nursing use in the paper chart. Aspen Meadows recently installed a stand-alone McKesson Pharmaserve for Windows. Future goals include interfacing this stand-alone system with the Cerner CIS.

At Beartooth NH, the affiliate in Red Lodge, the physician wrote orders on paper. The orders were all entered by a nurse or an LPN into the stand-alone MDS software system (VistaCare), which served both as an MDS system and a way to keep track of orders. An RN reviewed these typed orders for accuracy, and a physician signed off on the printout. There was no electronic signature. Beartooth staff indicated that this allowed them to have legible orders, a way to report MDS data with less duplicate work, and a way to reprint current orders for signature without rewriting everything every 60 days, which is another regulatory requirement.

**Narrative.** The physician wrote a note in longhand, and it was placed in the chart. Some physicians and physician assistants dictated their notes. A copy of the dictated note was placed in the paper chart (at both facilities) as well as put in Clinical Workstation when DBC physicians dictated their notes from the DBC Red Lodge Clinic. When the notes were dictated and transcribed at Beartooth, the notes were placed in the NH paper chart. The same workflow was true for both Aspen Meadows and Beartooth. Nursing notes at both institutions were kept on paper, with the exception of the elements of the MDS system documentation.

**Clinical Decision Making.** At Aspen Meadows, an interdisciplinary team helped generate MDS data, and there was a full-time RN whose main function was to abstract data and enter them into the stand-alone MDS software (VistaCare). VistaCare generated quality reports, and was able to create patient lists sorted by problem (e.g., diabetic patients). These additional features were used at Aspen Meadows on a regular basis, but less so by Beartooth staff.

Separate from the MDS software, the Aspen Meadows staff also had internal quality reports and audits that were done on paper. The pharmacist, who entered medications into the HELP system, received drug interaction alerts and then notified the physician. The VistaCare software generated regulatory-related alerts such as pain management and restraint orders, which were presented to the nursing staff for action.

Additionally, DBC extended its Micromedex drug database software to both the owned NH and the affiliates, so all the staff at both NH locations had full access to Micromedex for drug interaction checking and staff and patient education on drugs.

***MDS Integration.*** The VistaCare software was used at both the DBC-owned NH (Aspen Meadows) and the affiliate NH (Beartooth). It was a stand-alone MDS niche system requiring significant data entry.

***Access.*** At Aspen Meadows, the DBC-owned NH, both physicians and staff had access to the DBC EHR. At Beartooth, only DBC physicians had access to the DBC EHR; the Beartooth staff did not have access.

***Transition.*** The transition from acute care to the NH in both locations (Aspen Meadows and Beartooth) was primarily dependent on faxed documents and/or documents delivered with the patient. The shared information at transition included physician transfer orders, discharge summary, prescriptions, and patient information. There was a workstation at each NH at which the treating physician or physician assistant, if a DBC employee, could pull up additional data on the patient at the hospital. Access by other staff was variable and limited.

***Unique Characteristics.*** As previously mentioned, we visited two nursing homes (NHs) during the site visit. One, Aspen Meadows, is a DBC-owned nursing home that had access to the HELP order management and the McKesson pharmacy management system, and physicians there had access to Clinical Workstation for discharge summaries, clinic notes, outpatient and inpatient medication lists, allergy lists, laboratory results, and radiology text results. We also visited an affiliate nursing home in Red Lodge, 60 miles outside of Billings where the main campus is located. Beartooth Hospital and Health Center is a critical access hospital with an attached NH and home health agency. In contrast, the second nursing home only had read-only access to the DBC EHR (3M Clinical Workstation) for its physicians and PAs (if they were DBC physicians). The other clinical staff did not have access to the 3M Clinical Workstation. They also did not have access to HELP. They used VistaCare, an MDS management system, which also helped maintain some nursing documentation, a medication list, and demographic data. In fact, both NHs used this system for tracking and reporting on MDS data. Both NHs also had use of the DBC financial systems, although the data were kept in distinct databases (silos) from Deaconess Hospital. However, the Beartooth NH staff did not use all of the features of VistaCare (e.g., internal quality monitoring, creation of a face sheet, etc.).

Staff at Aspen Meadows indicated that there was a full-time RN whose main responsibility was MDS data entry, review, reporting, etc. They indicated that there is value to the MDS process, but that they would do that regardless of the reporting and regulatory requirements of MDS. Perhaps the least helpful parts of the MDS are the RAPs, which take up to 75% of the nurse's time. Reportedly, these treatment plans are not helpful and do not reflect the actual plans developed by the nurse and physician.

They believe that if the RAPs were not required, nearly 75% of that nurse's time could be spent on more productive patient care issues.

### **3. Home Health**

DBC does not own any home health agencies (HHAs), and we did not visit any affiliated agencies on this site visit. However, the director of the Beartooth NH also runs the home health and hospice. During the interview with her, she mentioned that her HHA has no connectivity or access to the DBC EHR. The OASIS information collected in the home every 60 days was entered into a stand-alone software package (SoftMed) specific to OASIS. No other information about the home health agency's process was collected during the visit.

### **4. Rehabilitation Facility**

DBC does not have an inpatient rehabilitation unit.

### **5. Pharmacy**

**Acute Care and Physician Offices.** At physician offices, the physician and/or clinical staff created a medication list in the 3M Clinical Workstation. This was purely an outpatient medication list, and it generated a legible printed prescription from a coded list of medications. It does *not* do drug-drug interaction or drug-allergy checking. The patient received the printout and took it to the pharmacy to fill. If a prescription refill is requested, the triage nurses in the clinic had full access to this medication list. There was a protocol in place for them to receive the call from pharmacy for refill requests; they checked the medication list while the pharmacy was on the phone, and authorized refills within a few minutes. This was a dramatic change from the previous nine-hour average turnaround, which was dependent on a chart pull request and delivery. The physicians and nursing staff had access to MicroMedex to check drug-drug interactions and staff and patient education materials.

In the hospital, physicians ordered medications on paper. This paper was handed to the pharmacist, who entered this information into HELP, the inpatient EHR system. HELP performed a drug interaction check and a drug-allergy check, and then generated labels and a MAR, which was printed out. The pharmacy "tubed" (tube transport system in the hospital) the first dose to the unit, then stocked the medication cart for scheduled routine delivery to the unit. The nurses used the paper MAR to administer medications, then initialed it and filed it in the patient's paper record. An Omni-cell dispensing cabinet was located on each nursing unit where nurses could obtain patient's evening medications, including narcotics. At discharge, the medication list was printed out and annotated, and could be given to the patient or faxed or mailed to the receiving institution (such as the NH or HHA).

**Nursing Homes.** At Aspen Meadows, the pharmacist received the written physician order similarly to the acute care setting and entered the data into HELP. This

generated labels, checked for drug interactions and allergies, and printed a MAR for nursing use, but this was a 30-day MAR specific to skilled nursing care. Medication was dispensed in 14-day cassettes, delivered by the pharmacy to each nursing unit and placed in a patient's medication drawer on the medication cart. The nurses dispensed medications from this mobile medication cart, came to the bedside, checked the printed MAR, clicked a pill out of the cassette, put it in a small cup (collected all the medications together for that time period), gave it to the patient, and initialed the MAR to indicate that the medication was dispensed.

The Director of Pharmacy at DBC indicated that despite the low reimbursement to NHs for medication administration, it may be possible for a NH to implement a unit dose and bar-coding system. Medication recovery may save the nursing home significant costs, and this savings might be redirected to dispensing technology. Medication recovery cost savings depend on the payor mix for the facility. Medicare payments for NH are capitated. This means that there is a daily payment for NH patients, regardless of medication cost. For this population, recovered drugs save the institution money. Non-capitated plans and self-pay patients, on the other hand, are generally charged per unit dose dispensed, so the savings from recovered drugs and the cost of the recovery make it a neutral proposition. Also, medication recovery cost savings are greater for high-cost drugs, so one might focus recovery efforts on these high-cost items.

He indicated it might make the most sense to put Omni-cell, the automated unit dose drug dispensing cabinet at Aspen Meadows. The pharmacist already uses HELP there to enter and manage medications for the patients, and these workflow processes and interfaces already exist in the acute care setting. Medicare predominates there, and so the payor mix is favorable for cost savings.

Aspen Meadows recently installed the McKesson Pharmaserve for Windows. The onsite pharmacist entered a drug into the system, and charged out the product to the patient at which time a label was generated. The pharmacist then filled the prescription, using color-coded, 14-day cassettes for the nursing home residents. Aspen Meadows provided a full-service pharmacy for all of its residents, including those in assisted living. The assisted living residents received their medications in bottle form. The pharmacist used the HELP system to verify current orders and to review laboratory reports and clinical notes of patients who were being admitted from Deaconess Hospital. The 30-day MAR was generated by the McKesson system. Cerner currently is working on a long-term care module that Aspen Meadows plans to install when the product is ready for market. This would replace the McKesson system.

## **6. Radiology**

All DBC-owned facilities had full access to PACS. The information was "pushed" to the rural sites via RadWorks (teleradiology technology). The eight affiliate sites had access to PACS through the DBC network. The affiliate sites also transmitted teleradiology images to central DBC radiologists. There was a mix of digital



radiography, computed radiography and scanned film. DBC uses GE Centricity PACS, which will persist after the implementation of the Cerner CIS.

At both the hospital and clinic, a written physician order for radiography resulted in clerical entry of that order into the HELP system and electronic transmittal to the radiology department. The patient then was transported to radiology and the test was performed. The results first were available on the radiology dictation line; other physicians could dial up and listen to the report. Later, it was available on Clinical Workstation and HELP. The result also was printed in the ordering location (ER, clinic, ward). The images were available in all DBC locations via Web-based image viewers. Some locations (ER, orthopedics, and pulmonary clinic) also had its own radiology high-resolution workstation to view images.

In the DBC-owned NH, a physician's written order was entered by a clerk into the HELP system, and transmitted electronically to radiology. This resulted in the DBC mobile x-ray bus coming to the facility whereby the portable x-ray device was transported to the patient's room. The image was taken and sent back to DBC for storage and radiologist's interpretation. The reading was faxed to the NH as well, and was available in Clinical Workstation or the HELP system. For more complex x-rays, the patient was transported to the hospital. The radiology report was filed in the patient's paper chart.

At the DBC affiliate NH (Beartooth), a written order by the physician was delivered by hand to the radiology department. X-rays were done on site by the local radiographer. This image was transmitted by teleradiology to DBC for reading, which returned it by fax to the NH. DBC physicians also accessed this report online at the NH.

DBC has elected to outsource its overnight radiology readings. This has allowed them to recruit and retain radiologists because aside from interventional procedures, its "on-call" responsibilities begin at 6am and end at 10pm. The Idaho-based company (Nighthawk) employs United States-licensed physicians in Sydney, Australia. Beginning at 10pm, DBC transmitted its images by secure teleradiology link to Nighthawk, and received radiology reports via fax within minutes. On occasion, urgent reports were made by telephone call. In the morning, a DBC radiologist "over-reads" the overnight films and reports. Even though the Nighthawk radiologist considered her/his reading to be "final," DBC considered them preliminary readings for two reasons: the DBC radiologist then created a report that was available in Clinical Workstation, and there is a regulation against official readings from non-U.S.-based physicians in terms of Medicare reimbursement.

## **7. Laboratory**

DBC has been using Cerner's lab system for more than three years. The laboratory kept its data in several isolated databases for business and privacy reasons. DBC data were available on Clinical Workstation and HELP throughout the enterprise: inpatient and outpatient laboratories were available to all. On the other hand, laboratory

tests done for affiliates and outreach clinics (non-DBC facilities) were kept in a separate database, and were not electronically available. Even within this separate database, data were separated by ordering location (e.g., Glasgow vs. Beartooth). It was possible for DBC physicians to have no idea that there were test results in the DBC Cerner laboratory system on their patients, as these results did not display in Clinical Workstation or HELP. There was no "break-the-glass" capability to view all available blood tests.

There were approximately 300 outreach clients, about 80 of which were high volume clients. This included 12 nursing homes, including all the nursing homes in Billings. There was no immediate effort to link these clients with the central EHR. There was a paper bar code system which worked pretty well; each outreach client had a unique bar code preprinted request form, to which they attached the patient's name and account information via sticker and selected the unique test and associated diagnosis code. DBC central laboratory performed the medical necessity checking. When the central laboratory received the paper, it scanned the various bar codes, did minimal data entry, and then processed the blood. Later, the patient data were entered into the DBC registration system. The report was sent by mail or automated fax to the client sites. DBC actually supplied fax machines to many client sites expressly for them to receive faxed lab reports.

Montana recently became a "direct access testing" state, meaning that patients can self-pay and request blood test results on their own. These test results were mailed to the patient, and can be faxed to a physician at the patient's request. However, the results also were stored in a separate database, not available to the EHR.

Finally, DBC partnered with the Mayo Clinic to serve as the reference laboratory for the multi-state region. Non-DBC clients sent blood tests; the majority were performed at DBC, but some tests were sent to the Mayo Clinic. This service included Montana and Wyoming. Many non-DBC clinics used Mayo-net, an online Web site to view patient test results (performed either at Mayo or at DBC). DBC central laboratory actually posted results from Mayo-net back into the Cerner laboratory system so that the DBC physicians could view the data and have continuity. Mayo-net had been a source of contention. Because some test results from Mayo and DBC were available online, DBC had chosen not to roll out its DBCdoc physician portal (with access to DBC test results) to all its affiliates for fear of appearing to compete with the Mayo online system and threaten this partnership.

## **C. Organization, Culture, and Impact**

### **1. Business Plan**

**Vendor Selection.** In 2001, DBC had committed to quality improvement and patient safety as a major strategic direction. It began to look at outside vendors (i.e.,

cease to use 3M) that could support inpatient and outpatient integration, CPOE for inpatient and outpatient care, alerts, and clinical guidelines.

An outside consulting company was hired to assist in the development of criteria to be used in vendor selection. Then a vendor steering committee was formed, composed primarily of physicians and department managers. The committee members were self-selected and represented many of the departments in the organization, including finance. Non-physicians (nurses, therapists etc.), however, were not on the committee. In addition, there was one geriatrician on the committee. The list of vendors was reduced to six and then eventually to two: EPIC and Cerner. In the end, Cerner was selected because it is a fully integrated system that does not require any interfaces. Several ad hoc committees were formed, consisting of a mix of clinical staff, to address specific aspects of the selection process.

**Organizational Culture.** As mentioned before, the DBC philosophy is one that encourages group decision-making. Other slogans that have been or are being adopted include "the right care the first time and every time" and "high tech, high touch."

**Competition.** Two hospitals compete for business within Billings. Because of a number of factors, DBC has grown six percentage points in market share in the past few years, and the EHR is perceived as being one of the driving factors for this success. Ironically, patient safety as a result of adopting an EHR has not been heavily marketed; rather, the benefits of having an EHR that extends to patients are largely shared by word of mouth. This marketing piece will become increasingly visible once the Cerner system is operational.

**Resistance to Using the EHR by Clinical Staff.** The 3M HELP system (ordering and results for medications, laboratory, respiratory procedures, and radiology) was implemented at DBC in 1988. There was great resistance by the physicians to its use, but with time the majority began to see the benefits, particularly because it included electronic charging costs for each of these procedures and requests. In 1998, DBC implemented the PACS system for radiologists. Again, the first few years were fraught with physician resistance; now, the radiologists cannot imagine life without it. The 3M Clinical Workstation was implemented about four years ago. It includes some useful clinical information such as dictated physician notes (text), medication list, prescription printing, problem list, allergy list, laboratory test results, and radiology test results. However, it is difficult to query the databases to conduct quality improvement activities.

As DBC prepares to implement the Cerner EHR system, it has a group of physicians that are resisting the change (10%), others that are early adopters and exuberant about making the change (10%), and others that are more "middle of the road" (80%).

Clinical staff (not physicians) at the DBC-affiliated and non-owned NH have no opinion about the Cerner EHR system. As of the writing of this report, there are no plans for DBC to extend this system to post-acute or long-term care settings.

**Payors.** Patient composition by payor at DBC is primarily discounted fee-for-service, with less than 1% of the patients receiving capitated services. It does not have a Medicare or Medicaid HMO.

**Business Agreements with non-DBC Physicians.** DBC differentiates between the DBC-employed physicians, the local independent physicians that are affiliated with the other hospital in Billings, and the non-DBC referring physicians that are providing care in the larger community. The third group of physicians will be targeted in the near future to obtain some level of connectivity with the Cerner CIS.

DBC does not have any business agreements with non-DBC physicians to use the EHR *per se*; however, if a local non-DBC physician is providing care within a DBC facility, s/he has access to view the EHR while on site, but has no ability to access the record remotely through the DBCdoc.com portal.

**Vision.** DBC leaders have identified seven areas of focus: (1) outstanding quality and patient safety; (2) personal service excellence; (3) leadership; (4) growth; (5) community, regional, and national strategic alliances; (6) information systems; and (7) financial strength and operational improvement.

## **2. Organization Structure**

**New or Consolidated Departments.** DBC has not had any major organizational changes as a result of its current EHR system, and it does not foresee any organizational changes as it plans for the implementation of the Cerner CIS.

**Healthcare Setting Implementation.** Implementation of the 3M Clinical Workstation and HELP systems first occurred in the acute care hospital and DBC-owned clinics. It then was extended into Aspen Meadows, the one DBC-owned NH in Billings.

**Prioritization of the Implementation of the Cerner EHR.** The overall information system philosophy has several tenets: (1) buy, not build; (2) DBC will not be an alpha partner; and (3) there is value to centralized systems and integration. However, "best-of-breed" department systems will be purchased and used when appropriate. For example, ophthalmology, dermatology, and labor and delivery may provide a winning argument for the need for a "best-of-breed" system rather than adopting what Cerner offers.

Implementation of the Cerner system (CIS) will take place first at the acute care site, including the emergency department, the in-house transitional care unit, and the DBC-owned clinics.

There are some systems within the hospital and/or clinics that will remain stand-alone. For example, the GE Centricity PACS, which has been in use at DBC for six years, will remain a stand-alone system and will not interact with the new Cerner

system. The ambulatory telemetry unit has a stand-alone quality monitoring tool called SoftMed ClinTrack. It currently is not integrated with the 3M Clinical Workstation or HELP, and it is not slated to be integrated with the Cerner CIS. This is used primarily by case managers to enter data such as reason for admission, insurance, variances, clinical and laboratory data, and length of stay. SMS and Misys will remain the scheduling and registration software used in the inpatient and outpatient settings, respectively.

At the time of the site visit, DBC had no plans to implement the Cerner system in any non-DBC owned post-acute and long-term care settings. Aspen Meadows will have access to EMR subsequent to the roll-out on the main campus. The primary purpose for placing an EHR in Aspen Meadows Retirement Community would be to improve the quality of patient care and patient safety. Other benefits would include: (1) increased efficiencies for physicians and physician assistants by having the ability to access hospital and clinic records. The hospital emergency department and nursing units would benefit as well by having access to the NH record when the patient presents to the ED and/or is admitted; and (2) the EHR would assist the hospital in minimizing the financial drain that occurs when treating patients that have numerous health problems. For example, if the hospital could use the EHR to minimize readmissions to the hospital, that would be ideal.

### **3. Staffing/Training**

**Staffing.** Staffing in the acute care and clinics has not been affected by the implementation of the current 3M HELP and Clinical Workstation systems. The only exception is that Deaconess Hospital has reduced the number of people that are in medical records from ten to three because a growing number of physicians are not requesting that charts be pulled.

None of the discussants with whom we spoke indicated that staffing would likely change with the implementation of the Cerner CIS.

**Staffing Skills.** DBC has a very strong interdisciplinary team with extensive background in building and implementing new IT solutions. The team reports to the VP/CIO and IT Medical Director. A full-time PharmD was hired to address the pharmacy component of the project. This team is supported by the DBC Executive Team and the Cerner Executive Team. In addition, the Electronic Medical Record Committee and the Advisory Committee (made up of department managers) play a key role in providing oversight and feedback to the CIS team.

**Training.** Training for DBC's CIS project is guided by a formal learning plan developed with the guidance of Cerner Corporation. In all, DBC will train approximately 1,825 staff end-users on one or more of the seven different applications being installed. More than 200 staff physicians and mid-level practitioners will be trained on the physician application by the end of Phase I. DBC has chosen a blended approach for

training staff before going "live." Staff first completed an online Windows assessment and, if indicated, they attended an instructor-led Windows class.

Prior to attending the CIS formal training classes, all staff will complete Web-based training (WBT) for the applications they will be using. These classes will be instructor-led and will be four hours in length. Classroom training will be provided by staff clinicians that have been assisting with the testing of the application and with the development of all the training materials. Classroom trainers will be assisted by Super Users in all classes. PowerChart, RadNet, PharmNet and FirstNet will be implemented in Phase I. PowerChart Office will be implemented in Phase II. Hospital end-user staff will be trained first. Clinic end-user staff will be trained the following month. Physicians and mid-level practitioners will be trained using several methods that will include Web-based training, formal classroom training, and one-on-one training sessions. After the initial implementation of CIS, ongoing training will continue in the form of refresher classes, "lunch and learn" demonstrations and updates in the DBC weekly paper.

#### **4. Communication**

**Channels.** Workstations for accessing HELP and 3M Clinical Workstation are located throughout the acute care hospital and in many examination rooms at the clinic. At Aspen Meadows, the DBC-owned NH, there is a workstation with Internet access where DBC-physicians and physician assistants (PAs) can access Clinical Workstation (read-only). At the affiliate NH (Beartooth), there was one workstation that has read-only access to Clinical Workstation. According to the CIO, although the nursing home staff have read-only access to the Clinical Workstation, most do not use this capability; however, this is not a technological barrier. At both NHs, the use of paper (including facsimiles, handwritten notes, and documented phone calls) to communicate information and drive clinical care is evident.

Within the acute care hospital and ambulatory clinics, some DBC physicians are piloting the use of wireless laptops in the hospital and clinical environment. There are some bedside workstations. A growing number of physicians within the acute care hospital and downtown clinic are not requesting a chart pull, but rather they are reviewing the clinical information available in 3M Clinical Workstation and/or HELP.

The hospital's emergency department currently does not have an EHR, but a number of its forms are going to be incorporated into the Cerner CIS and will be available when it "goes live" in July 2004. The ED currently uses the HELP system for order management and uses Clinical Workstation for data viewing. The ED also uses Misys, which is the outpatient (clinic) registration system. There is no nursing or physician documentation available online. With the Cerner system, the emergency department (ED) functionality will include nursing triage functioning, a tracking board, PowerChart documentation for nurses and physicians, CPOE, and an electronic MAR. PowerNote ED is a templated electronic note system, developed by Lynx Medical Systems and bought by Cerner for emergency department electronic documentation and coding. DBC will be an e-code coding alpha partner.

All DBC-owned facilities have full access to PACS, and the information is "pushed" to the rural sites via RadWorks (teleradiology technology). The eight affiliate sites have access to PACS through the DBC Network. The affiliate sites also transmit teleradiology images to central DBC radiologists. There is a mix of digital radiography, computed radiography and scanned film. DBC uses GE Centricity PACS, which will persist after the implementation of the Cerner CIS.

All DBC-owned clinics have full interactive access to the 3M Clinical Workstation and PACS images via a secure CITRIX Nfuse connection (VPN). Referring physicians have read-only access through the portal, DBCDoc.com.

**Frequency.** Although no one explicitly stated that the use of the HELP system and the 3M Clinical Workstation has increased communication frequency, it was implicit in the discussion of medication and laboratory ordering, as well as the PACS. With the ability for physicians to order medications and maintain a medication list, as well as receive laboratory and radiology reports in the EHR, the physicians are provided with information more quickly and frequently than was possible before the EHR was in place.

**Alerts.** The current EHR systems (HELP and 3M Clinical Workstation) do not have any alerts or real-time communication capabilities relative to physicians. However, pharmacists using HELP receive drug interaction and drug allergy alerts. Orders entered in the clinic as well as inpatient settings are transmitted electronically to the receiving departments, reducing potential transcription errors and faxing delays.

**Quality.** Medications, and laboratory, radiology, and respiratory procedures, orders and results currently are generated in the HELP system, which has increased the legibility of prescriptions and thereby likely has decreased errors. However, at times of transfer, the inpatient medication list is printed, annotated and modified by hand and delivered with the patient. It is then cross-checked and re-entered into the system at the NH, thereby increasing the possibility for error.

To illustrate this point, here is the process by which medications are recorded by Aspen Meadows when a patient is transferred from Deaconess Hospital to the NH. A printed transfer medication list is faxed to the NH as part of the referral paperwork to consider whether the NH can take the patient. This medication list has pen-and-ink notations on it (scribbled out medications that are discontinued). Assuming Aspen Meadows agrees to take the patient, this same piece of paper accompanies the patient upon arrival. The physician or PA then transcribes this list of medications onto a new form (s/he may add some additional medications to the existing list), and gives a copy to the clerk who gives a photocopy to nursing and a copy to the pharmacist. The pharmacist then views the paper orders, compares them to the online HELP system, and makes modifications as necessary. If there are any drug interactions or concerns about medications, the pharmacist contacts the doctor directly, makes the change online and writes a verbal order to be signed by the physician at a later time. The

pharmacist then uses this updated medication list to generate the 30-day MAR, which nursing uses to document in the paper chart.

**Quality Monitoring.** The current EHR does not have any electronic quality monitoring capabilities. According to the Director of Critical Care Services, quality improvement and quality monitoring activities still are done by hand, because the Clinical Workstation is not designed to be able to query the database for this type of information. However, the inpatient medical manager described a quality monitoring tool that is separate from and not integrated with Clinical Workstation or HELP. Called SoftMed Clin Track, it is used primarily by case managers to enter data such as reason for admission, insurance information, clinical and laboratory data, and length of stay. This information also is used as a quality monitoring tool by the Utilization Review Committee.

The NH software (VistaCare) has some quality monitoring features, such as the generation of problem lists and QI reports that are based on regulatory specifications. Aspen Meadows uses the VistaCare software as part of its internal QI activities, but it also uses its own processes that were in place prior to the mandatory MDS data requirements. According to the Assistant Director of Nursing at Beartooth, VistaCare is only used for MDS reporting requirements; other features of the software are unused.

**Content.** More than 180 templates for CPOE have been written for DBC with the help of a technology called <http://Zynxhealth.com>. It provides baseline content and automates the customization of content, and then downlinks it to the CPOE provider of choice.

**Collaboration with Other Health Settings, Including Competitors.** The ED staff met with the other hospital in Billings, with which DBC is in direct competition, as well as the seven nursing homes in the area to co-develop a nursing home transfer form (from NHs to the hospital). This multi-page form was mocked up and shown to the nursing home collaborative which, in general, found it to be useful. The emergency departments of both hospitals, in turn, committed to providing certain data to all nursing homes. This effort is an attempt to achieve a uniform level of care. At the time of the site visit, this activity has been put on hold while efforts were focused on implementing the Cerner CIS.

The two EDs also share protocols for blood alcohol reporting to police, sexual assault standards, and transporting patients between EDs (especially if the majority of the patient's data reside at the other hospital).

## **5. Workflow/Process Changes Due to EHR Adoption**

**Management Functions.** The two NHs have not been impacted greatly by the EHR. Paper is still the primary way information is communicated and maintained. The legal medical record is the paper record.



Workflow within the two NHs has not been impacted by the DBC EHR. The Beartooth Director indicated that none of the Beartooth employees has access to the DBC Clinical Workstation. Of the six physicians, four are DBC employees. They have read-only access to the DBC EHR. Physicians at both NHs can either handwrite their notes or dictate into a handheld device. This information then is sent on to a transcriptionist and is printed off and put in the paper record. If the NH dictation is done at Beartooth, the notes do not make it into the EHR. If the DBC physicians dictate their nursing home information at the DBC clinic, the notes are placed in the EHR and a paper copy is sent to Beartooth.

**Patient Interactions.** The use of the DBC EHR has improved interactions with patients in a positive way. Prescription refills in the clinic that used to have a nine-hour turnaround time now are routinely completed within a few minutes of a phone call request, an achievement made possible with "anytime, anywhere" availability of the patient's record. The DBC IT Medical Director indicated a future vision of a patient-physician communication system, allowing appointment scheduling, prescription renewals, and online messaging.

**Staff Interaction.** The DBC EHR has not impacted how the NH staff interact with each other. Nursing staff have realized significant time-savings in the "anytime, anywhere" access to a patient's medical record. For example, a nurse from one specialty can call a nurse in another specialty to refer a patient. Both nurses can be online reviewing pertinent patient information to ensure the proper scheduling of the patient. The same is true in the acute care setting.

**Care Implementation.** Tasks such as medication dispensing, care planning, patient interviews, and action forms have not been affected at the NH with the adoption of the DBC EHR.

Within Deaconess Hospital and the DBC-owned clinics, the adoption of the PACS six years ago has been of great benefit to radiologists and other physicians that have very timely interpretations of radiology images. Legible orders were also mentioned by several staff as a significant benefit. Within the hospital and clinics, less time is spent looking for a patient's chart and x-rays, allowing for more time with the patient.

**Tracking.** At the hospital and clinics, there is cost accounting at the department level. It includes direct costs, including physician and staff salaries, as well as direct revenue such as physician billing. It also includes indirect costs such as allocated dictation costs, electronic records costs, administration costs, and costs associated with pulling paper charts. The department heads meet on a quarterly basis to review these data.

**Security.** DBC has different access levels depending upon the role of the employee. Different tasks and read/write authorizations are allowed. DBC logs and audits access to information about patients. It has sanctions against care providers that abuse access privileges. DBC has confidentiality and security policies in place. All staff

members are expected to adhere to these policies. An infraction may result in termination.

**Documentation.** Paper is used to document clinical notes at both NHs, as well as at Deaconess Hospital, and the DBC clinics. At Aspen Meadows, the current process for orders (laboratory and radiology) is that the physician or PA writes the orders by hand. A nurse or clerk enters this order into the HELP system, which transmits the order to the appropriate place (laboratory and radiology). Pharmacy enters the medication order into the freestanding McKesson system, which also charges out the product to the patient and prints a pharmacy label.

# **APPENDIX E: TECHNICAL EXPERT PANEL (TEP) MEMBERSHIP**

**Meeting held on Wednesday, April 14, 2004  
Washington, DC**

**Sponsored by: The Office of the Assistant Secretary for Planning  
and Evaluation (ASPE)**

Chris Chute, MD, DrPH  
Chair, Medical Informatics Research  
Mayo Clinic - Rochester

Pat Coon, MD  
Medical Director for DBC Center on  
Aging  
Deaconess Billings Clinic

Michelle Dougherty, RHIA  
HIM Practice Manager  
American Health Information  
Management Association

Stephen Guillard, MPA  
Chairman and CEO  
Harborside Healthcare

Karen Hatfield, RN  
Nursing Liaison  
North Mississippi Medical Center

Barbara Manard, PhD  
Vice President, Long-Term Care Health  
Strategies  
American Association of Homes and  
Services for the Aging

Judy Ozbolt, PhD, RN  
Professor of Biomedical Informatics  
Vanderbilt University

Barbara Paul, MD  
Senior Vice President and Chief Medical  
Officer  
Beverly Enterprises

Mary Pratt, MS, RN  
Acting Director, Division of Ambulatory  
and Post Acute Care  
Centers for Medicare & Medicaid  
Services

Sunil Sinha MD, MBA, FACP, CHE  
Acting Director  
Division of Acute and Chronic Disease  
Management, Quality Measurement &  
Health Assessment Group  
Centers for Medicare & Medicaid  
Services

Ron Stock, MD, MA  
Regional Medical Director, Geriatrics &  
Care Coordination Services  
Center for Senior Health, PeaceHealth  
Oregon Region

Eric Tangalos, MD  
Chair, Primary Care Internal Medicine  
Mayo Clinic College of Medicine

John Williams, BS  
CIO  
Bay Pines VA Medical Center

Bill Yasnoff, MD, PhD, FACMI  
Senior Advisor, National Health  
Information Infrastructure  
Office of the Assistant Secretary for  
Planning and Evaluation

# **CASE STUDIES OF ELECTRONIC HEALTH RECORDS IN POST-ACUTE AND LONG-TERM CARE**

## MAIN REPORT

HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm>  
PDF <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.pdf>

## APPENDICES

All Appendices

PDF <http://aspe.hhs.gov/daltcp/reports/ehrpaltc-Ap.pdf>

APPENDIX A: Bay Pines Veterans Affairs Medical Center  
HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm#appendA>

APPENDIX B: North Mississippi Health Services  
HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm#appendB>

APPENDIX C: PeaceHealth  
HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm#appendC>

APPENDIX D: Deaconess Billings Clinic  
HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm#appendD>

APPENDIX E: Technical Expert Panel Membership  
HTML <http://aspe.hhs.gov/daltcp/reports/ehrpaltc.htm#appendE>