

CARDIOVASCULAR INFORMATION SYSTEM (CVIS)

2005 COMPUTERWORLD HONORS CASE STUDY

MEDICINE

OCHSNER CLINIC FOUNDATION'S CARDIOVASCULAR INFORMATION SYSTEM (CVIS) GENERATES CLINICAL INTERPRETIVE REPORTS INSTANTANEOUSLY AT A HIGH VOLUME CARDIOLOGY CENTER, TRACKING OVER 4,200 PIECES OF DISCRETE DATA, REDUCING INTERPRETATION TIME, TEST TURN-AROUND TIME, TEST REPORTING ERRORS AND PATIENT CARE COSTS, WHILE CREATING ONE OF THE MOST COMPREHENSIVE CARDIOLOGY RESEARCH DATABASES IN THE WORLD. [20055330]

SUMMARY

To transform its manual patient information management system to increase efficiency, deliver better patient care and reduce costs, New Orleans' Ochsner Clinic Foundation developed the Cardiovascular Information System (CVIS). CVIS generates clinical interpretive reports instantaneously at a high volume cardiology center. It tracks over 4,200 pieces of discrete data, reducing physician interpretation time, test turn-around time, test reporting errors and patient care costs, while creating one of the most comprehensive cardiology research databases in the world. Since its implementation, CVIS has delivered a 340% ROI.

APPLICATION

Founded in 1941, the Ochsner Clinic Foundation has grown into a large, not-for-profit, multi-specialty healthcare organization, treating over 250,000 patients each year and employing over 6,000 staff including 600 physicians. Headquartered in New Orleans, the organization operates two hospitals as well as 24 out-patient clinic facilities throughout Southeast Louisiana. Its specialty services include oncology, cardiology, pediatrics, organ transplants, gastroenterology, women's services and orthopedics.

Capturing, storing, and providing timely access to patient information has always been challenging to healthcare providers. Historically these efforts have cost healthcare organizations like Ochsner millions of dollars per year. This has been especially true in Ochsner's cardiology division, which alone generates over 32% of Ochsner's annual revenue.

To transform its manual patient information management system to increase efficiency, deliver better patient care and reduce costs, Ochsner developed the Cardiovascular Information System. The point-and-click driven CVIS allows clinicians to instantaneously generate and input various procedural and patient examination reports directly into a patient's record, thereby eliminating the delays inherent in the previous dictation/transcription/file-based system. Additionally, CVIS' procedure-specific modules contain decision-making intelligence which assists clinicians using the system and facilitates more robust and detailed reports.

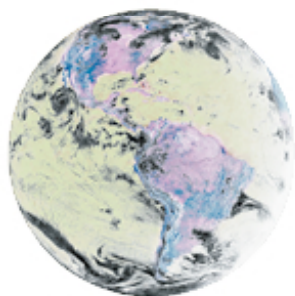
Prior to the implementation of CVIS, the methodology for gathering, transcribing, reviewing and storing detailed patient records was manual and cumbersome. Doctors and technicians would order and conduct myriad tests and procedures, but would then wait days or weeks for hard copy results to be filed in patients' medical records. In a very busy procedural laboratory, backlogs on transcriptions could be up to three weeks.

The typical path was test > file > review > dictate > transcribe > review > edit > review > and finalize. This manual process was not only time-consuming and costly, but error prone due to the time required from test to review as well as the multiple steps involved. Given its growth projections, Ochsner realized it needed a better way to manage patient data.

To that end, a group of medical and IT staff teamed up to develop a prototype application to manage this wealth of critical information via a point of care solution. The key objectives were to:

- Provide medical and administrative staff with real-time access to patient data
- Support the organization's anticipated growth while improving patient care
- Streamline claims-related paperwork
- Reduce the incidence of insurance payer denials, through more accurate coding
- Eliminate the need for outsourced transcription services.

Based on these key objectives, the project team developed the Cardiovascular Information System, which



A Search for New Horizons



Robert Carrigan,
Chairman of the Chairmen's Committee

Ron Milton,
Vice-Chairman of the Chairmen's Committee

Dan Morrow,
Chief Historian

proved to be transforming.

CVIS allows technicians and physicians to directly enter results, protocols and interpretations into patients' records. CVIS' point and click data entry functionality is extremely user-friendly, which has led to 100% physician buy-in. Elimination of multiple manual processes has eliminated the delays inherent in the previous, paper-based processes. Transcription costs have been eliminated, lab backlogs eradicated, and healthcare payer denials have been reduced by \$300,000 to \$400,000 per year.

Initially developed to address specific needs of the Echocardiography Laboratory, the functionality and applicability of the CVIS solution prompted other cardiology sub-specialties to request similar applications.

Requests for CVIS-like systems has not been limited to cardiology. For example, the Ochsner Clinic Foundation prides itself on medical research conducted by its scientists. CVIS has made a significant contribution here as well. With easy access to clinical information, research studies that once encompassed 100 records now can encompass 40,000 records. Queries made against the CVIS database have contributed directly to the publication of over 10 major medical papers, with more than 20 additional papers under review. This kind of rich data benefits patients, the cardiology division, and the Ochsner Clinic Foundation as a whole.

Currently, IT managers and developers are customizing and packaging CVIS for use beyond Ochsner's Cardiology division. At least two outside IT solution providers are looking closely at CVIS, with an eye toward providing its powerful capabilities to other healthcare centers.

BENEFITS

The overarching goal for CVIS was to improve the standard of patient care and ultimately, save lives. By improving the accuracy, timeliness and accessibility of patient test and procedure data, Ochsner Clinic Foundation has improved its level of service. Specifically, CVIS has:

- Eliminated a three-week backlog for "finalized" cardiovascular test results enabling physicians and patients to get immediate, accurate results from life-sustaining procedures and tests
- Improved the accuracy of patient records
- Streamlined claims paperwork by eliminating manual intervention
- Reduced service claim denials by health insurance carriers by \$300,000 to \$400,000 per year
- Eliminated transcription costs, saving Ochsner \$40,000 to \$60,000 per year
- Enhanced Ochsner's medical research capabilities by capturing a wealth of vital data over time with no additional work required
- Provide the ability to generate comprehensive reports in a matter of seconds.

Thanks to CVIS, doctors and technicians can now focus on what they do best – providing quality patient care – without long waits for test results and wading through seemingly endless stacks of patient charts.

CVIS has significantly exceeded its developers' initial expectations, and in fact, since its implementation, has generated a 340% return on investment for Ochsner.

IMPORTANCE

Sybase PowerBuilder, a development environment that perhaps has one of the best implementations of object-oriented programming (OOP), has allowed a very limited team of developers to use the concepts of inheritance, encapsulation and reusability to create CVIS as well as other applications. A foundation class library developed in-house makes the job of developing new software on top of it a task that some in the team have called "programming for dummies." Sybase Powerbuilder's extreme ease of use has contributed in large part to the team's ability to focus on user-end design and business logic issues, and to produce timely results.

Through HL7, window socket and FTP technologies, CVIS is able to integrate legacy data from other institution wide systems such as HIS, Purchasing, Scheduling, Billing and Laboratory systems. Results generated in CVIS are then propagated instantaneously to the legacy systems.

One important breakthrough in CVIS has been its ability to capture data directly from medical devices. As cardiovascular technologists capture heart images using GE echo equipment, measurements are taken of various areas and these measurements are then incorporated into the CVIS algorithm to help physicians generate clinical interpretations. Also, CVIS is able to incorporate speech recognition technology making the task of incorporating general remarks into the electronic medical record (EMR) extremely easy. The team is

currently working on incorporating images collected from medical devices as well as other scanned medical graphs into the EMR.

ORIGINALITY

Perhaps the most unique feature of CVIS has been its development environment. Far from a typical IT shop, Ochsner staff physicians and programmers work shoulder to shoulder every day. IT resources are solely dedicated to the cardiology group, on location, right in the middle of the clinical practice. Programmers empowered with tools that make testing and implementation quick and effective, are then able to focus on design issues to turn concepts into products. Iterative development, with the customers (physicians/technicians) constantly providing feedback, has made this a unique software development lab – a lab that has created a product that helps the physicians become more effective and productive, without having to increase their numbers.

This unique attention to end-user detail, coupled with Ochsner's focus on patient care and its drive for quality and efficiency, have resulted in a unique and elegant solution that delivers real-time results, streamlines the patient and practitioner process, and provides richer data stores for medical research purposes. The CVIS solution and its attendant success have elicited attention not only from Ochsner's senior management including the chief executive officer, but also from other healthcare providers. As a result, Ochsner is now considering marketing CVIS to other hospitals and specialists.

SUCCESS

CVIS is now an integral and indispensable system within the Ochsner Cardiology practice. The success of the CVIS project can best be illustrated by the requests from other Ochsner divisions to use their own versions of this application.

Another equally impressive indicator is the amount of interest CVIS has generated among other healthcare organizations that recognize its potential to improve the quality and efficiency of the healthcare experience for providers, payers and patients.

DIFFICULTY

There were two major challenges that had to be addressed in creating CVIS.

- converting a physician's procedural report into a viable algorithm, and
- implementing the product into the daily operation of the medical practice.

In developing a viable algorithm, the CVIS project team had to accommodate the data requirements unique to each type of subspecialty. Therefore, concepts of entity attribute value (EAV) had to be implemented into the design of the database.

Although the database follows a relational model, EAV has the flexibility to store previously undefined attributes that correspond to the same data entity. For instance, a general cardiologist may be interested in keeping track of specific historical details that may differ from those of an interventional cardiologist. Keeping the integrity of the relational model of the database, plus allowing for this flexibility presented a challenge in the construction of the application.

In addition, parts of the algorithm that implemented the clinical interpretive intelligence had to be carefully designed so that similar "point-and-click" screens would produce the appropriate report for a specific area of the practice. For instance, an echocardiographer (a cardiologist with advanced training in echocardiography) interpreting an echo would require a more robust data interface than a general cardiologist interpreting similar studies.

The second implementation challenge involved two major obstacles. The first was converting paper-based medical record information into an electronic medical record (EMR). The second was timing the data input so that nursing information was always available in the EMR at the time the physician was accessing it in order to allow the physician to compose the encounter note.

