CHAPTER

9

Case Studies of VistA Implementation— United States and International

"**VHA's integrated health information system, including its framework for using performance measures to improve quality, is considered one of the best in the nation.**"

Institute of Medicine (IOM) Report,
"Leadership by Example: Coordinating Government Roles in Improving Health Care Quality, 2002"

Introduction

The U.S. Department of Veterans Affairs (VA) has developed and implemented a comprehensive health information system and EHR system known as VistA, which was built from the ground up with a clinical focus. Many of the commercial off-the-shelf (COTS) health information systems in the private sector today were designed from a financial perspective and now are being reengineered to address medical and clinical informatics requirements. The VistA system is a proven product and can be readily adapted for use in acute care, ambulatory, and long-term care settings. It has been used in public and private healthcare provider organizations across the United States and in a number of international settings.

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Table 9-1 VistA Software Modules

VistA Software Packages
Health Data Systems
Automated Medical Information Exchange
    (AMIE)
Incident Reporting
Lexicon Utility
Occurrence Screen
Patient Representative

Registration, Enrollment, and Eligibility Systems
Patient Registration
Admission/Discharge/Transfer (ADT)
Clinical Monitoring System
Enrollment Application System (EAS)
Hospital Inquiry (HINQ)
Income Verification Match (IVM)
Record Tracking
Resident Assessment Instrument/Minimum
    Data Set (RAI/MDS)
Veteran Identification Card (VIC)

Health Provider Systems
Care Management
Clinical Procedures
Computerized Patient Record System (CPRS)
CPRS: Adverse Reaction Tracking
CPRS: Authorization/Subscription Utility (ASU)
CPRS: Clinical Reminders
CPRS: Consult/Request Tracking
CPRS: Health Summary
CPRS: Problem List
CPRS: Text Integration Utilities (TIU)
Dentistry
Hepatitis C Case Registry
Home–Based Primary Care (HBPC)
Immunology Case Registry (ICR)
Intake and Output
Laboratory
Laboratory: Anatomic Pathology
Laboratory: Blood Bank
Laboratory: Electronic Data Interchange (LEDI)
Medicine
Mental Health
Nursing
Nutrition and Food Service (N&FS)
Oncology
Pharmacy: Automatic Replenishment/Ward
    Stock (AR/WS)
Pharmacy: Bar Code Medication
    Administration (BCMA)
Pharmacy: Consolidated Mail Outpatient
    Pharmacy (CMOP)
Pharmacy: Controlled Substances
Pharmacy: Drug Accountability/Inventory
    Interface
Pharmacy: Electronic Claims Management
    Engine

Pharmacy: Inpatient Medications
Pharmacy: Inpatient Medications—
    Intravenous (IV)
Pharmacy: Inpatient Medications—
    Unit Dose (UD)
Pharmacy: National Drug File (NDF)
Pharmacy: Outpatient Pharmacy
Pharmacy: Pharmacy Benefits Management
    (PBM)
Pharmacy: Pharmacy Data Management (PDM)
Pharmacy: Pharmacy Prescription Practices (PPP)
Primary Care Management Module (PCMM)
Prosthetics
Quality: Audiology and Speech Analysis and
    Reporting (QUASAR)
Radiology/Nuclear Medicine
Remote Order Entry System (ROES)
Scheduling
Social Work
Spinal Cord Dysfunction
Surgery
Surgery: Risk Assessment
VistA Imaging System
VistA Imaging: Core Infrastructure
VistA Imaging: Document Imaging
VistA Imaging: Filmless Radiology
VistA Imaging: Imaging Ancillary Systems
Visual Impairment Service Team (VIST)
Vitals/Measurements
Women's Health

Management and Financial Systems
Accounts Receivable (AR)
Automated Information Collection System
    (AICS)
Beneficiary Travel
Compensation and Pension Records
    Interchange (CAPRI)
Current Procedural Terminology (CPT)
Decision Support System (DSS) Extracts
Diagnostic Related Group (DRG) Grouper
Engineering
Equipment/Turn-In Request
Event Capture
Fee Basis
Generic Code Sheet
Incomplete Records Tracking (IRT)
Integrated Funds Distribution, Control Point
    Activity, Accounting, and Procurement
    (IFCAP)
Integrated Patient Funds
Integrated Billing (IB)
Patient Care Encounter (PCE)
Personnel and Accounting Integrated Data
    (PAID)
Voluntary Service System (VSS)

(continues)

Table 9-1 *continued*

Information and Education Systems	List Manager
Automated Safety Incident Surveillance Tracking System (ASISTS)	MailMan
Library	Master Patient Index (MPI) and Master Patient Index/Patient Demographics (MPI/PD)
Police and Security	My Health*e*Vet Personal Health Record
Cross-Cutting Monographs	Network Health Exchange (NHE)
Duplicate Record Merge	Patient Data Exchange (PDX)
Health Level Seven (HL7)	Remote Procedure Call (RPC) Broker
VistA Kernel	VA FileMan
VistA Kernel Toolkit	VistALink

VistA software is in the public domain and has been available to non-VA users under the Freedom of Information Act (FOIA) for several decades. Like open source software, the application code is made available to anyone requesting a copy of the system. Therefore, in the paradigm we have discussed in this book, VistA falls under the broad term of Free and Open Source Software (FOSS). There have been many thousands of downloads of the FOIA–VistA software over the years.

The VistA software suite is available from the VA at http://www.va.gov/vha_oi.

It has also been made available via the VistA Hardhats organization (www.hardhats.org) and the WorldVistA organization (www.worldvista.org). Also, leading information technology companies such as HP, Perot Systems, and IBM, and rapid-growth firms such Medsphere Corporation, DSS Inc., and Mele Associates are actively supporting implementations in the United States and around the globe.

This chapter is divided into two parts. Part A, for the most part describes VistA implementations by public and private sector healthcare provider organizations across the United States. In Part B of this chapter,

Table 9-2 VistA Implementations

Part A: United States	Part B: International
· Department of Veterans Affairs	· Samoa
· Midland Memorial Hospital, Texas	· Egypt
· Indian Health Service	· Mexico
· Department of Defense	· Germany
· HHS and VistA–Office EHR	· Finland
· National Hansen's Disease Center	· Nigeria
· State of Hawaii	
· District of Columbia (DC)	
· State Veterans Homes	
· Oklahoma	

implementations of VistA around the world are presented. Of special note is Mexico, where the government has already successfully deployed VistA in more than 20 hospitals, with many more facilities slated for VistA deployments in the coming months. There are many more examples of VistA implementations underway in Hawaii, West Virginia, California, Louisiana, and other locations around the world that are not profiled here.

Part A: United States

Profiles of selected VistA implementations in small, mid-size, and large-scale healthcare organizations in the United States

U.S. Department of Veterans Affairs (VA) VistA System

The Veterans Health Administration (VHA) operates the nation's largest medical system. It provides care to approximately 4.5 million veterans out of an eligible population of 25 million. The VHA currently employs approximately 180,000 healthcare professionals at 170 hospitals, more than 800 community and facility-based outpatient clinics, over 135 nursing homes, 43 domicilaries, 206 readjustment counseling centers, and various other facilities. In addition, the VHA is the nation's largest provider of graduate medical education and a major contributor to medical and scientific research. VA medical centers are affiliated with more than 152 medical and dental schools, training more than 80,000 health-related students and residents each year. More than half of U.S. practicing physicians have received training in VA hospitals. The VA is the second largest funder of biomedical research in the United States. The VA also provides healthcare services to active military personnel during wartime and the general population in times of national disasters.

The VA began deploying its VistA system in all of its medical facilities starting around 1984. The system was originally known as the Decentralized Hospital Computer Program (DHC) system. The "initial core" system that was deployed consisted of a limited number of clinical and administrative software modules, which included patient registration, outpatient clinic scheduling, inpatient admission/discharge/transfer (ADT), pharmacy, laboratory, and radiology. Over the years many additional software modules were added, and the DHCP system was eventually renamed VistA

Links to Key Web Sites and Documentation

- VHA Office of Information Web Site—www.va.gov/vha_oi/
- VistA System Web Site—www.va.gov/vista_monograph

Links to Key Articles on VistA

- VistA—U.S. Department of Veterans Affairs National Scale Healthcare Information Systems, *International Journal of Medical Informatics,* February 2003.
- The Veterans Health Administration: Quality, Value, Accountability, and Information as Transforming Strategies for Patient-Centered Care, *The American Journal of Managed Care,* November 2004.
- Comparison of Quality of Care for Patients in the Veterans Health Administration and Patients in a National Sample, *Annals of Internal Medicine,* December 2004.
- The Best Care Anywhere, *Washington Monthly,* January/February 2005.

(Veterans Health Information Systems and Technology Architecture). With the subsequent release of the Computerized Patient Record System (CPRS) for clinicians in 1997 and the deployment of VistA Imaging in the late 1990s and early 2000s, the VistA system emerged as one of the most advanced health information systems in the world. (http://www.va.gov/vista_monograph/)

The VA plans to continue using VistA and will continually improve the system over time. For example, planned enhancements to VistA include:

- My Health*e*Vet, a personal health record (PHR) module.
- National VistA Health Data Repository (HDR).
- Federal Health Information Exchange (FHIE) enhancements to include the Bi-directional Health Information Exchange (BHIE).
- Building a Web-enabled VistA front end.
- Other IT architectural enhancements and new technologies.

Midland Memorial Hospital and VistA

Midland Memorial Hospital is a 371-bed community hospital that operates three campuses in Midland, Texas. Midland provides a full range of acute-care services including emergency medicine, cardiovascular surgery, and advanced radiological and oncology services and serves as a regional

referral center for other communities throughout west Texas and southeast New Mexico. The Midland "OpenVista Implementation Project" represented a formidable challenge on multiple fronts. For example, it was the first nongovernment, acute-care hospital in the United States to adopt a VistA-based electronic health record (EHR); it has a community-based physician staff representing all major specialty areas; and they wanted a "best of breed" software environment that would leverage investments in current solutions that needed to be interfaced to VistA. The contract for the project was awarded to Medsphere Systems Corporation.

Guiding Principles and Major Project Objectives

The following are some of the guiding principles and major objectives associated with the Midland OpenVista Implementation Project:

- Enhance patient safety, increase clinical efficiency, and improve healthcare quality.
- Standardize the delivery of care across the continuum (acute, ambulatory, and rehabilitation) and multiple geography locations of care (hospitals and clinics).
- Reduce medical errors and wasteful costs associated with the delivery of health care.
- Build upon the proven success and experience of the VA in the implementation of its comprehensive VistA EHR system for Midland.
- Leverage the OpenVista EHR system as a differentiating factor in helping recruit and retain patients, physicians, and staff.
- Leverage the OpenVista solution to reduce overall systems lifecycle costs for Midland.

Project History

In 2003, Midland Memorial Hospital determined to replace their "sunsetting" pharmacy and laboratory systems. This review prompted IT steering committee members to rethink their best-of-breed strategy and take the opportunity to evaluate a single, integrated solution to meet their clinical, administrative, and financial needs. During the course of their evaluation of traditional healthcare IT companies, they were unable to overcome the $20 million price barrier to implement the comprehensive solution they envisioned. They became aware of VistA through their interaction with the Big Springs VA Medical Center; from Texas Tech medical residents who rotated through the VA center; a general increase in articles in

health IT magazines and journals about the VistA system; a growing awareness of the open source community; and the realization that there were multiple commercial vendors supporting the VistA solution.

Midland next engaged in a rigorous 12-month evaluation of the technology, product, and health IT service providers. After attending several national conferences, completing multiple site visits, and a series of intense product demonstrations to its staff, Midland determined to move forward with a comprehensive enterprise assessment of the issues related to implementing the OpenVista solution (Medsphere's commercial version of the VA VistA system). This assessment was completed in August 2004. In January 2005, Midland's IT steering committee unanimously approved the recommendation to begin the OpenVista implementation project.

With OpenVista serving as the platform of innovation, a six-month software development effort ensued to ensure that the product would meet some of the unique functional specifications of Midland. A primary objective of this effort was to complete the required interfaces to share patient demographic information, the event points where charges could be captured, and the seamless sharing of information among 13 disparate information systems Midland wanted to retain. This process was successfully completed by a talented team of VistA engineers who had a thorough knowledge of the system and leveraged standard VA design concepts, improved existing software tools, and developed new integration utilities to accomplish the work. These efforts proved highly successful and set the stage for the next step, the clinical configuration of the system.

Clinical configuration of the system begin in earnest in the summer of 2005, with the training of six newly hired registered nurses who formed the core of Midland's clinical information technology (IT) team. These individuals, under the direction of a Midland nurse informaticist, were trained to become "super users" of the graphical user interface to VistA, known as the Computerized Patient Record System (CPRS). This training gave them the knowledge needed to create templates, order sets, and clinical reminders; set clinical rules; and configure other VistA clinical modules. Staff from Medsphere augmented their staff during the design, configuration, training, and deployment of the VistA system. The goal of the training program was designed to allow Midland to become a self-sufficient organization that would not be dependent on a vendor for many of the ongoing operational and maintenance tasks.

Multiple committees were convened under the direction of the IT steering committee to ensure a smooth transition to the OpenVista EHR.

These multi-disciplinary subcommittees included Computerized Provider Order Entry, Bar Code Medication Administration, Forms, Pharmacy, Medical Records, and Ancillary Department committees. The various subcommittees reported up to the IT steering committee, which would meet monthly for the duration of the project.

Midland and Medsphere also established a joint project governance structure with regular project communication and issue resolution meetings.

Systems Architecture

The enterprise architecture chosen by Midland Memorial Hospital included a centralized server cluster with a single VistA database residing at Midland's main campus facility. Midland selected InterSystems Cache product for its "M" language and database environment due to its robust capabilities, proven scalability, and rich management tool set, which had been deployed in large-scale clinical settings. The multi-campus enterprise is the first acute-care hospital to deploy the OpenVista EHR solution on a Red Hat Linux infrastructure. A high-availability cluster, using multi-processor x86 servers and clustering software, was installed and configured by Hewlett-Packard (HP). This technology configuration provided Midland with an affordable, high-performance, and completely redundant solution using a mix of open source tools, proven application servers, and commodity x86-based hardware.

Software Solution

Midland's best-of-breed software environment presented some challenges for a fully integrated solution like OpenVista. Medsphere was required to develop several enhancements and interfaces to present a unified solution within the VistA framework. Midland currently uses McKesson's Precision 2000 Health Information System. Precision serves as the authoritative source of patient demographics, registration, scheduling, master patient index, and other master files. It is also the primary source of order entry by the ward clerks for laboratory, cardiopulmonary, dietetics, and related consults. Once patients are registered, the information is sent to OpenVista by standardized Health Level Seven (HL7) messages where it is then "filed" away in the appropriate places within OpenVista. From here, at key steps of the clinical-care process, various "events" trigger the

charge capture engine to fire off a charge-related message to the Precision system. After the clinical course of care has ended, the Precision system generates a bill and manages the revenue cycle from that point forward. Medsphere developed a unique technology solution to assist with both the filing and the charge capture component of this interface.

The primary VistA modules initially deployed at Midland included the following:

- FileMan
- Kernel
- MailMan
- Patient Information Management
- Master Patient Index (MPI)
- Inpatient Pharmacy
- National Drug File
- Outpatient Pharmacy
- Laboratory
- Radiology and Nuclear Medicine
- Computerized Patient Record System
- Adverse Reaction Tracking
- Authorization/Subscription Utility
- Clinical Reminders
- Consult/Request Tracking
- Health Summary
- Problem List

Medsphere OpenVista Enhancements Developed for Midland

The above packages provided the foundation of the OpenVista solution. From here, Medsphere was required to make the following modifications. This list is not comprehensive, but is representative of the types of changes required to adapt VistA technology in a non-VA setting.

GENERAL:
- Fee Tables in OpenVista linked to a foreign system's Charge Master File
- Common Physician Identifier
- Protocol Event Points for charge capture with HL7 interfaces
- Options to populate User (NEW PERSON) file from a foreign registry

PATIENT REGISTRATION:
- Creation of a common Medical Record Number
- Creation of Account Number file and corresponding field in Visit file
- HL7 interface from authoritative medical manager to VistA

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PHARMACY:
- Charge capture for real-time or batch transmission to foreign billing system
- High Dose Alerts
- Pharmacokinetic Dosing
- Link Lab Results to Inpatient Med Order

LABORATORY:
- Charge capture for real-time or batch transmission to foreign billing system
- HL7 interface for intake of lab orders
- HL7 interface for reporting out of lab orders
- Tracking Specimen Transfers between Facilities
- Faxing of Laboratory Results
- Creating multiple interfaces for Blood Bank

RADIOLOGY:
- HL7 interface for intake of radiology orders
- HL7 interface for reporting out of radiology orders
- HL7 interface for intake of radiology result reports
- Radiology procedure file populated and updated automatically from Charge Master file

IMAGING:
- Developed document scanning enhancement

Future Enhancements

As Midland has gained more familiarity with the OpenVista product, it has initiated several product enhancement requests. These requests have been funneled into the Medsphere product development roadmap and include:

- Nurse Flowsheets.
- Physician Dashboard.
- Improved, "active" templating.

Project Challenges

As the first commercial enterprise deployment of OpenVista, Midland and Medsphere both learned significant lessons during the project. Some of the many issues and challenges being addressed during the Midland project include:

- This was as much a clinical business transformation initiative, as much as it was a health IT systems implementation project.
- Hardware and Infrastructure Enhancements:
    - Upgrade of existing network infrastructure to accommodate users needs.
    - Upgrade of existing hardware needed for improved reliability and performance.
    - Upgrading clinician work spaces to provide more access and ergonomic feasibility.
- Interface challenges of integrating more than 15 disparate information systems.
- Implementation challenge of training 1,500 users on a mission-critical application for an organization that operates 24/7/365.
- Project management challenges of moderating expectations, managing personnel, and developing a repeatable deployment methodology with no commercial precedent.
- Developing an internal support function that meets the needs of the organization and the end users; integrating customer support with vendor support of the application.

Project Summary

As of 2006, Midland had successfully deployed the foundational Open-Vista modules: Patient Information Management, Pharmacy (inpatient and outpatient), Laboratory, Dietetics, Order Entry/Results Reporting, Radiology, National Online Information Sharing, and Document Imaging. The successful integration of 15-plus other disparate information systems was also completed, and the project remained on budget and on schedule. The physician and clinician "go-live" date was scheduled for the end of January 2006. Implementation of a Bar Code Medication Administration was slated for spring 2006.

The deployment of VistA at Midland represents a seminal event within healthcare IT and positioning of OpenVista as one of the leading EHR platforms involving public–private collaboration and investment. The implementation of a mission-critical, VistA-based solution in the commercial setting by a value-added professional open source technology company for less than half the price of commercial alternatives represents a new paradigm with significant and long-range ramifications for the healthcare industry.

IHS Resource and Patient Management System (RPMS)

The Resource and Patient Management System (RPMS) run by the Indian Health Service (IHS) is an integrated solution for the management of clinical and administrative information in healthcare facilities of various sizes and orientations. Flexible hardware configurations, more than 50 software applications, and network communication components combine to provide a comprehensive clinical, financial, and administrative solution.

Background

The IHS is charged with administering the principal healthcare program for American Indians and Alaskan Natives and provides comprehensive health services through a system of Federal IHS-, tribal-, and urban-operated facilities and programs. These facilities and programs provide health services to 1.4 million American Indians and Alaskan Natives through 144 service units composed of more than 500 direct healthcare delivery facilities, including 49 hospitals, 190 health centers, 7 school health centers, and 287 health stations, satellite clinics, and Alaskan village clinics.

The IHS and the VA have a long–standing tradition of health information and technology sharing spanning the past several decades. In 1984, the IHS began implementation of 60 systems using VistA software, then referred to as DHCP. Many components of the RPMS health information system are still based on the VistA system. A number of RPMS software modules have also been incorporated into VistA over the years.

Resource and Patient Management System (RPMS)

RPMS is a decentralized automated information system of over 50 integrated software applications. Many RPMS applications can function in a stand–alone environment if necessary or appropriate. The system is designed to operate on micro- and mini-computers located in the IHS or tribal healthcare facilities. RPMS software modules fall into three major categories: 1) administrative applications that perform patient registration, scheduling, billing, and linkage functions; 2) clinical applications that support various healthcare programs within the IHS; and 3) infrastructure applications.

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Administrative Applications The RPMS administrative applications support the business of healthcare provision. Applications in this category are used to collect, store, and report patient demographic information;

manage the scheduling, admission, discharge, and transfer of patients in inpatient facilities; create claims and handle both manual and electronic billing and accounts receivables; and electronically manage resource requests and supplies.

Clinical Applications The RPMS clinical applications directly support the provision of health care. Applications in this category generally collect all patient-related information gathered during patient contacts into one comprehensive, centralized data file to support healthcare planning, delivery, management, and research. The Patient Care Component provides for entry of visit data that forms the core data set used by most of the RPMS applications. Other applications in this category support patient care and include Laboratory, Radiology, Inpatient and Outpatient Pharmacy, Allergy Tracking, Immunology, Dental, and Women's Health.

Infrastructure This category of applications comprises and supports the RPMS environment with management, development, and communication tools. The MailMan application is an electronic messaging system. VA Kernel software provides a portability layer between the underlying operating system and application code and provides a Kernel Toolkit that supplements the Kernel software package with development and quality-assessment tools, capacity management tools, and system management utilities. The VA FileMan is the RPMS database management system (DBMS).

The Division of Information Resources (DIR) distributes the RPMS application suite to headquarters and each IHS area office. The area office then releases the RPMS application suite to the healthcare facilities within its area. Different facilities use different configurations of RPMS applications, depending upon the types of services they provide.

Technical Environment

- The RPMS suite runs on mid-range to personal computer hardware platforms. Typical configurations range from two RS 6000 computers for large facilities to one Intel-based Windows NT computer for small facilities.
- RPMS applications operate individually and as an integrated suite. Using the HL7 protocol, RPMS applications can be interfaced with a variety of commercial-off-the-shelf software products.
- RPMS information can be exchanged over a local area network (LAN) within a single facility, a wide area network (WAN) with other facilities, and the Internet with other providers and medical researchers.

Other Plans and Activities RPMS software is in the public domain, making it a cost-effective choice in software applications for others to consider using. The IHS recently signed a memorandum of understanding to share the RPMS software with the National Aeronautics and Space Administration (NASA).

The IHS plans to continue to enhance RPMS over time, adding an electronic health record, a clinical imaging module, and other software modules. In addition, the IHS and the Veterans Health Administration plan to continue their long–standing practice of collaborating on various software development projects related to health information exchange, health informatics standards, personal health records, VistA–Office EHR, and other initiatives.

Key Reference Web Sites

- http://www.ihs.gov/Cio/RPMS/index.cfm
- http://www.ihs.gov/cio/ehr/

FIGURE 9-1 RPMS: An Example of an EHR Screen Developed for Use Within the IHS

DoD Composite Health Care System (CHCS)

The Composite Health Care System (CHCS) is an automated information system supporting the administration and delivery of health care at Department of Defense (DoD) Medical Treatment Facilities (MTF) throughout the world. Operational support is provided not only to fixed MTFs, but also to mobile fleet hospitals, hospital ships, and at pier-side.

Background

CHCS supports over 130,000 providers and staff in the delivery of health care to MHS beneficiaries at MTFs worldwide. It provides essential, automated information support to Military Health System (MHS) providers, enabling improved quality of care for 8.9 million beneficiaries at more than 700 DoD hospitals and clinics around the world.

The DoD and the Department of Veterans Affairs (VA) have a long-standing tradition of health information and technology sharing spanning the past several decades. In 1983, the DoD was first provided copies of the VistA application software (then known as DHCP). In 1987, two DoD facilities, March Air Force Base and Fitzsimmons Army Medical Center, began extensive testing of the VistA software. In 1988, SAIC was awarded a $1 billion, eight-year contract to design, develop, and implement its system, which involved modifying the VA VistA system to meet DoD requirements for use in all major MTFs around the world.

Composite Health Care System (CHCS)

CHCS provides automated support to all areas of healthcare operations and patient care via modules including these functionalities:

- Patient Administration
- Patient Scheduling
- Pharmacy
- Radiology
- Laboratory
- Nursing QA
- Medical Record Tracking
- Managed Care Program
- Clinical and Administrative Report Generation

Eligibility, enrollment, and data synchronization are supported by the National Enrollment Database (NED) application. Third-party collections are supported through Ambulatory Data Coding, Ambulatory Patient Visits, and Outpatient Itemized Billing interfaces.

CHCS Clinical Practice Support is enhanced through interfaces to specialized clinical systems. Those systems include:

- Digital Imaging Network—Picture Archiving and Communications System (DIN-PACS)
- Collaborative Medical Systems Anatomic Pathology (CoPath)
- Defense Dental Scheduling Application (DDSA)
- Clinical Information System (CIS)
- Defense Enrollment and Eligibility Reporting System (DEERS)
- Defense Blood Standard System (DBSS)
- Executive Information/Decision Support (EI/DS)
- Integrated Clinical Database (ICDB)

For patients, the CHCS allows quicker diagnostic test results resulting in reduced wait time and increased access to medical and professional resources. For providers, using CHCS allows increased communication among physicians, nurses, clinicians, technicians, ancillary services, and administrators.

The CHCS II is the military computer-based patient record that is accessed through a provider-developed graphical user interface. It facilitates outpatient management of health information requirements for the U.S. Armed Forces and, along with CHCS, it provides MHS beneficiaries with a lifelong military medical record. CHCS II was recently renamed Armed Forces Health Longitudinal Technology Application (AHLTA).

Future Plans

The VA and DoD health IT staff are continuing to collaborate on a large, umbrella electronic health record (EHR) initiative. This is part of the Health*e*People (federal) strategy. Specific collaborative projects related to this initiative include development of a Clinical/Health Data Repository (C/HDR), testing of the Bi-directional Health Information Exchange (BHIE) system, and replacement or enhancements to the agencies' Pharmacy, Laboratory, Clinic Scheduling, and other software modules used in both VistA and CHCS.

Key Reference Web Sites

- http://www.saic.com/integration/chcs.html
- http://www.tricare.osd.mil/peo/citpo/projects.htm

VistA–Office EHR

Introduction

The Centers for Medicare and Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services (HHS), and the Department of Veterans Affairs (VA) are collaborating on an initiative to transfer the VA's electronic healthcare record (EHR) suite of software, known as VistA, to the private physician office setting. The VistA–Office EHR project combines the strengths of both agencies as they aim to make available a high-quality, public-domain EHR solution that can be used in both clinics and physician offices.

The CMS allocated funds in 2005 to modify the VA VistA software into an "office version" to be made available for public use. They also provided initial funds to provide limited end-user support, installation procedures, training materials, system documentation, help desk support, and other needed assistance. Contracts were awarded to the Iowa Foundation for Medical Care (IFMC), Daou Systems, and the WorldVistA organization to support this initiative.

Functional Overview

The functional capabilities contained in the current VistA software suite will serve as the basis for the VistA–Office EHR system. Additionally, modifications are being made to the existing software to augment and support the diversity of patient care provided by a family physician. The VistA–Office EHR system is being made available in the public domain and will provide the capability to transfer outpatient data between the physician office and the Quality Improvement Organization (QIO) clinical warehouse. The initial focus of the VistA–Office EHR program is the family physician practice of four to eight physicians in a small, community-practice setting.

Product Architecture The VistA–Office EHR product adheres to the architecture of VHA's VistA FOIA release. VistA FOIA is designed in a three-tier hierarchy consisting of:

- Cache database
- VistA FOIA software
- VistA/CPRS graphical user interface (GUI) software

Organizations will still need to purchase servers, workstations, and telecommunications (LAN); staff the project; and buy licenses for selected commercial off-the-shelf (COTS) products that might be needed. In other words, while the VistA software is free, approximately 75% of typical systems lifecycle costs will still need to be funded by the healthcare provider organization. VistA–Office EHR will be released to run on the Microsoft Windows operating system.

Product Functionality/Features

The predominant clinical application within VistA that directly supports the healthcare provider is the Computerized Patient Record System (CPRS). VistA–Office EHR will provide a desktop application that offers CPRS ambulatory functionality to the family physician's office. CPRS's ambulatory applications encompass the complete patient-care process, from initial patient registration and scheduling, to physical exams and documentation, treatment, medications, vital signs, and laboratory. Additionally, the administrative functions contained within the VistA system work synergistically with CPRS to support the basic business functions of the office. VistA–Office EHR is being designed so that any existing external interfaces will be preserved, and connectivity to other office software applications will not be precluded. The following are some of the key features it includes:

- The system uses the complete VA VistA FOIA suite of health information systems.
- It also includes Pediatric and Obstetrics and Gynecology modules.
- The system provides the ability to register patients and record patient demographics.
- The system provides the ability to schedule ambulatory encounter patient visits.
- The system shall provide the ability to record billing and health insurance information.
- Claims validation and submission will be performed by third-party products, such as a claims clearinghouse.
- Patient account and receivables management will be addressed by third-party products external to VistA–Office EHR.

- The system provides the ability to record and document the complete clinical encounter for each patient visit. This may include, but is not limited to:
  - Physician's orders
  - Nursing orders
  - Physical examination
  - Patient history and physical
  - Vital signs and measurements
  - Laboratory orders
  - Pharmacy orders
  - Radiology orders
  - Treatments and procedures
  - Referrals
  - Diagnosis and prognosis
  - Plan of care
  - Health summary
  - Problem list
  - Immunizations
  - Allergies
  - Adverse reactions
- The system provides the ability to print any or all parts of the medical record.
- The system supports data entry and retrieval by all physician office personnel, with appropriate access controls.
- The system supports and complies with all governing privacy, security, and confidentiality standards.

Implementations and Current Status

Early on, the CMS recognized the need to provide some limited technical support for initial installation and technical problem resolution with the software. The CMS has reached out to companies that have already expressed a strong interest in providing implementation and support services to healthcare organizations that intend to use VistA–Office EHR. Many of these companies are members of the industry trade association known as the VistA Software Alliance (VSA).

The first version of the VistA–Office EHR software suite was released in August 2005. It was deployed at a limited number of facilities during the first year of its release. This will allow the many companies supporting VistA to become more familiar with this particular variant of the VistA system, even as additional functionality is identified and added to the system for the next release of the product in 2006. Additional resources on the Web to learn more about VistA–Office EHR are:

- VistA–Office EHR Distribution Point: http://www.vista-office.org/.
- WorldVistA, the VistA–Office Support Organization: http://www.worldvista.org/vvso/.

- VistA Software Alliance, an international network of large and small corporations and a network of developers working to enable the deployment of VistA throughout the world: www.vistasoftware.org.
- Center for Health Information Technology sponsored by the American Association of Family Practitioners: http://www.centerforhit.org/x1442.xml.

National Hansen's Disease Center and VistA

The National Hansen's Disease Programs (NHDP), based in Baton Rouge, Louisiana, is primarily responsible for inpatient and outpatient care and treatment of Hansen's disease (leprosy). In addition to the clinical programs in Baton Rouge, the NHDP also coordinates outpatient care for Hansen's disease patients throughout the United States at BPHC grant funded clinics as well as private physician offices.

Health information systems (HIS) are essential to the record-keeping functions and clinical care management of a medical center and its associated patient care programs. For over decade the NHDP has been using a version of the U.S. Department of Veterans Affairs (VA) VistA health information system to meet its needs.

Background

In 1994, the World Health Organization estimated that there were 2.4 million cases of Hansen's disease worldwide with 1.7 million cases registered on treatment. In the United States there are approximately 6,500 cases on the registry, which includes all cases reported since the registry began and still living. The number of cases with active disease and requiring drug treatment is approximately 600. There are 200 to 250 new cases reported to the registry annually with about 175 of these being new cases diagnosed for the first time. The largest numbers of cases in the United States are in California, Texas, Hawaii, Louisiana, Florida, New York, and Puerto Rico.

The National Hansen's Disease Center at Carville, Louisiana, started as a state institution in 1894 named Louisiana Leper Home, treating leprosy, one of the most misunderstood and stigmatized diseases of all time; developed into a highly respected world famous hospital for the treatment, rehabilitation, research, and training in the field of leprosy under

federal sponsorship in 1921; and in 1999, had evolved to cover three campuses at Baton Rouge and Carville. It operates within the Department of Health and Human Services, Public Health Service, Health Resources and Services Administration, Bureau of Primary Health Care, Division of National Hansen's Disease Programs. The site at Carville was placed under the National Register of Historic Places in 1992 as part of the Carville Historic District.

The National Hansen's Disease Programs (NHDP) in Baton Rouge, Louisiana, is the only institution in the country exclusively devoted to Hansen's disease. In addition to the clinical programs in Baton Rouge, the NHDP also coordinates outpatient care for Hansen's disease patients throughout the United States at Bureau of Primary Health Care (BPHC) grant funded clinics as well as private physician offices. The NHDP conducts professional education programs for U.S. and international healthcare workers, providing basic information that is not provided in standard medical curricula. The NHDP also operates state-of-the-art, world-renowned laboratory research programs dedicated to improved detection, treatment, and prevention of Hansen's disease.

The U.S. Department of Veterans Affairs (VA) has developed and continues to maintain the VistA healthcare information system to provide a high-quality medical care environment for veterans of the U.S. Armed Forces. Designed from the beginning to focus on clinical aspects of healthcare, the VistA applications share a common set of files such as the patient and provider files. The NHDP chose to adopt and begin installing the VistA system in its institutions in the mid-1980s.

Current Situation

The initial installations of VistA, then known as DHCP, was performed at the Gillis W. Long Hansen's Center. In-house staff were added with the expertise needed to implement and maintain the system. With the loss of staff over the years, much of the needed expertise has been lost and the VistA system has not been updated. The last major upgrade to the system was in 2000. They are running on the last version of MSM v.4.0, the Kernel, and the "full core" set of VistA applications. They have a patient database size of 16,082 patients. The VistA system is in daily use within the program, and the breadth and complexity of its functionality require that a better support infrastructure be put in place.

A study group assigned to conduct a failure mode analysis reported a need to upgrade the VistA system and implement the VA Computerized Patient Record System (CPRS). The committee reported that interdepartmental communication would be enhanced, patient safety would improve, and medication errors would be reduced as a result of implementation of the CPRS. A notable improvement in patient outcomes is expected due to access of health information among healthcare practitioners located at NHDP and the regional health centers.

Implementation of the system would integrate the ordering, dispensing, and administration of medication to the patient. The system alerts the physician, nurse, and pharmacist to allergies and provides a tracking system for the administration of medication. The electronic record is available to healthcare providers at any location where a computer is available. This would eliminate problems with the transportation and tracking of the record at multiple sites. An added benefit of the system is the availability of patient data for clinical investigations. The integrated record will improve communication among health professionals and decrease the space required for record storage.

NHDP Plans

In 2004, the NHDP contacted the VA to discuss how best to proceed with upgrading its system. Apparently, the NHDP plans to maintain and enhance its VistA system. It also plans to implement the VA Computerized Patient Record System (CPRS) module. To accomplish this, they plan on moving from their existing MSM operating system environment to the InterSystems Cache solution currently favored by the VA. Other major objectives include:

- Updating the existing VistA system with current patches or upgrades.
- Implementing many additional VistA applications and utilities.
- Hire trained IT staff to support the VistA system.
- Obtain additional contract support for the system as needed.
- Modify and enhance the VistA system as needed to better meet NHDP needs.
- Provide needed training to administrative and clinical staff on the use of VistA and CPRS.
- Transition to a "paperless" electronic health record.

Unfortunately, budget constraints in FY 2005–06 may preclude them from pursuing the planned enhancements to their VistA system over the short term. However, it appears they will continue to use the currently installed system. It still meets their basic needs for Pharmacy, Medical Records, Clinical, Lab, and Engineering Work Orders. When funding becomes available, they will move forward with the planned enhancements.

Hawaii and VistA

Introduction

Hawaii has been a hotbed of activity with regard to the VistA system. Not only has VistA been used by the VA Medical Center and its clinics in Hawaii, but Tripler Army Medical Center uses a system called CHCS, which is an offspring of VistA. The Pacific Telehealth and Technology Hui has taken VistA and modified it slightly to run on a Linux open source platform. Their VistA open source solution is known as Hui OpenVista. The Hui helped American Samoa implement VistA at the LBJ Tropical Medical Center and is now working with a number of private companies to deploy VistA in a number of hospitals and clinics across the state of Hawaii.

Pacific Hui and OpenVista

The Pacific region has a varied economic infrastructure. Proprietary solutions that are easily affordable to some areas are economic hardships for other areas. Because enterprise-wide healthcare information systems based on VistA are available and in the public domain through the Freedom of Information Act (FOIA), economic factors do not limit its deployment. Making taxpayer-funded software freely available for use by the general public fits in well with the Hui's mission to improve the quality, accessibility, and cost-effectiveness of healthcare services to people living in remote areas of the Pacific.

The Pacific Hui's OpenVista technology transfer initiative is the outcome of a research project funded and managed by the Hui, building on the strengths of the U.S. Department of Veteran Affairs (VA) VistA system. Unfortunately, the VA VistA system currently runs on proprietary operating systems and "M" language compilers that require somewhat

costly licensing fees. The Linux-based Hui OpenVista solution is now available to the public in a nonproprietary open source version that avoids these costs. The Pacific Hui's OpenVista project was a collaborative development effort involving WorldVistA, Medsphere, Sanchez/GT.M, the Pacific Hui, and the contributions of countless others in the larger VistA and open source global community.

On June 6, 2003, the Pacific Hui officially released OpenVista. The system operates on a Linux platform and is now available to hospitals and clinics worldwide in a nonproprietary, open source version. One can obtain the software from the SourceForge.net Web site, which is a well-known open source software development site. An updated version was expected to be posted in late 2005.

The initial release of Hui OpenVista encompassed the following functional modules from the VA VistA system:

- Patient Information Management System (Patient Registration and Bed Control)
- Clinic Scheduling
- Pharmacy System
- Laboratory System
- Radiology System
- Computerized Patient Record System (CPRS)
  - Cover Sheet
  - Problem Lists
  - Medication Lists
  - Patient Notes
  - Consults
  - Discharge Summaries
  - Electronic Orders
  - Results Reporting

On August 1, 2003, the Pacific Telehealth and Technology Hui reported that more than 230 healthcare, software development, and medical research organizations had executed licenses and downloaded the Pacific Hui OpenVista software from the organization's Web site at www.pacifichui.org in the first 60 days since its release. That number has since grown significantly.

OpenVista ASP Solution

After release of the OpenVista system, the Pacific Hui recognized a need to provide OpenVista services to small hospitals, remote clinics, and nurs-
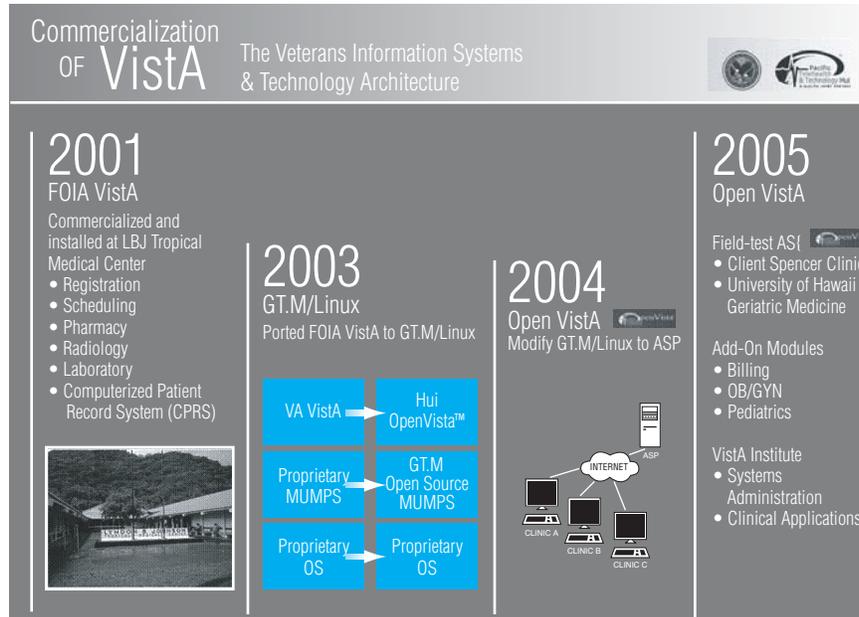
FIGURE 9-2 Commercializing VistA in Hawaii

ing homes in Hawaii that did not have the needed information systems resources to install, operate, and maintain a stand–alone system.

In order to accommodate these types of healthcare facilities, the Pacific Hui developed and tested a prototype of an OpenVista application service provider (ASP) solution. In the ASP configuration, OpenVista is maintained on servers at a central location from which healthcare organizations can access the system via computer workstations. This provides the small, remote sites with access to a fully integrated healthcare information system that has been configured to meet their specific needs. It is equivalent to having an OpenVista system on-site without the need to hire a technical staff to maintain it. Based on tests of the prototype, the Pacific Hui was able to demonstrate that OpenVista can be configured as an ASP solution that uses a single set of OpenVista routines to maintain separate, secure databases for different clients.

The next step was to validate the OpenVista ASP in an operational environment. Once the OpenVista ASP was fully tested and validated at pilot client sites, it could be transferred to private commercial or non

Links to Key Web Sites and Documentation

- Pacific Hui: http://www.pacifichui.org/
- VistA System Web Site: http://www.va.gov/vista_monograph/docs/ vista_monograph2005_06.doc
- WorldVistA Organization: http://www.worldvista.org/
- VistA Software Alliance: http://vistasoftware.org/

profit organizations through the Hui's technology transfer program. As of June 2005, all was proceeding well with the Hui's pilot test of the OpenVista ASP approach with the Clint Spencer Clinic and the University of Hawaii's Geriatric Clinics. A company called BlueCliff, Inc. was established in mid-2005 aimed initially at marketing the OpenVista ASP solution in Hawaii. Another company, Mele Associates, works closely with the Pacific Hui and Blue Cliff on these OpenVista initiatives.

In another related effort, the Pacific Hui collaborated with the University of Hawaii in 2005 to establish the VistA Institute to help promote the development, use, and sustainability of VistA and OpenVista systems. The institute will provide systems applications and administration training and create a VistA library of user manuals and other technical documentation. They are sharing their experience and work with the WorldVistA organization and others involved with the national VistA– Office EHR initiative.

Hawaii, and the Pacific Telehealth and Technology Hui in particular, has proven to be a true "Center of Excellence" for VistA-related activities taking place in the United States and around the world.

D.C. Department of Health and VistA

In the summer of 2002, the District of Columbia (D.C.) Department of Health approached the U.S. Department of Veterans Affairs (VA) about possibly acquiring and pilot testing the use of the VA Computerized Patient Record System (CPRS) in several of its clinics. CPRS is one of the major modules within the more comprehensive VA health information system known as VistA. What emerged was a very successful collaborative effort resulting in the successful deployment of VistA and CPRS in selected pilot test sites by the D.C. Department of Health (DOH).

Following several demonstrations of the system by the VA, management at every level of the D.C. government, from the Mayor's Health Policy Council to the community clinic directors, readily saw the many potential benefits to be derived from choosing to deploy VistA and CPRS. The fact that the system had been successfully deployed in a mix of large, medium, and small healthcare facilities within the VA, DoD, and the Indian Health Service (IHS), and that the healthcare providers using the system were very satisfied with the technology, reinforced their confidence in the decision to move forward with the pilot. The fact that it was available at no cost under the Freedom of Information Act (FOIA) was also a big plus.

The acquisition and implementation of VistA and CPRS by the D.C. DOH became the primary focus of the three-year Technology Opportunities Program (TOP) project. Some of the desired outcomes specifically sought by the TOP project included:

- Improved administration of medical records processes and associated cost savings.
- Improved provider satisfaction with the administrative and clinical care processes.
- Improved patient satisfaction with waiting times and communications with providers.
- Improved patient safety and quality of care as more complete medical records are made readily available to providers.

A combination of DOH staff, contractors, and VA technical support staff were used to identify detailed functional and technical requirements and to configure and install the servers, workstations, and local area networks (LAN). Training was provided to DOH technical and clinical staff by the VA and various vendors such as Cisco and Hewlett-Packard.

The location for the servers used to run the VistA software was centrally located at DOH, near the selected clinics implementing the system. Each of the initial clinic sites was connected to the VistA servers at DOH point-to-point by T1 telecommunications lines. Although the VA provided the VistA and CPRS software, some customization was necessary to adapt the systems to accommodate business rules and functional requirements specific to DOH. A combination of DOH clinical staff, vendors, and VA technical support personnel worked on the installation, setup,

and tailoring of the newly installed software to meet the specific needs of the clinics.

The D.C. TOP project encountered many challenges along the way such as the closure of the NPCC and Community Medical Care, Inc. Nevertheless, at the conclusion of the D.C. TOP project, pediatric providers at Mary's Center for Maternal and Child Care were using the VistA CPRS in combination with the paper medical chart. Some observations and results of the implementation of the pilot system include:

- Providers perceived the VistA CPRS module as more legible and more secure than the paper record.
- The online prescription medications list was perceived as very helpful.
- The programmed encounter form was expected to enhance compliance with Medicaid well-child standards over time.
- Problem lists, not always kept current in paper records, were automatically updated in the VistA CPRS.
- Providers were dissatisfied that the initial arrangement required duplicate entry of information to VistA and other existing systems; however, the VistA billing interface and laboratory connectivity will eliminate much of the double-entry by administrative staff and providers.
- The Laboratory Electronic Data Interface (LEDI) module in VistA needed modifications that were not identified and planned for up front.

DOH is looking to possibly replicate VistA's initial successful implementation in other D.C. clinics and healthcare facilities beyond the first pilot sites. Expanded use of VistA and CPRS across other DOH facilities will bring a number of anticipated benefits such as:

- Creating a more reliable, accessible, and centralized medical record.
- Improving quality, effectiveness, and continuity of patient care.
- Enhancing overall patient safety.

As the DOH looks to the future, many new health information technology and business needs may also start to emerge. These might include needs for the following:

- Interfacing other commercial off-the-shelf (COTS) modules such as Patient Billing and Pediatrics.

- Implementing the VistA Health Data Repository (HDR) and Personal Health Record (PHR) modules.
- Implementing a generic health information exchange (HIE) capability
- Adding biosurveillance or disease-reporting capabilities.
- Acquiring and installing wireless network solutions, support for PDAs, and a secure VPN.

State Veterans Homes and VistA

In October 2003, the secretary of the U.S. Department of Veterans Affairs (VA) and the under secretary for health issued guidance to its healthcare facilities across the country on a nationwide initiative to make the VA VistA and Computerized Patient Record System (CPRS) available for use by all interested state veterans homes (SVH). The SVH program is the oldest federal–state partnership and represents a sizeable commitment by the VA to states for shared construction costs and ongoing per diem payments for veterans' care in long-term settings. This effort is part of the VA Health*e*People long-range strategy to pursue collaborative partnerships with other healthcare organizations in the public and private sectors. Specific goals of this SVH initiative were to:

- Contribute to improved health care provided to veterans by both the VA and state veterans homes.
- Improve communication among providers between different levels of care.
- Support continuity of care by making medical record information seamless and transparent to clinicians responsible for care provided at both the VA and state veterans homes.
- Enhance interagency (federal and state) sharing of healthcare information and technology.

Background

The U.S. Congress first authorized federal cost-sharing for state veterans homes in 1888. There are currently about 23,000 residents at more than 120 state veterans homes in 47 states and one U.S. territory. Residents are typically incapacitated or unable to earn a living and require long-term nursing care. Residents are normally military veterans who have generally

already received care at VA healthcare facilities. However, residents can sometimes include veterans' spouses.

Of the many state veterans homes, some are physically located on the grounds of a VA Medical Center (VAMC). This close physical proximity led naturally to clinical staff at many SVHs requesting access to the VA VistA and CPRS systems, which are used at all VA healthcare facilities across the country. Within a healthcare setting, automation of medical records has been generally found to improve communication and quality of care by clinicians. It was concluded that providing secure access to VistA for selected staff at the SVHs would better facilitate requests for consultations and associated clinical procedures and improve turnaround time for feedback about results.

Planning and Analysis

The primary business office responsible for overseeing any sharing arrangements with SVHs is the Geriatrics and Extended Care Strategic Healthcare Group (GEC-SHG). In 2002, this office convened a task force to examine in depth the issue of providing access to VistA and CPRS for selected staff at the state veterans homes. They determined that there would be a number of benefits both to the VA and the state veterans homes if secure access to patient data contained in these systems was granted. These benefits included:

- Improved patient care by both institutions.
- Enhanced productivity by professionals at both institutions.
- A reduction in administrative and healthcare delivery costs.
- Increased clinical and health services research.
- Support for future developments in healthcare technology, standards, policy, and management.

Two primary alternatives were identified for sharing VistA and CPRS functionality and data with state veterans homes:

- Alternative 1: State veterans homes could obtain the VistA and/or CPRS software from the VA and operate their own systems using state or contract technical staff.
- Alternative 2: VA Medical Centers could grant state veterans homes with secure read-only access to patient data in the VistA and CPRS systems. The read-only option meant that SVH staff could not write entries into the VA medical record.

A more detailed analysis into the feasibility of providing VistA and/or CPRS read-only access to the state veterans homes was conducted in January 2003. Some of the other issues and major concerns surfaced by this study included:

- Complying with various accreditation requirements such as JCAHO.
- The need to build additional security features into CPRS to handle queries from an authorized external entity.
- The need to address potential physician credentialing and privileging issues.
- Affects on VA help desk and technical support staff.
- Possible VistA software modifications that might be needed.
- Privacy and security requirements such as HIPAA and Privacy Act.
- User access and background checks.
- Legal or contractual requirements.

Based on a survey of state veterans homes completed in June 2003, there were eight states that expressed some interest in possibly acquiring and installing VistA for use as their own health information system. However, over 90% of the states expressed a clear desire to simply have CPRS read-only access for a small number of key staff at their facilities. In addition, the survey found that approximately 30 state veterans homes had already been given CPRS read-only access as a result of local sharing agreements.

Over a period of approximately six months, staff from the Office of Information, General Counsel, CyberSecurity, Geriatrics and Long Term Care, Medical Records Administration, and others helped to develop an implementation plan and detailed guidance needed to address these concerns. In October 2003, the Under Secretary for Health authorized moving forward with this initiative, and this guidance was transmitted to the field.

Systems Implementation

An implementation plan was developed and a VHA Office of Information (OI) program manager was assigned to provide support to the Geriatrics and Long Term Care SHG in moving this national effort forward. Specific objectives for the SVH initiative included the following:

- Provide limited support needed to complete implementation of VistA/CPRS for the SVHs in a selected state, e.g., Oklahoma (pilot test), by the end of FY 2003

- Complete implementation of VistA/CPRS read-only access for a limited number of SVHs in selected state(s) by January 2004.
- Ensure that all states wishing to obtain VistA/CPRS read-only access in their SVHs achieve this by the end of FY 2006.
- Monitor and regularly report to management on the progress of this initiative.

CPRS Read–Only Access

The states that have obtained CPRS read-only access to date for their SVHs are listed below: 20 states, Puerto Rico, the District of Columbia, and more than 70 facilities. Numerous sites in other states are in the process of being connected. There are a total of 128 SVHs in 47 states with more being opened.

VistA Implementations

The Oklahoma Department of Veterans Affairs worked with Hewlett-Packard and Medsphere to implement VistA in its seven SVHs (Norman,

Table 9-3 State Veterans Homes and VistA

All Homes with Read-Only Access	Some Homes with CPRS Read-Only Access	No Homes with CPRS Read-Only Access
Alabama	Florida	Arkansas
Arizona	Georgia	Colorado
California	Idaho	Illinois
Connecticut	Massachusetts	Maine
District of Columbia	Michigan	Mississippi
Indiana	Minnesota	Nevada
Iowa	Montana	New Hampshire
Kansas	Nebraska	New Jersey
Kentucky	New York	New Mexico
Louisiana	Ohio	North Dakota
Maryland	Pennsylvania	Tennessee
Missouri	South Carolina	Virginia
North Carolina	Texas	
Oklahoma	Washington	
Oregon	Wisconsin	
Puerto Rico		
Rhode Island		
South Dakota		
Utah		
Vermont		
West Virginia		
Wyoming		

Claremore, Talihina, Clinton, Ardmore, Sulphur, and Lawton). The VA provided some limited consultative expertise through the local VA Medical Centers. The VistA has been successfully installed in every SVH in Oklahoma. The system has received excellent satisfaction ratings from Oklahoma system users and administrators.

Conclusion and Future Scenarios

This collaborative initiative between the VA and SVHs has proven to be very successful. In fact, it is a model for others to follow when attempting to pursue federal and state government partnerships. The VA was able to share its systems with the states and did not have to expend significant resources in doing so. The SVHs provided the funding and resources needed to implement and use the VA systems. The veterans who received healthcare treatment at both the VA and state facilities ended up being the real winners.

As a result of Oklahoma's successful acquisition and implementation of the VistA system for its own use, it is anticipated that several other states may choose to follow suit in the coming years. It is also expected that over time, those SVHs that have CPRS read-only access may want to work with the VA on next steps to take to obtain the ability to place orders and have other interactive VistA and/or CPRS system capabilities. Over the long term, whether the state veterans homes are using VistA or a commercial electronic health record (EHR) system, it is anticipated that they will one day want the ability to share or exchange information on patients receiving care at both the VA and the state homes.

Oklahoma State Veterans Homes and VistA

In 2003, the Oklahoma Department of Veterans Affairs (ODVA) initiated its project to acquire and implement the VistA electronic health

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Key Web Links

- Armed Forces Veterans Home Foundation:
  http://www.vethomesfoundation.org/frameset.htm

- VA Geriatrics and Extended Care Program:
  http://www.va.gov/geriatricsshg/

record (EHR) system in its seven healthcare facilities, including the state veterans homes (SVHs) in Norman, Claremore, Talihina, Clinton, Ardmore, Sulphur, and Lawton.

Project History

Here is a brief overview of the project time line:

- Hewlett-Packard (HP) was selected as the prime contractor for the ODVA project.
  - HP has been a key partner with the VA for more than 20 years.
  - HP subcontracted with Medsphere for VistA software application expertise.
- Norman was the first facility to implement VistA. Much work was put into customizing VistA to meet the needs of the Oklahoma SVHs. Standardization, documentation, database configuration, and development of training materials and programs were going to be crucial to the overall success of the project and implementation at the future sites.
- VistA was implemented at Norman, a 300-bed facility, in May 2004.
- Claremore was the second site. It was also a 300-bed facility. VistA was successfully implemented there by the end of August 2004.
- Talihina was the third site to go live in September 2004.
- As of June 2005, all seven Oklahoma SVHs were using VistA.
- The project was completed at the beginning of June 2005. Deployment was completed three months ahead of schedule and at a significant cost-savings to ODVA.

Guiding Principles and Major Project Objectives

The following are some of the guiding principles, major objectives, and other planned activities associated with the Oklahoma VistA implementation project:

- Utilization of the proven VA VistA and CPRS software solutions.
- Implement VistA and CPRS in all seven of Oklahoma's SVHs.
- Improve quality of veterans' health care at the Oklahoma SVHs.

- Focus on software deployment, not software development.
- ODVA will stay aligned with the VA VistA system and future plans.
- ODVA will seek to leverage the VA for selective VistA software development and support.

Systems Architecture

The IT architecture chosen for Oklahoma was a centralized one, using a single VistA database residing in Oklahoma City at the ODVA central office. Each of the seven facilities is represented as a division within the overall system and its database. There is a disaster recovery configuration in Norman. Given a disaster occurring at the central site in Oklahoma City, the system at Norman could be brought online to support the production environment.

Project Benefits

The following were some of the major benefits to be derived from the Oklahoma VistA system implementation project:

- Move toward standardization of care across ODVA facilities.
- Implementation of a single, seamless medical record across ODVA facilities.
- Improved access to patient information by ODVA healthcare providers.
- Reduced occurrence of medication errors, and other improvements in patient safety.
- Potential sharing of patient records between ODVA and the VA in the future.
- Reduced costs as funds were focused on software deployment, not software development.
- VistA will help ODVA become HIPAA-compliant.

Project Challenges

Some of the many issues and challenges addressed during this ODVA project to implement VistA included:

- VistA consists of two environments that currently must be implemented: "Roll and Scroll" and the Windows GUI environments.

- Identifying subject matter experts (SME) and/or "champions" in each ODVA facility.
- VistA for ODVA needed some customization for long-term care facilities.
  - Seek a balance between VistA's capabilities and ODVA's requirements.
  - Some reengineering of ODVA processes were needed to meet VistA design.
- Hardware and infrastructure enhancements.
- Upgrade of existing network infrastructure to accommodate users needs.
- Upgrade of existing hardware needed for improved reliability and performance.
- Increasing the number of desktop PCs and printers at ODVA facilities.
- Migration of existing ODVA patient data into VistA.
- Keeping VistA software at ODVA facilities up-to-date and patched.
- An intergovernmental agreement between ODVA and the VA for some degree of software support was needed.
- Centralized IT staff were needed in ODVA to support the seven remote locations.
- Providing 24/7 customer support for the ODVA users of VistA.
- Customized reports needed to be developed for ODVA at the central administration and hospital levels.

VistA Foundation Software Modules

The basic VistA software modules initially implemented by ODVA included:

- Patient Registration
- Admission/Discharge/ Transfer (ADT)
- Inpatient Pharmacy
- Outpatient Pharmacy
- Laboratory
- Master Patient Index (MPI)
- National Drug File
- Patient Demographics
- Radiology and Nuclear Medicine
- Clinic Scheduling

Additional VistA Software Modules

Other VistA software modules to be implemented by ODVA as soon as possible to take advantage of using the VA Computerized Patient Record System (CPRS) include:

- Adverse Events Tracking
- Clinical Guidelines and Reminders
- Consult Requests and Reminders
- Discharge Summaries
- Graphical Lab Trending and Results
- Health Summaries
- Order Entry
- Problem Lists
- Progress Notes
- Vitals and Other Measurements

Additional VistA Software Modules Desired

Other VistA software modules ODVA wants to possibly implement in the future include:

- Controlled Substances
- Dietetics
- Incident Reporting
- Long-Term Care (Accu-Care)
- Mental Health
- Nursing
- Patient Intake and Output
- Social Work
- Volunteer Timekeeping

New Customized Software Modules Needed

There were a number of additional software modules that needed to be acquired and implemented by ODVA that were not a part of the VistA system, such as:
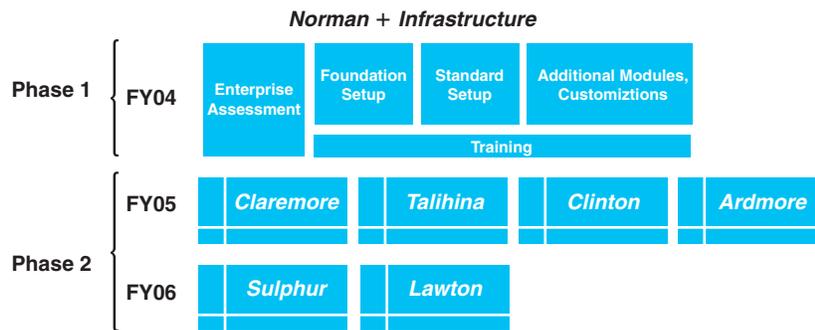
- Patient Billing and Banking
- Nurse Scheduling
- MDS (Accu-Care)
- Selected Lab Device Interfacing

Future Enhancements

A list of long–range enhancements sought by ODVA include the implementation of the following VistA software modules:

- Bar Code Medication Administration (BCMA)
- Claims and Benefit Management
- Vista Imaging (Document and Medical)

The VHA Office of Information (OI) continues to provide updated versions of VistA software and patches to ODVA. Oklahoma has moved on to the next stage of addressing ongoing operations and moving on implementing planned enhancements to its system. This has been a highly successful public-private collaborative initiative implementing an innovative, open source solution.

Norman + Infrastructure

Phase 1	**FY04**	Enterprise Assessment	Foundation Setup / Standard Setup / Additional Modules, Customiztions		
			Training		
Phase 2	**FY05**	Claremore	Talihina	Clinton	Ardmore
	FY06	Sulphur	Lawton		

Critical Sucess Factors

- Standardization
- Documentation
- Incremental Efficiencies
- ODVA Involvement
- Training
- Collaboration
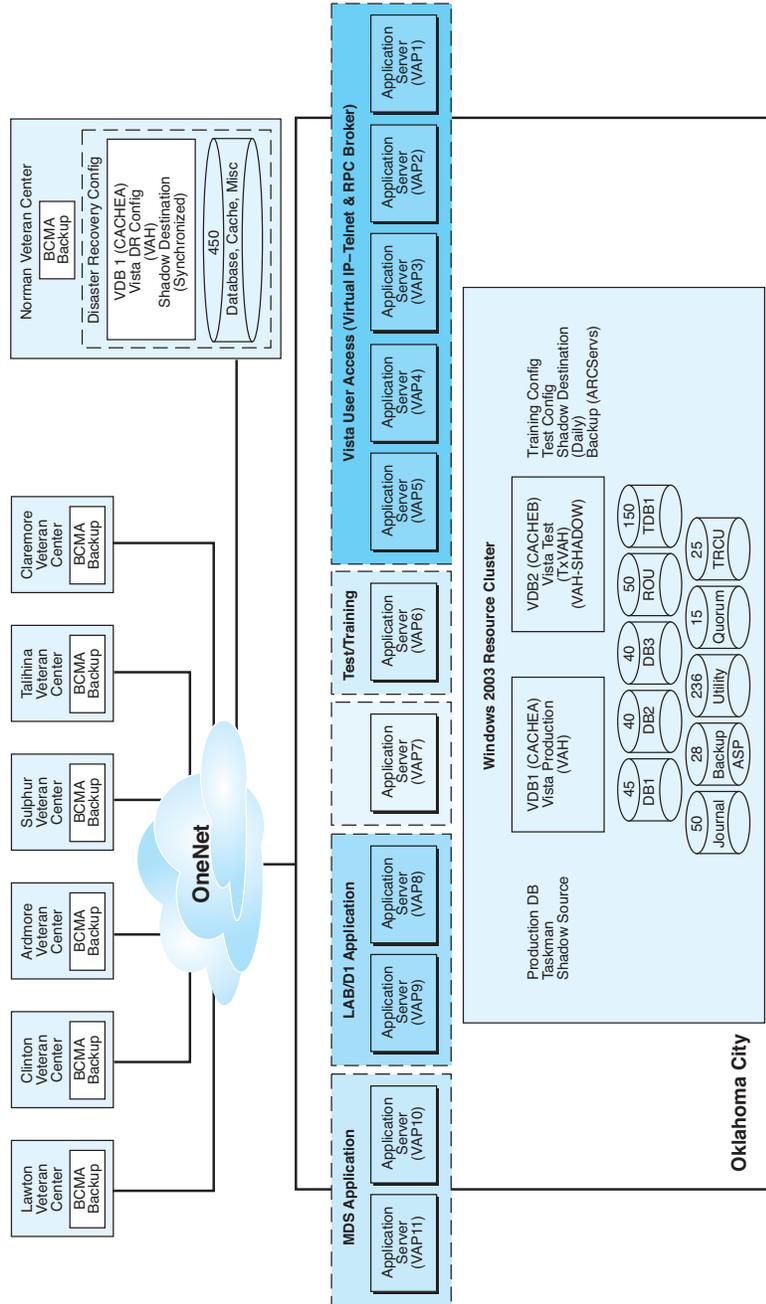
FIGURE 9-3 Oklahoma and VistA Success Factors

FIGURE 9-4 Oklahoma and VistA System Topology

Part B: International

The following section of this chapter contains profiles of selected VistA system implementations in healthcare organizations around the world.

American Samoa and VistA

The Lyndon Baines Johnston (LBJ) Tropical Medical Center in American Samoa recently completed a highly successful collaborative project involving the acquisition and implementation of VistA, the electronic health record (EHR) system developed by the U.S. Department of Veterans Affairs (VA). LBJ Tropical Medical Center is located in Pago Pago and is the only medical facility in American Samoa. The facility is a 160-bed hospital that provides health care to approximately 70,000 people. It has services such as laboratory, pharmacy, dietetics, radiology, dialysis, and mental health. Before it implemented the VistA system, LBJ had no computer system at all and all record keeping was paper-based, which resulted in a loss of revenue and duplication of many medical services.

LBJ management knew they did not have the resources to develop their own system or to buy a commercial solution. Their CEO and board members went to Honolulu, Hawaii, and talked to the director of the VA Medical Center about the possibility of acquiring and using the VistA system, a comprehensive healthcare information system that has been made available to other organizations for many years through the Freedom of Information Act (FOIA). The VA recognized that military veterans would benefit from this initiative because the VA has no clinics in Samoa and all veterans are treated at the LBJ Tropical Medical Center. The Pacific Telehealth and Technology Hui in Hawaii helped to coordinate the collaborative efforts of all parties that ultimately worked on making this project a success. Some of these other organizations included the Tripler Military Hospital, University of Hawaii, U.S. Air Force, National Guard, PEACESAT, WorldVistA, the governor of Samoa, the American Samoa congressional delegate, and several corporations.

The VistA Patient Information Management System (PIMS) module was implemented first so that basic demographic data on most patients could be entered into the computer database. LBJ then proceeded to implement a series of clinical applications based on their relative importance to the organization. These included the Clinic Scheduling, Pharm-

acy, and Laboratory software modules. These were the areas that formed the foundation needed in order to effectively implement the VA Computerized Patient Record System (CPRS). Over time, a prioritized list of additional software modules was developed for subsequent implementations in Samoa, such as Radiology, Dietetics, Billing, Surgery, Medicine, and Nursing.

Overall, the implementation of the VistA system went quite well and the employees are enthusiastic about using the system. Very few calls have had to be made by the LBJ Tropical Medical Center to the Honolulu VA Medical Center for help or assistance. The small servers donated by the University of Hawaii have performed extremely well for the 50 or so simultaneous users of the VistA system installed and used by the LBJ Tropical Medical Center. This collaborative effort to implement the "free" suite of software modules that make up the VistA electronic health record (EHR) system was truly successful. It has been very rewarding to the staff to see patient care begin to improve almost immediately once the system was implemented. For example:

- Use of the Patient Information Management module has led to improvements in tracking of discharges, admissions, and transfers (ADT) and the creation of up-to-date in patient rosters.
- Use of the Clinic Scheduling module has led to improvements including better coordination between clinics and medical centers getting records to the clinic, identification and verification of LBJ patient names and ID, and improved reports on clinic workloads.
- Use of the Laboratory module has led to more timely reports, improved tracking of historical lab results, and improved controls on identifying false LBJ patient ID numbers.
- Use of the Radiology module has improved the legibility of the report now that results are typed. Also, workload reports can be readily produced for better management of the department.
- Use of the Pharmacy module has improved its ability to process prescriptions in a timely manner and has also given the center a tool to monitor drug usage and workload. The staff has also seen a significant reduction in duplicate prescriptions.
- The Computerized Patient Record System (CPRS) module allows clinicians to now submit electronic orders to laboratory, radiology, and pharmacy. It also provides the ability to keep progress notes and
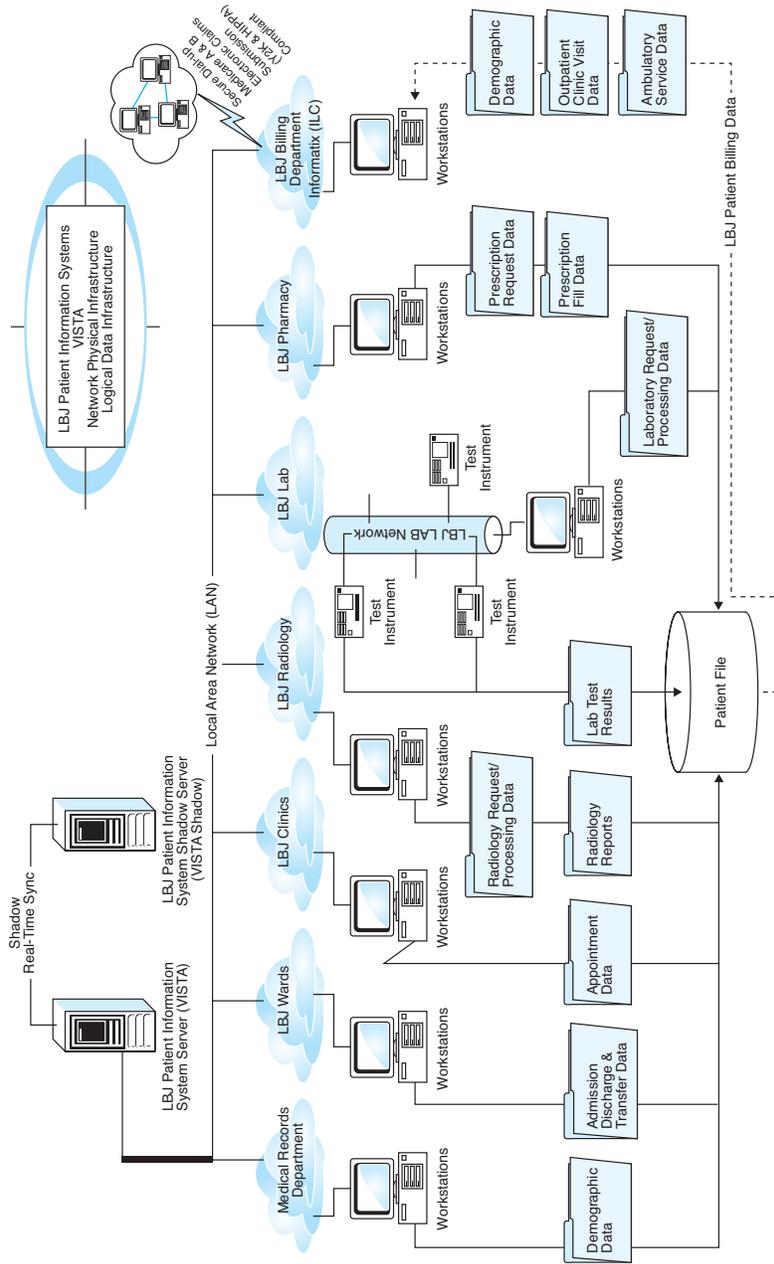
FIGURE 9-5 VistA System Deployed in American Samoa

other defined electronic digital documents associated with a patient, and to view all data associated with a patient, from lab results to medications that have been prescribed and dispensed.

• Use of the Informatix (ILC) Billing/Accounts Receivable module has resulted in dramatic improvements in billing and/or cost recovery. This third-party billing system was added in 2003. Due to the improvement of record keeping, the percentage of earnings from nonresidents increased from 1% to 26%.

Currently there are no plans to further enhance the VistA system in American Samoa. The LBJ Tropical Medical Center will simply continue to use the standard system released by the VA and will keep it patched and up-to-date. The VA VistA and Computerized Patient Record System (CPRS) appear to be more than adequate to meet the long-term needs of the center. However, over time, one would expect that VistA clinical imaging, wireless technology, and other cost-effective enhancements may be made.

Egypt and VistA

National Cancer Institute (NCI)

In 1990, a project was launched to implement a Hospital Management Information System (HMIS) at the National Cancer Institute, Cairo University (NCI-CU). NCI-CU is the leading cancer center in Egypt, delivering cancer care for about 12,000 new cancer cases every year, more than half free of charge.

VistA, formerly known as DHCP, was adopted as the Health Information System. Customization and conversion to Arabic of many parts of VistA was achieved in-house, with cooperation from VA staff and staff from the University of Wurzburg in Germany. Applications used included Patient Registration, Inpatient Admissions/Discharges/ Transfers (ADT), Surgery, Laboratory, Pharmacy, Radiology, Record Tracking, Nursing, Engineering, and a test version of the Clinical Imaging module.

NCI updated the original VistA system running on DataTree "M" into Cache in 2000. The original data was migrated to Cache, which included patient data collected since 1992. NCI has also started working on a GUI interface for ADT, Lab, Radiology, and others. Some of this software is in Arabic, some in English, and some mixed.

Nasser Institute Hospital—An Overview

Nasser Institute Hospital (NIH) was opened in July 1987, encompassing an area of about 35 acres. The main hospital is an eight-floor building with two basement levels. It used to be part of Cairo Curative Organization, but it was moved to the custody of the Ministry of Health and Population (MOHP) in late 1997. NIH is the largest tertiary reference center for MOHP. It consists of 885 beds distributed over more than 40 medical specialties and sub-specialties ranging from ordinary medical and surgical services to the most sophisticated BMT and open heart surgery. Other statistics include:

ICU beds:	68	Total number of ER patients:	20,241
Operating rooms:	23		
Dialysis machines:	53	Total number of outpatients:	201,535
Number of inpatients:	21,347		
Average occupancy %:	98.3%	Number of major operations:	13,509
Average length of stay:	14.6 days		
Average bed turnover:	5.2 times/ year	Number of cardiac catheterizations:	2,474
		Total number of lab tests:	48,969
Average daily admissions:	58.5 p/day	Total number of radiology tests:	31,442
		Total number of dialysis sessions:	18,092
		Total number of mortalities:	1,109

HMIS Project Implementation

The Hospital Management Information System (HMIS) project in Egypt started in 1997. The aim was to establish an HMIS in up to four hospital members of the CCO group and at headquarters. The Nasser Institute Hospital (NIH) joined the project in late 1997. Since about 1994, NIH had been using stand–alone PC workstations set up with a prototype system to provide some financial and statistical data. NIH joined the CCO/MOHP USAID project and implemented HMIS in early 1999, later than the other hospitals in the CCO. This delay entering the project motivated NIH to try to run the activities of the implementation faster to keep up with the other MOHP hospitals. The CIO and other senior management and clinical staff regarded the project from the first as the best

chance to join the future of health care and to make the best use of scarce resources. The staff had the medical experience, and with the VistA implementation project they hoped to learn all about information management.

It took about a year from joining the project to the complete cabling of the facility. During this start–up period they had a limited network solution in place to demonstrate the capabilities of the system and to train the hospital staff. In early 2000, network cabling was finished.

The concept of a universal patient number was also implemented for the first time in Nasser Institute Hospital with this project. This concept not only revolutionized its statistics but it was a new start for its future electronic health record (EHR) system.

Maximus played a key role providing support for this joint USAID and Egyptian government project. Maximus provided a training program for a team of programmers, system administrators, troubleshooters, and hardware support staff. The Egyptian staff closely shadowed their counterparts on the Maximus team. For every task in the project performed by Maximus, NIH assigned one of its project team to be trained on that task so they would be able to carry out the job at the end of the project. This knowledge-transfer approach was initiated by Maximus at the outset of the project. Some tasks were completely carried out by NIH staff that were supervised by Maximus. (http://www.maximus.com/corporate/pages/adminhealthsyssvs.asp)

Maximus trained the following number of NIH staff:

- Programmers/Analysts   7
- System Administrators   7
- Help Desk   22
- End Users   376
- Trainers   20
- Application Coordinators   32

For every VistA software application module, NIH had a member of the HMIS department and a member from the department of specialty coordinate the system's implementation. These staff were trained by Maximus. They in turn later shared the responsibility of providing the training to others. They ensured that the transfer of knowledge to end users was successfully accomplished. This approach, plus creating backup or a second line of trained counterparts, ensured the smoothness of the flow of work and gave the staff self-confidence in their ability to achieve their goals.

The NIH team members were always questioning the end users about their opinions on the customization of the VistA packages to meet their needs. Aside from their regular assignments, the team trained more than 300 employees on basic PC skills using a computer-training laboratory set up with the assistance of Maximus. This PC literacy campaign was one of the most successful efforts in the history of the hospital. It was a success as a propaganda tool leading up to the HMIS implementation. As a result, almost everybody was willing to share in making this project a success.

The major benefit of using Maximus was not its expertise in computer hardware or software but its transfer of information management knowledge. Understanding and managing the cultural effect of the system on end users was also a key service provided by Maximus. These results and the overall success of the project could not be achieved by a company or an institute alone. It needed the successful collaboration and interaction among all the partners involved in this project.
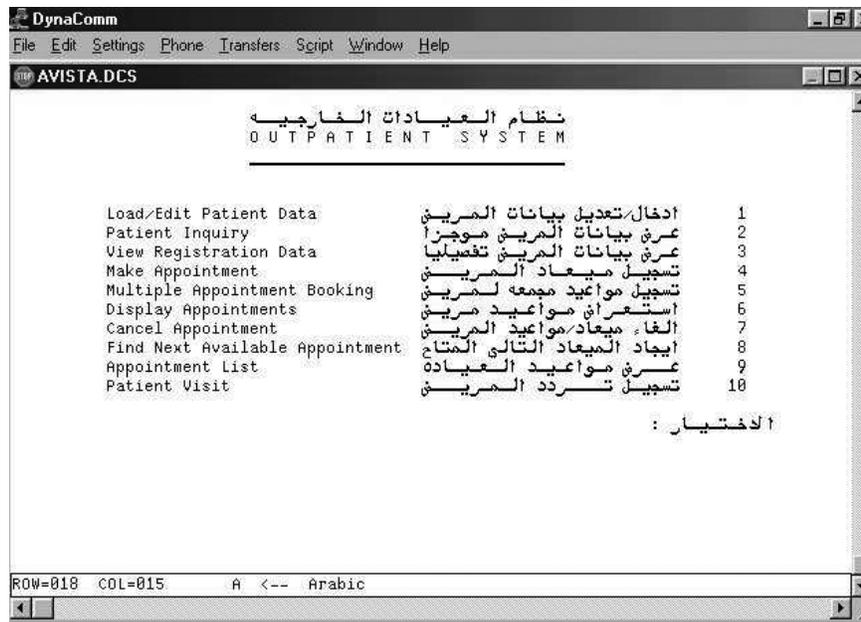

FIGURE 9-6 Copy of a VistA Outpatient Scheduling Screen Displaying Options in Arabic

Current Status

As of January 2005, at least two hospitals in Egypt were running components of the original VistA software installed by Maximus, but with lots of help and support of Egyptian National Cancer Institute (NCI) programmers. NCI is upgrading all VistA system modules to the current versions and are using CPRS. NCI also plans to use VistA Imaging.

Future Plans

NIH has plans to implement Picture Archiving and Communications System (PACS) and other clinical-imaging capabilities. It also hopes to possibly implement the VA Computerized Patient Record System (CPRS) module and integrate VistA with other existing activities and systems such as Telemedicine, Cancer Registry, Quality Assurance, and Decision Support.

Mexico and VistA

In May 2004, representatives of the Instituto Mexicano del Seguro Social (Mexican Government Social Security Healthcare System) visited the VA Medical Center in Washington, D.C., to learn more about the U.S. Department of Veterans Affairs comprehensive health information system known as VistA. The Instituto Mexicano del Seguro Social (IMSS) was interested in possibly installing VistA and the VA Computerized Patient Record System (CPRS) in all of its hospitals. The IMSS operates a government chain of 40 large tertiary hospitals, 223 regional hospitals, and more than 1200 clinics. They also have about 3,000 very small community clinics that provide care to some 10.5 million uninsured people. It is worth noting that IMSS is a nonprofit state-owned organization and is the main healthcare provider in the country. It serves a population of more than 50 million insured people, making it the largest social insurance organization in Latin America. In terms of medical research, it has 67 research centers and more than 473 full-time researchers.

Representatives of the IMSS met with Veterans Health Administration (VHA) senior IT staff three times during 2004 to be briefed on VistA and see it in operation. During their meeting in mid-2004 with the chief health information officer for the VHA, they raised a number of specific issues. For example, they wanted to know how to go about gaining access to VistA software, patches, training materials, and documentation. They also dis-

cussed how to collaborate on new software modules, exchange data in the border states where patients are treated in both countries, and many other issues. The director of the Health IT Sharing (HITS) program within the VHA Office of Information (OI) subsequently coordinated contacts between the agencies and helped them obtain copies of the VistA software, documentation, patches, and other information they have requested.

In July 2004, the VA was provided with an update by the VistA project manager for the IMSS on the status of their efforts to move forward with testing and implementing the VA VistA system. In brief, they had:

- Finished their preliminary evaluations of cost and performance.
- Installed and tested a number of VistA configurations successfully over the past months.
- Started loading in sample patient data on their test system.
- Started sizing the infrastructure required (PCs, servers, network, etc.) in order to operate the system across the IMSS.
- Begun concurrently modeling their business processes so they can attempt to reproduce and relate them to VistA to find any gap that might exist between their current model and the VA system.
- Begun doing some complexity assessments on changes that will need to be made to better tailor VistA to meet their needs.
- Developed plans to deploy VistA at a pilot site by September 2004.
- Developed plans to deploy the main modules of VistA in one of their hospitals and have it online by December 2004.
- Assigned approximately 15 full-time employees to the startup of the project.
- Received funding to proceed with the implementation of VistA over the next year at additional IMSS hospitals in Mexico.
- Requested additional information from the VA about VistA Imaging and VistA training opportunities.
- Began the translation of the VistA system and CPRS into Spanish.
- Made the preliminary decision to move forward with implementation of VistA in their IMSS hospitals by the end of FY 2006.

As of 2006, the VistA implementation project in Mexico was continuing to move forward at an aggressive pace. The IMSS reported having VistA installed in 14 hospitals with 11 more hospitals in the process of installing the system. The plan called for more than 20 tertiary hospitals to be running VistA by early 2006. The goal was to bring up VistA in

FIGURE 9-7 VistA/CPRS Cover Sheet Screen in Spanish

approximately 100 additional general hospitals by the end of 2006. Additional installations were planned for 2007.

In August 2005, a new VistA module was developed by the IMSS and released to support its emergency departments. It was embedded in CPRS and allows physicians to easily and quickly calculate and capture injury severity scores and revised trauma scores. The first version of a VistA Imaging module was also developed and released by the IMSS. It is a Java client-server application that allows physicians to view a digital copy of DICOM-compliant imaging studies from their computer workstations. The IMSS is also busy developing enhancements to the VistA Surgical and Nursing modules to better meet its needs.

This has been a highly successful international collaborative effort. In several years, Mexico may become the biggest user of the VistA system. Some of the new modules developed will prove beneficial to the VA and the global VistA community.

Germany and VistA

The German Heart Institute in Berlin opened in 1985. It is a hospital specializing in cardio-thoracic surgery and cardiology. It has more than

8,100 inpatient admissions each year and did 4,557 open heart procedures and 2,797 cath procedures in 2002.

In 1992, the German Heart Institute started adding software modules from the U.S. Department of Veterans Affairs (VA) VistA system to its existing system. The institute's hospital information system was already based on the "M" programming language that was also used in VistA. At the time, there was a need to address an application development backlog with its current system as well as hardware limitations, and VistA offered a low-cost alternative to purchasing a solution from established IT vendors in Germany at that time.

The VA Kernel was adopted and incorporated into the framework of the German Heart Institute's existing health IT systems. It gave the institute a set of software tools that allowed greater flexibility in new application development. In addition to the Kernel, the institute implemented a number of VistA applications such as Laboratory, parts of Blood Bank, Anatomic Pathology, and Record Tracking, in addition to other internally developed applications that were built using the VA FileMan and ScreenMan tools.

Marcus Werners, MD, reported on some of the problems encountered at the start of the project to introduce VistA software. Problems included:

- Convincing IT management and colleagues that applications written in the "M" language were not based on exotic or dying technology.
- Showing the functionality and speed of development, so it was much easier to convince users and hospital management.
- Gaining and keeping management support is an ongoing effort.

On the technology side, the natural language issues were the hardest to overcome. Fortunately the VA (i.e., the San Francisco OIFO) was very helpful in this respect. The VA FileMan and Kernel now contains code that allows different languages (prompts, date formats, date input) to coexist on the same machine.

In bringing up the Laboratory module, which meant automating the laboratory at the German Heart Institute for the first time, they were able to invite two people from the VA in San Francisco to help. Those two weeks made a tremendous difference. To train the institute's developers in FileMan, Greg Kreis (http://pioneerdatasys.com/home.html) came to Berlin to conduct two one-week training sessions.

The current VistA technical infrastructure in place at the German Heart Institute includes:

- **Servers**
    - Database running on redundant HP Alpha servers.
    - Applications also running on redundant HP Alpha.
    - 26 Windows NT, 24 UNIX, and 1 Macintosh server.
    - All servers also running True64 UNIX and Cache.
- **Clients**
    - 600 PCs running Microsoft Windows.
    - 135 SUN UNIX OS workstations.
    - 15 Apple Macintosh computer workstations.
    - Some ASCII terminals.
- **Network**
    - ATM-Backbone, Gigabit and Fast-Ethernet.
- **IT Staff** 16 full-time employees.

Marcus Werner devoted many days of work in San Francisco and at home to helping the VA implement the multi-language capabilities found in the most recent versions of VA FileMan. Figure 9-9 is a screen shot of a local application they have developed with a graphical user interface.
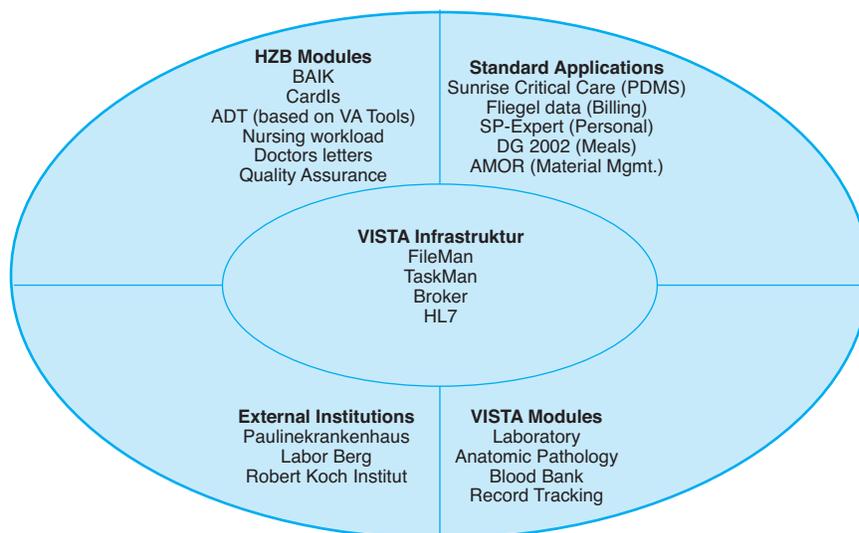

HZB Modules
BAIK
CardIs
ADT (based on VA Tools)
Nursing workload
Doctors letters
Quality Assurance

Standard Applications
Sunrise Critical Care (PDMS)
Fliegel data (Billing)
SP-Expert (Personal)
DG 2002 (Meals)
AMOR (Material Mgmt.)

VISTA Infrastruktur
FileMan
TaskMan
Broker
HL7

External Institutions
Paulinekrankenhaus
Labor Berg
Robert Koch Institut

VISTA Modules
Laboratory
Anatomic Pathology
Blood Bank
Record Tracking

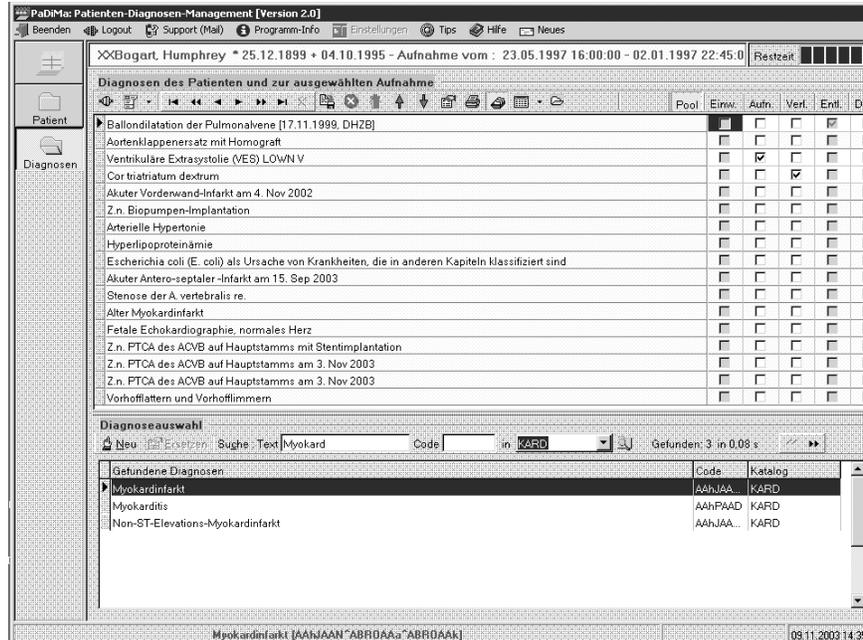**FIGURE 9-8** VistA Modules Implemented by the German Heart Institute

FIGURE 9-9 VistA GUI Screen in German

There have been a number of issues over the years related to support for VistA.

- **Problems**
  - Foreign language environment is weak.
  - Different healthcare regulations and business rules.
  - No commercial vendor supporting VistA in Germany.

- **Solutions**
  - Internationalization functionality in VistA needs to be enhanced.
  - In-house development of applications not in VistA.
  - Contacts with the VA and other VistA developers need to be strengthened.
  - Increased support for VistA by the open source community.

Some of the lessons learned from implementing VistA include:

- Free software is not free.
- You need more in-house IT capacity and support.

- IT management must bridge the gap between users and developers/administrators.
- You have to challenge conventional wisdom.
- Buying is better than making.
- Software from different sources can be integrated by just using standards.
- If you cannot pay a competitive salary for your IT professionals, job-satisfaction becomes an issue.

Despite the many challenges, the institute continues to use VistA, and its plans for the future include possibly implementing the complete Blood Bank, Radiology, Order Entry, Clinical Imaging, and other VistA software modules.

Finland and VistA

Introduction

The family of Finnish-made software applications packages, called MUSTI is one of the most important hospital information software systems in use in Finland. MUSTI is a VA Kernel and FileMan based hospital applications portfolio developed in the mid-1980s for deployment in Finland. By 1996, MUSTI information systems were installed in almost two-thirds of the hospitals in Finland. In the mid-1990s, a concerted effort began to redesign and significantly enhance the system. The MUSTI modernization effort and FixIT projects (Delphi-FixIT, Web-FixIT, Component-FixIT) have resulted in a stepwise migration path from terminal-based to Windows-based to browser-based component systems. The overall objective of the MUSTI modernization effort of developing technological solutions for gradually migrating from existing M-based departmental information systems toward systems that fit the requirements of the early 21st–century appear to be materializing in the Component-FixIT project.

Background

Finland installed its first system using the "M" programming language and operating system in 1978. Also in the late 1970s, Finland acquired and implemented the Costar health information system written in the "M" pro-

gramming language and tailored it to meet Finland's needs, referring to the system as FINSTAR. The University of Kuopio Computing Centre played a key role in introducing the "M" and VA FileMan technologies into Finland.

The VA FileMan database management system was first installed in Finland at the Helsinki University Central Hospital (HUCH) in October 1981. During the 1982–1984 timeframe, HUCH installed the VA Kernel, MailMan, Patient Administration, and Laboratory software modules. In 1983, the MUSTI project was born, which was aimed at further developing and deploying VistA and other integrated software modules to other major university and public hospitals throughout Finland.

By 1985, selected VistA applications were in use at three university hospitals as well as several district hospitals. A number of additional FileMan-based applications that met the unique needs of Finland had also been developed, such as Library, Accounting, and Disease Registries. They also built an electronic data interface, called MUSTAR, which interfaced the FileMan-based systems with FINSTAR.

It was clear that the user interface and system architecture had become outdated by the late 1980s. In the early 1990s, the teaching hospitals set up a joint company to begin the process of completely replacing the core architecture and applications of their system. The MUSTI modernization project officially started in 1995 and consisted of one vendor, three hospitals, and the University of Kuopio Computing Centre. "M" technology and non-M alternatives were studied in 1995 and 1996. The VA FileMan database was found to be worth retaining. Non-M technologies were identified to be used on the client side of the new client-server architecture. When the VistA Broker was released, it was accepted as the tool to provide client-to-server linkage. Finland developed and began using the 16-bit Delphi-FixIT toolkit in 1996 and 1997. The 32-bit version was released in January 1998. Half a dozen applications were quickly developed by staff at the University of Kuopio using FixIT.

A research and development project was initiated in 1998 to further modernize MUSTI by developing a Web-FixIT toolkit. This multi-year project was funded by the National Technology Agency and consisted of a consortium of four vendors and three university hospitals.

Web-FixIT is based on the Java language and was designed to be used in producing browser-based user interfaces to the MUSTI hospital information system and departmental applications. It was tested on a small–scale in 1999 and was scheduled for initial release in January 2000.
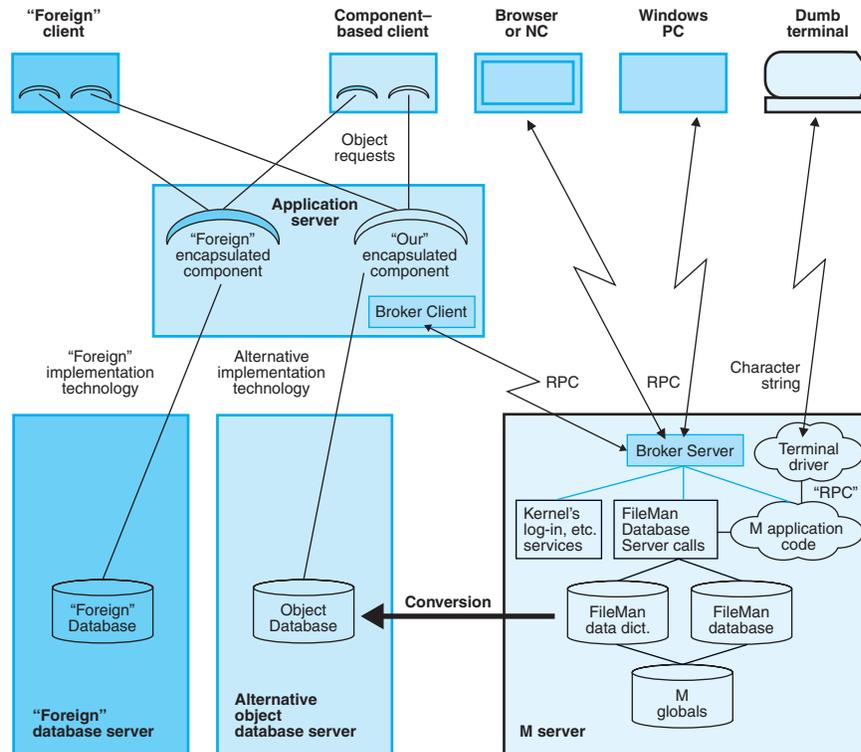
FIGURE 9-10 MUSTI Interfaced to VistA

One of the results of this highly successful project was the development of a plan for the next phase of the migration path, where the core functionality of the information systems will be encapsulated into business components, and a foundation laid for the application of alternative database management systems. Funding for this long-range Component-FixIT project for 2001 was granted by the National Technology Agency, TEKES. (http://www.uku.fi/tike/fixit/comp/english.html)

Current System

As of FY 2000, the MUSTI health information systems and the FixIT toolkit were deployed and in use at more than 30 major public hospitals in Finland. The system uses a variety of applications from a half dozen different vendors. Finland had successfully developed and deployed a

comprehensive electronic health record (EHR) system that was tailored to fit the requirements for everyday use of the healthcare delivery system. The system continues to evolve.

The Kuopio Computing Centre continues to receive new versions of VistA software through the VA's Freedom of Information Act (FOIA) office and is in charge of translating FileMan and the VA Kernel to fit Finnish requirements. The centre also provides technical support to the various software houses in Finland using these products. Many small corrections and modifications proposed by the Finns over the years have been incorporated into new versions of the VA Kernel, FileMan, and MailMan.

Future Plans

In 2000, the Component-FixIT project was born. This new project received funding in 2001 from the National Technology Agency of Finland, TEKES. The project was further supported by the collaborative consortium of numerous software vendors and university hospitals in Finland participating in this project. The goal was to develop and test a platform-independent framework architecture and migration strategy looking toward the year 2005 and beyond. New solutions were to be sought with a focus on standards, interoperability, reusable distributed objects, and business components.

During the first phase of the project, toolkits are being developed to encapsulate existing MUSTI departmental systems' functionality to an applications server as business components, the interfaces of which will be used in composing clients. Component-based core applications and other "foreign" applications based on other technologies will be able to use FileMan-based components and vice versa.

Key Web Sites

MUSTI: http://neuro-www2.mgh.harvard.edu/PDF_Repository/
    MYKKANEN.PDF

MINPHIS: http://www.egov4dev.org/minphis.htm

VistA System: http://www.va.gov/cprsdemo
WorldVistA: http://www.worldvista.org

> **FixIT**
>
> Using the Windows-based Delphi-FixIT and the browser-based Web-FixIT toolkits, different parallel user interfaces can be developed to "M" or VistA FileMan-based applications in a stepwise manner, according to which type of a user interface is needed in which situation. The toolkits and their documentation are available as a commercial package localized to Finnish requirements and as freeware in English. Free support is available only through the Hardhats user community.

In the next phase, the ability to convert FileMan-based components to an alternative database technology internally is being sought, without having to make modifications in the user or software interfaces. One of the objectives is to also allow for the internal implementation of business components based on either FileMan or on an Object DBMS in 2005 or later.

Conclusion

The MUSTI modernization effort and FixIT projects (Delphi-FixIT, Web-FixIT, Component-FixIT) have resulted in a stepwise migration path from terminal-based to Windows-based to browser-based component systems. The overall objective of the MUSTI modernization effort of developing technological solutions for gradually migrating from existing M-based departmental information systems toward systems that fit the requirements of the early 21st–century appear to be materializing in the Component-FixIT project.

In addition, the establishment of collaborative international relations related to the further development of health IT systems and the internationalization of the FixIT toolkit succeeded far beyond expectations. Staff associated with the MUSTI modernization effort have been working with developers in the United States, Brazil, Nigeria, and other countries with some degree of success.

Nigeria and VistA

Introduction

The important role of information technology in Africa's development has recently been recognized by several international agencies, including the

United Nations, World Bank, USAID, and International Development Research Centre. Health care is one of the highest-priority areas where IT should be applied for public health benefits (Mandil, et al., 1993). However, appropriate off-the-shelf software packages for African hospitals and health centers cannot generally be found; they must be developed locally. There is one significant exception, the Made-in-Nigeria Primary Healthcare and Hospital Information System (MINPHIS) (http://minphis.4t.com/).

MINPHIS was developed as part of a joint research and development project by Nigeria and Finland on health informatics. The MINPHIS hospital information system has now been deployed in approximately eight teaching hospitals in Nigeria, is used to keep electronic patient records, and generates various reports for health management and research purposes. The system easily scales up or down in size to meet the needs of different types of healthcare facilities. It is very affordable and has been found to be a productive and efficient tool that opens up the path to more effective and higher quality of care over time. The system is based on free or open source software developed and used by the governments of Finland and the United States. Variations of these systems are being used by public and private healthcare institutions around the world. MINPHIS may prove to be of great interest to other countries across Africa that wish to acquire and implement a healthcare information system for their own use.

Background

Established in 1962, Obafemi Awolowo University (OAU) in Ife-Ife is one of the largest universities in Nigeria with approximately 20,000 students and 5,000 faculty and staff. OAU Teaching Hospital Complex consists of two hospitals (342 and 212 beds), two urban and one rural health center, a dental hospital, and schools including nursing and laboratory technology.

In 1987, initial contact between the OAU Teaching Hospital Complex and the University of Kuopio in Finland led to the creation of a joint research and development project on health informatics in Nigeria called the Ife Project. It was formally launched in 1989. The project partners jointly produced a rudimentary Hospital Information System in late 1989, using the public domain Admission/Discharge/Transfer (ADT) software module of the U.S. Department of Veterans Affairs (VA) VistA system. It also makes use of the VA Kernel, FileMan, and MailMan software modules, which are all written in the "M" programming language.

The software technology is the same as that deployed in the MUSTI systems deployed in most hospitals in Finland.

This computerized system for storing and reporting patient record data has been under operation and refinement in the Obafemi Awolowo University Teaching Hospital since 1991. Its use was expanded to the second OAU hospital in 1995.

Another proposal for continued Finnish–Nigerian collaboration on the system was approved by the Academy of Finland and funded for two more years in 1997. This new research project started January 1998.

Basic infrastructure improvements were made, followed by new systems development work on MINPHIS. In May 1999, an application to extend the project into 2000–2001 was submitted to the Academy of Finland.

The system was originally installed in 1991 on a PC server with three dumb terminals. The second generation of the system implemented in 1998 was based on more powerful servers running Microsoft NT, InterSystems Cache, the VA Kernel and FileMan, and the FixIT software developed in Finland for the MUSTI system. It was upgraded and enhanced for potential national use.

Current System

The MINPHIS application keeps patient records and generates various reports for health management and research purposes. The reports include the patient status, medical history, and admissions as well as indicators such as length of stay per patient, discharge summaries, mortality and morbidity data, and operations. The application can answer ad hoc queries from medical researchers (e.g., cases of cholera for a period per geographical location for specific age group or sex or both). It can also provide performance information relevant to particular healthcare professionals, such as the mortality rates for patients treated by a particular staff member. Such information can be used for self-appraisal by medical staff, or for formal appraisal by hospital managers. As of July 2005, there were eight teaching hospitals using MINPHIS in Nigeria.

Benefits

The system has helped to improve the quality of patient data, which, in turn, has been used through reporting to improve the quality of decision

making. This should have helped in planning, for example to understand which disease categories are priorities for attention, or to understand the availability and requirements for particular drugs. It should help in research, for example to identify trends in patient health and care. It has also been used in resource management decisions, by improving the understanding of indicators such as the number of consultations per day handled by medical professionals, the number of patients per ward, the number of professionals who fail to write discharge summaries for their patients, and so on. The availability of such performance information should also help focus the minds of health professionals on their clinical performance.

Conclusions

The system easily scales up or down in size to meet the needs of different types of healthcare facilities. It is very affordable and has been found to be a productive and efficient tool that opens up the path to more effective and higher-quality care over time.

There have been two evaluations of the system, first in the 1990s and then more recently. The first evaluation found that MINPHIS was useful
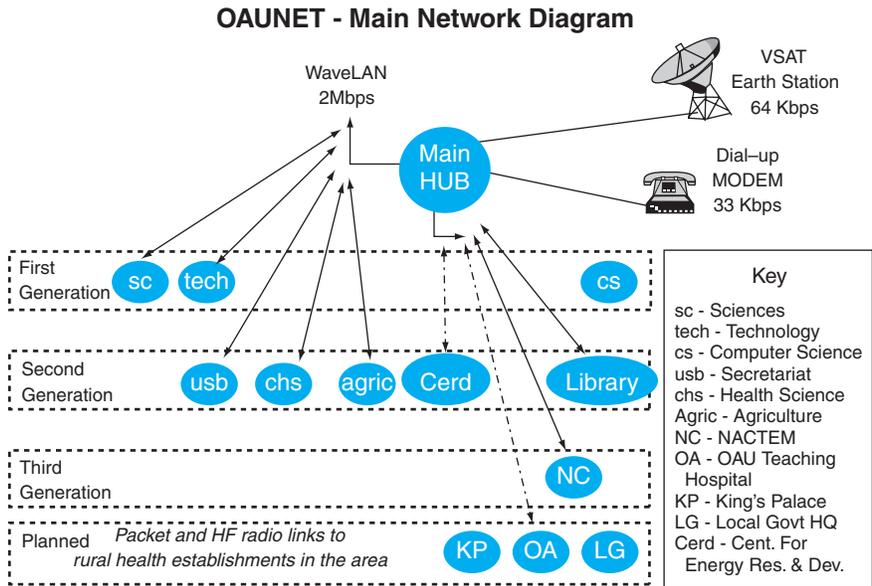

OAUNET - Main Network Diagram

FIGURE 9-11 OAUNet in Nigeria: Main Network Diagram

Key Web Sites

Obafemi Awolowo University: http://www.oauife.edu.ng/

MINPHIS:
- http://minphis.4t.com/
- http://www.egov4dev.org/minphis.htm
- http://www.uku.fi/tike/indehela/Nig2004report.htm

MUSTI:
http://neuro-www2.mgh.harvard.edu/PDF_Repository/MYKKANEN.PDF

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but should be expanded to give more clinical benefits. The second evaluation reported that MINPHIS was underutilized and was more like a "status symbol" at the hospital. It should therefore be categorized as a partial success and a partial failure. The MINPHIS package is now on the market.

A multidisciplinary Health Informatics Group gradually emerged in Ife-Ife, and it is currently the strongest research and development center in health informatics in sub-Saharan Africa, excluding South Africa. It will be interesting to observe the potential collaboration by Nigeria with other nations on the development and implementation of EHR systems in Africa.

Future Plans

MINPHIS v.2.0 is now available. The intention is to continue to extend the system to become a more comprehensive electronic health record (EHR) solution that can be deployed across the three tiers of the Nigerian healthcare system.

Conclusion

In conclusion, as the profiles in this chapter have clearly shown, VistA can be successfully implemented in a wide range of public and private sector healthcare organizations, from large hospital chains to stand–alone outpatient clinics and nursing homes anywhere in the world. It has demonstrated its ability to support the delivery of quality healthcare with low rates of medical errors and high patient satisfaction within the Veterans

Health Administration, Indian Health Service, and other organizations in the United State and around the world.

Healthcare organizations that do not investigate the VistA option as one of the choices when selecting a comprehensive health information system may end up paying higher costs with less favorable results. In this capital-constrained environment, being able to reduce the costs of licensing software is significant.

VistA has been backed, and will continue to be backed, by a huge investment from the U.S. government. Steps are being taken by the government (e.g., HHS, VA, CMS) to more closely collaborate with the private sector in supporting EHRs for everyone as part of a national health informatics infrastructure that can support nearly error-free care and quality. There is a rapidly growing private sector market available to support any healthcare organization seeking to evaluate and implement VistA to better serve patients and realize quality through EHRs, collaboration, innovation, and clinically focused health information technology systems.