

A MedCentral radiologist dictates a report. Once completed, the report will become part of the patient's electronic record, where its content will be automatically mined for quality-of-care information.

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# The Data Mining Engine that's Revving up Healthcare

A medical center in Ohio is implementing a remarkable Siemens data mining product. Using matrix-like intelligence to extract key information from the data pouring into each patient's electronic health record, the product has already helped slash quality-of-care evaluation time by 50%. Soon, it could be doing this in near real time — setting the stage for on-the-spot decision support.

MedCentral Health System, a 351-bed medical community based in Mansfield, Ohio, is running like never before. The software that's helping to make this possible is a hospital information system from Siemens known as Soarian, an enterprise-wide solution that is designed to help synchronize information throughout the entire organization. From the moment a patient is admitted, Soarian creates an electronic health record that includes his or her demographics and medical history, tracks diagnostics and treatment, including surgery, medications and links to medical images, and aggregates associated clinical, financial and operational information. As this data accumulates, it is critical to measure and analyze the outcomes of interventions and processes.

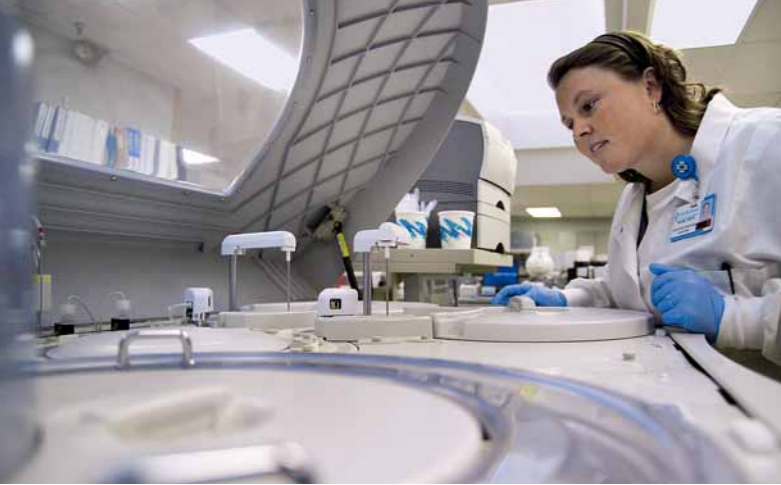
Soarian Quality Measures (SQM) is a Siemens product with formidable intellectual muscle — and bottom line relevance. It is de-

signed to analyze how well organizations adhere to best practice in the care of patients. SQM also measures clinical practice against the most current clinical guidelines, while providing outcome metrics for these practices. This is set to become a critical issue for hospitals across the U.S. because healthcare legislation will tie a hospital's reimbursement to its ability to verify that it has met quality-of-care guidelines. "This is in stark contrast to the old fee-for-service model in which the more you do, the more you get reimbursed," explains Bharat Rao, PhD, Senior Director, Knowledge Solutions at Siemens Healthcare and the inventor of the patented software platform known as REMIND (Reliable Extraction and Meaningful Inference from Non-structured Data) that drives SQM. "In the new reimbursement environment the idea is that the first time you encounter a patient, you treat them right — because by doing so you know you are

going to reduce total costs in the long term" (*Pictures of the Future*, Spring 2008, p. 89).

MedCentral has implemented Soarian Quality Measures, a remarkable data mining product, to help propel patient care to a stunning level of efficiency. Unlike conventional data extraction tools, which evaluate only structured, discrete data, such as lab results, MedCentral leverages SQM to analyze mountains of structured data, but also unstructured data such as free text from physician dictations, and turn it into actionable information that can help improve processes and outcomes. Currently used for retrospective analysis, MedCentral's use of SQM capabilities is helping staff manage a large volume of patient data and transform it into actionable information.

**Information Avalanche.** How does SQM support this goal? "A patient who spends a week or less in the hospital typically winds up with



Based on Siemens technology, MedCentral's highly automated laboratory automatically extracts information from samples and feeds it into electronic patient files.

Thanks to advanced software, physicians' orders are entered directly into the system, thus speeding delivery of medications to patients and reducing errors.

the digital equivalent of around 200 pages of documentation," says MedCentral's Chief Medical Information Officer Michael Patterson, MD, who is also a practicing nephrologist. In a Soarian environment such as MedCentral, information pours into the patient's electronic health record from a wide variety of sources. Typically, it includes results from the lab, dictated notes from one or more radiologists, entries from nurses' stations, physicians' orders for medications, and the pharmacy.

All of this can wind up being a bit too much of a good thing. Digital healthcare produces such immense quantities of data that some essential part of the quality-of-care process may fall between the cracks. Yet, even with electronic files, it is extremely time consuming and inefficient for people to analyze content to determine if quality guidelines have been met. Nevertheless, in the near future, this will have to be done in order to obtain reimbursement from government healthcare programs.

And that's where SQM fits in. "SQM uses algorithms based on expert knowledge and semantic reasoning to go through all these different systems, including the content of dictated notes. It gathers the data, extracts the information that is relevant, and combines this with medical knowledge standards to answer one key question: Did the patient receive the quality of care that is required?" explains Patterson. "I am not aware of any other product that can read and interpret that kind of data."

Adds Rao, "On the one hand, you have an observational record of the patient from clinicians, and on the other you have a program that contains the latest federally-mandated guidelines for management of pneumonia, acute myocardial infarction, heart failure, and the Surgical Care Improvement Project (SCIP). SQM takes these two worlds, combines them, and produces actionable information, such as 'you did this, you did not do that, you met this measure, you did not meet that measure.' And it does this automatically. It does this on the individual patient level and on the level of a hos-

pital's entire patient population in such a way that the data can be sliced and diced to examine quality of care based on objective metrics."

"Historically, collecting this data was a huge job," says Janene Yeater, Vice President of Quality and Planning at MedCentral. She explains that in the past, nurses had to find the data, enter it and submit it to a system. The data would then go to the quality improvement department, where it would be evaluated. "All of this could easily take three or four months after a patient was discharged," she says. "But since the introduction of SQM, we've been able to reduce the time it takes to assemble the data to about two weeks, while shifting our focus from gathering information to analyzing it."

**Heading for Real-Time Error Detection.** A technology that could potentially shave months from a process sounds great. But that's not enough. Soarian Quality Measures' current two-week abstraction time lag is set to be cut to near zero. Before that can happen, however, process questions have to be addressed. "SQM could operate in real time right now," says Rao. "But the issue is to refine it to the point that it presents the right information exactly when it's needed." In view of this, "MedCentral expects to ramp up SQM to real time operation within a year or two," says Patterson. "It will thus evolve from being a retrospective quality measurement system to being a concurrent quality improvement system. That will open up amazing new possibilities."

What's next for Siemens quality reporting as it does this? For one thing, its ability to draw from hundreds of thousands of case histories and results could vastly accelerate the arduous detective work performed by physicians every day as they seek to zero in on the right diagnosis. "I'm the first to admit that physicians' work is often grueling, and that we are not perfect,"

says Patterson. "But with Siemens software doctors may in the future be able to simply enter symptoms. The system would then compare that information with data collected over multiple occurrences, and help to drive the final diagnosis much faster and more accurately than is now possible. That would be a huge help."

Yeater goes even further. She foresees the technology evolving to a predictive stage. "I think Soarian [Quality Measures] will eventually be used to identify which patients are at risk for certain kinds of events. So the vision is that we will be moving from today, where we are working retroactively, to real time in the next couple of years, to a predictive-preventive kind of care further down the line. And as we do that we will be saving lives, saving money, and making the entire healthcare system far more efficient."

What such a transition can mean in practical terms is made clear considering the use of a

*The vision is that we will move from working retroactively, to real time, to predictive-preventive care.*

system such as Soarian Clinicals with its computerized physician order entry (CPOE) capabilities. Soarian with CPOE allows healthcare providers to enter their medical orders directly into the patient's electronic record. The technology then leverages clinical conflict screening of medication orders to compare a new order for a medication to the patient's record, checking for information such as allergies or previously-documented reactions to the medication and for possible drug-drug interactions. It then notifies the physician of any possible problems. "When I used to order medications in the past, I would have to keep all these things in mind," says Patterson. "Now, thanks to our database, I have support for my decision-making process. When I order a medica-

tion for a patient, Soarian automatically checks all those factors. That is happening right here, right now." By June, 2011, the medical center expects that 100 percent of its physicians will be placing their medication orders through computerized physician order entry.

Already, CPOE is helping the provider to reduce errors and improve efficiency. "In the past, it was hard enough to even read what a doctor wrote down," notes Patterson. "A scrawled order would go to a clerk. Then it would be validated by a nurse, and finally the medication would be requisitioned. Each step opened the door to potential clerical errors, and the entire process could easily take a couple of hours. Now, a physician makes the order directly in the system, and the medication is over to the patient literally within minutes. That can make a world of difference for a patient who is experiencing severe pain."

**Eagle-Eyed Expert.** And that's just the beginning. Fred Crowgey, Director of Project Expert Care, which covers the Soarian implementation project at MedCentral, expects the software to soon be able to cross-reference the center's entire patient population data. "It will

allow us to see all the salient elements from the database," he says.

Furthermore, Soarian Clinicals will be able to assist with more complex questions. For instance, suppose a cardiologist performing an echocardiogram test discovers that her patient's ejection fraction — the fraction of blood pumped out of the heart in a single beat — has dropped below 40 percent. Is this an anomaly or has it happened before? Here, for instance, Soarian would comb the entire patient record and highlight any evidence of an abnormally low ejection fraction.

"Under these circumstances, if it uncovered previous instances of low EF, the doctor would normally place an order for an angiotensin converting enzyme (ACE) inhibitor, which is designed to improve EF," explains Yeater. "But suppose that other tests had found that the patient might be suffering from chronic renal disease — a condition that is a contraindication for the use of ACE inhibitors. Then the software would point this out to the cardiologist, and possibly suggest another class of medication. So Soarian will look for elements of this kind in the documentation, thus helping to ensure optimized management."

Data entered and stored in Soarian Clinicals can be used not only to detect quality-of-care errors in processes, but also among people. For instance, MedCentral chose to provide 250 physicians with report cards — at first anonymously, and then in an openly competitive manner. The reports were generated using data available in Soarian that was then used to represent color-coded red (bad), yellow (not so good), and green (good) outcomes. "During the anonymous phase, overall quality results remained the same," recalls Patterson. "But when we opened up the data and our doctors knew their colleagues could see their results, competitive behavior really kicked in. The results started looking better and better. Since the software documents everything, doctors could check through reports and see why patient X came back. They have found that they can learn and improve from this information. Acceptance of the system has been total." In addition to the fact that the software can stimulate health professionals to excel, much of its success is the result of one very simple fact: It's easy to use. "The software is intuitive," says Yeater. "After about 35 minutes people have figured it out." ■ Arthur F. Pease



At MedCentral (right), Siemens software measures and analyzes the outcomes of interventions such as angiography exams (left) and other procedures.