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MEDICINE on the Net

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What physicians don't know

by Cynthia Johnson

On FOX television's medical drama *House, MD,* knowledgeable diagnosticians are presented with a complicated case at the outset of each show. The team members gather around a whiteboard, frantically jotting down the most likely diagnoses they can conjure up based upon the patient's symptoms and clinical signs. From there, they hunt and peck and poke and prod to narrow down the list to one diagnosis—usually revealed as the show comes to an end.

Although the show is fictitious, it is not far removed from reality. For every difficult case, a physician must rely on his or her knowledge to diagnose a patient. The knowledge a physician possesses is dependent upon what he or she has already observed, researched, or read. But let's face it: No one physician can be all-knowing about every condition and disease.

That's where Isabel Healthcare, Inc. (*www.isabelhealthcare.com*), of Reston, VA, lends a hand. The company has a Web-based tool that provides clinicians with a list of diagnoses to help them determine which one is accurate and begin treatment.

The company's product is a diagnosis decision-support system called Isabel. It begins its work when a clinician enters a patient's symptoms and clinical signs into the system using everyday terms, making it unlike most of its competitors. Alternatively, the database can also pull information from an electronic medical record with a single click of a mouse. Isabel checks the information the clinician enters against its

database of medical literature, which covers 11,000 diagnoses and 4,000 drug references. From there, it provides a list—in no given order—of reasonable and relevant diagnoses and drugs that may be causing the symptoms and signs for the physician to consider. The list typically contains diagnoses that the clinician may have already considered alongside others that he or she may not have. Once the clinician determines which of the possible diagnoses provided by Isabel is most likely to be the correct one, investigation and treatment can begin.

Because the system turns clinical symptoms and signs into diagnoses, Isabel can link clinicians to Web-based resources such as Up-to-date, PubMed, Medline, and Google Health. These resources typically do not work well unless you

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already have a diagnosis. At less than 50 cents per day per bed, the tool is gaining in popularity among the nation's healthcare facilities—proving itself most useful to pediatricians and primary care and ER physicians—where diagnostic challenges are more commonplace.

Facilities in Europe and India are also signing up to use the tool.

Napoleon Knight, MD, is vice president of medical affairs and quality improvement at Carle Foundation Hospital in Urbana, IL, a 305-bed regional care hospital that offers the area's only level one trauma center and only independent level three perinatal service. The hospital has been using the system since 2006.

"The times that you need Isabel are the times that are important," says Knight. "The times that you need it are the times that you don't know. And the times that you don't know are the times that you are probably at the highest risk in terms of making an error, coming to the wrong diagnosis, or coming to premature closure."

Premature closure occurs when a clinician arrives at an initial diagnosis that seems to fit the facts, and then he or she does not consider other reasonable possibilities.

"We will instantly tell you diseases that you aren't familiar with," says **Joseph Britto,** CEO and cofounder of Isabel Healthcare.

Medical diagnosis errors

A poll commissioned by the National Patient Safety Foundation found that one in six people have personally experienced a medical diagnosis error. Further, according to a 2005 meta-analysis funded by the Agency for Healthcare Research and Quality and published in *Advances in Patient Safety,* diagnosis errors represent 10%–30% of all medical error cases.

A study published in the *Annals of Internal Medicine* found that of 300 closed malpractice claims, 59% involved diagnostic errors that harmed patients and 30% resulted in death. Additionally, a 2003 paper published by the AMA found that at least 4% of all U.S. patients who die in a hospital might have survived had their diagnosis been correct. In fact, it is estimated that diagnosis errors lead to death in as many as one in 20 patient deaths.

The Institute of Medicine estimates that $17 billion–$29 billion is spent annually on unnecessary or inaccurate patient care as a result of misdiagnosis. If malpractice figures are added, the figure jumps significantly, as was reported in 2002 by the U.S. Department of Health and Human Services. The annual report found that the average medical malpractice payment made due to diagnosis-related malpractice in the United States was $307,418 per case; 5,611 diagnostic-related medical malpractice payments were made.

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Racking your PC—not your brain

Find one doctor who doesn't have a pile of journal articles collecting dust in an office. With medical knowledge constantly evolving, there's no way to keep up with everything that is published or every drug that is put on the market, or taken off the market, for that matter. "It's impossible to keep up with all the knowledge that comes out," says Knight. "You could spend your entire lifetime reading articles."

As an emergency medicine physician, Knight says he is required to keep up with all specialty areas—which is no easy feat. "You have to find contemporary means of keeping up with all the knowledge that's out there," he says.

Knight describes physicians as being proud and ego-driven people who take great satisfaction in their knowledge—it's not easy for them to admit that they don't know something. But he says that wise, seasoned physicians admit when something just doesn't seem right or make sense. It's those times that he finds Isabel the most helpful.

Stephen Borowitz, a pediatric gastroenterologist at the University of Virginia Children's Hospital in Charlottesville, says that the tool is primarily useful when he needs to make sure there aren't other things he hasn't considered.

For example, it proved effective when he had a male patient suffering from hemorrhagic shock and encephalopathy syndrome, who also had significant neurological damage and was on a feeding tube. The Isabel system helped him diagnose the patient with gallbladder disease, something he hadn't contemplated.

Although Borowitz says it's relatively rare for the tool to help him in his own specialty, he finds it helpful when he works in other environments, such as general pediatrics.

"Every once in a while, there's just something out there that you haven't had a chance to see and recognize," Knight says.

Isabel's success rate

A November 2005 study found that Isabel provided the correct diagnosis 96% of the time when key clinical features from 50 challenging clinical pathology conference cases reported in the *New England Journal of Medicine* were entered into the system.

Isabel also contains diagnoses that no one has seen or dealt with before. The database includes the Centers for Disease Control and Prevention data about bioterrorism toxins such as anthrax, sarin, and ricin.

"We're all preoccupied and concerned about bioterrorism," says Britto. "We are expecting healthcare providers to make a diagnosis without ever having seen a case before."

Knight finds this information useful to have ready if such an event should occur. "There are a number of biological diseases that you aren't familiar with because you've never dealt with them."

Opening the doors to other resources

The University of Virginia's library Web site hosts Isabel. The library links to it through the clinician portal page—the default home page for all university workstations. Borowitz says that the university librarians sponsored Isabel and are the primary educators, champions, and promoters of the tool.

"Our medical librarians were very forward thinking in terms of push technology and knowledge resources and how they might be integrated into work flow and providing access," says Borowitz.

What librarians must enjoy about the tool is its ability to link users to the resources that they rely on. Britto says Isabel lets users get information on Web resources such as PubMed, Medline Plus, CDC, Up-to-date, and MD Consult.

"The currency of medicine is diagnosis. If we don't get the right diagnosis, we can't initiate the right investigations or treatment," says Britto.

Borowitz says there is no way to search primary literature effectively for symptoms, because you need to know what you are looking for first. When he enters symptoms into tools such as PubMed, his search results aren't very useful. But when he puts symptoms into Isabel and selects a diagnosis from Isabel's list, he can jump to PubMed and get at the literature he needs. "It's a very unique way of getting people into medical literature," he says. He finds this feature particularly helpful for residents and students at the teaching hospital who may not know what they're looking for.

Borowitz has been using Isabel as an intellectual exercise to teach students and residents to distill cases into one or two sentences that contain the case's key elements.

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What physicians don't know

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"If you can't separate the forest from the trees, you'll never be able to make that big sentence," he says. "If you can't create a big sentence and put it into Isabel, Isabel will not give you a useful differential diagnosis."

He says he hopes that the tool will give students and residents practice at the distillation process, something he describes as being critical to their education and to their patients.

In addition to teaching students to distill information, the university uses the tool frequently during rounds, says Borowitz. For example, students and residents enter information into Isabel and discuss the list of results that it returns, hypothesizing why one diagnosis might be more likely than another diagnosis.

The company is aware that Isabel can be used as an educational tool—so much so that it recently added continuing medical education (CME) capture to its offerings. Now the product can capture Isabel session activity for submission for CME accreditation.

To click or not to click

The tool leaves many users discussing whether to use it all the time or just for those tough-to-solve cases. Britto uses global positioning system devices as an analogy to back his opinion that physicians should use it for every case and make it a part of their culture.

"Why not just stick it on my dashboard and let it always be on?" he says. "The problem in medicine is that we don't know when it's a straightforward urinary tract infection or something more ominous like an upper kidney infection. We don't know what we don't know and when we don't know it."

Britto says the company works with its customers to change their culture and discuss the broader issues of the quality of diagnosis decision-making.

Knight says that although his hospital doesn't mandate the use of Isabel, physicians are still embracing it and providing positive feedback. "It's quite amazing the broad array of people that have actually taken the time to use it."

Doctors at Carle Foundation Hospital can access Isabel from the tablet PCs they carry. He says that the tool gets patients engaged in the diagnostic process when he takes the tablet into the exam room. According to Knight, it gives patients the opportunity to understand everything that a clinician needs to consider prior to making a diagnosis.

"You can use it as a very nice educational tool for patients," Knight says. He says patients who come in with file folders of the Web research they've done don't find the use of the technology strange, and he explains the process to those who aren't as receptive, he says.

The story of Isabel Maude

The Isabel system is named after Isabel Maude, a three-year-old who was diagnosed with chicken pox in the summer of 1999. Sadly, she had a condition that wasn't immediately recognized, so she was sent home from the ER and her condition worsened.

Britto says Isabel returned about 36 hours later experiencing multisystem failure and cardiac arrest. She was transferred to the pediatric ICU (PICU), where she spent the next month of her two-month hospital stay. Britto cared for her as the attending physician in the PICU.

Isabel was eventually diagnosed with complications of chicken pox toxic shock syndrome and necrotizing fasciitis, a flesh-eating bacteria. She underwent an emergency operation to remove the infected skin, which has left her with extensive scars. Her condition has required multiple reconstructive operations.

"Had her disease been recognized, had it been treated, she would not have ended up in intensive care," Britto says.

Isabel would have avoided this experience if doctors had taken all of her symptoms and clinical signs into account and thought of all possible diagnoses, rather than just assuming her symptoms were related to the chicken pox. Rather than

Isabel's price tag

Hospitals can purchase the Isabel system for a yearly cost of less than 50 cents per day, per bed. The annual cost for hospitals starts at $180 per bed and reduces on a sliding scale with size. Individual physicians and group practices can purchase Isabel for approximately $60 per provider, per month. There are no additional setup or upgrade fees.

For more information, visit *www.isabelhealthcare.com*.

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suing the hospital, Isabel's father, Jason Maude, teamed up with Britto to develop the Isabel system and help clinicians reduce diagnostic errors.

Around the time Maude and Britto were building the Isabel device, Britto was learning how to fly a single-engine plane. He learned how even the most experienced of pilots still use a flight checklist. Physicians didn't have anything comparable.

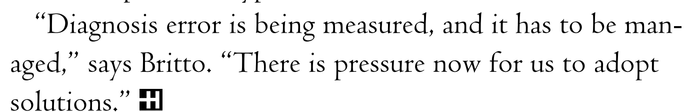
"Doctors rely on what they carry inside their heads," he says. "I might be hardworking and conscientious, but there's a limit to what I can remember. Why can't we hand over that data processing responsibility to software and computers?"

Maude, who left his job in finance and banking, introduced Britto to Mike Lynch, the founder and CEO of San Francisco–based Autonomy. The company, which focuses on meaning-based computing, enables computers to understand the relationships that exist between disparate pieces of information and perform analysis operations.

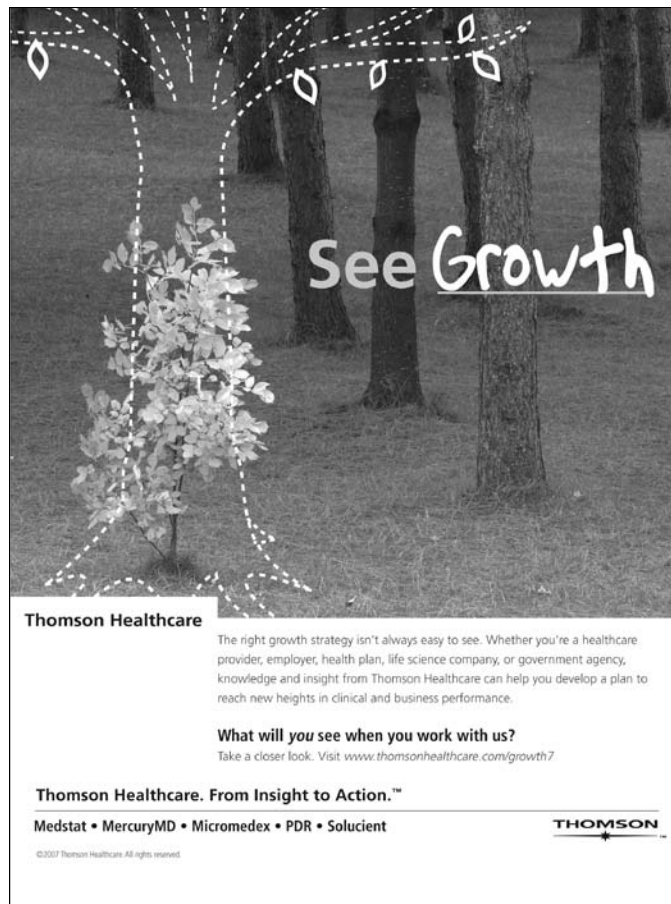
Autonomy invested in Isabel Healthcare and helped the company semantically index medical and pharmaceutical literature to the diagnoses and drugs in its database, which is continually updated.

Managing diagnosis error

With so much emphasis on safety and quality, systems such as Isabel are set to become the norm in hospitals. Consumers are growing increasingly concerned about medical and prescription errors, especially with so many Web sites devoted to measuring quality and patient outcomes. Britto says that students and residents who have grown up with Google will consider tools such Isabel a "no brainer." Borowitz, who describes himself as a "digital immigrant," agrees with this notion, saying "digital natives" expect these types of tools.



"Diagnosis error is being measured, and it has to be managed," says Britto. "There is pressure now for us to adopt solutions."



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