

State of the Art in Diagnostic Clinical Decision Support

With the recent passage of the American Reinvestment and Recovery Act of 2009 (ARRA) and the release of the Obama administration's 10-year budget plan, health information technology (IT) will play a key role in any efforts to reform healthcare. The ARRA is investing more than \$19 billion over 5 years on health IT, specifically electronic medical records, through economic incentives presented to physicians, clinics, and hospitals. In addition, it is funding effectiveness research to provide information on the benefits of various treatments and medications. The Obama budget plan presents an outline on expanded effectiveness research funding that can lead to more robust clinical decision support systems, a key component of any healthcare reform.

To better understand the state of the art in clinical decision support tools, I sat down with Art Papier, MD, a board certified dermatologist and founder of Logical Images, an established clinical content vendor in Rochester, New York, to talk to him about VisualDx™, a diagnostic clinical decision support system. VisualDx™ utilizes almost 20,000 images of the skin, tied to evidence-based treatment guidelines, to support the diagnostic and treatment decision-making done by physicians. VisualDx™ merges medical images with clinical information to build a visual differential diagnosis based on actual patient findings. By allowing the physician user to enter patient's finding as a combination of medical images and text, physicians can build a customized pictorial differential diagnosis.

Chaiken: Art, what prompted you to develop VisualDx?

Papier: Well, I had a background in art, and I've always been interested in graphic design. I ended up in Rochester in 1990 right when Kodak was about to begin scanning film to digital. My background in medicine included working with Dr. Larry Weed, the inventor of the problem-oriented medical record. Larry was one of my mentors, with whom I worked on clinical problem solving and decision support research. When I got to Rochester, I began thinking of leveraging the advances in imaging with the need for decision support. I worked with Kodak to develop a medical image database, one of the first, back in 1992.

My dermatology practice in western New York provided care to an underserved area in a rural county. My colleagues and I noticed that the primary care physicians were making the same diagnostic mistakes over and over again, some originating from very common visual presentations. Working as a dermatologist full time and seeing repeated errors, I realized that technology was available that could provide primary

care physicians with meaningful diagnostic support that transcended flipping through atlases.

Chaiken: And how long did it take from when you first thought of the idea to when you were able to develop the product?

Papier: We had a number of prototypes and products throughout the mid 1990s. One was a multimedia CD-ROM for identifying skin disorders that was quite successful. But we realized that the future was going to be about using technology to make better decisions at the point of care, not multimedia training. We wanted to create more than computer-based education. We really wanted to focus right on the point of care, where the decision is made. In the 90s, before the Internet took off, we developed some prototypes. In 1999, with the maturing of the Internet, we used the JAVA platform to develop a product that was first released in March 2001.

Chaiken: Your product release came just a few months before the anthrax attacks in late 2001. Is your product

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used as a bioterrorism surveillance tool?

Papier: We have deployed VisualDx in hundreds of emergency rooms across the United States for bioterrorism surveillance as well as regular diagnostic clinical decision support. The ER is the most challenging care environment. The physicians are overworked, with hallways overflowing with patients due to the lack of beds. They often do not have enough staff, and physicians literally have only seconds to use any information tool. We realized that you have to get your tool to follow the workflow as much as possible. If you're not in the right location, where access to the technology is easy, even if you have the greatest technology in the world, no clinician will use it. In pushing this technology out through ERs, we learned a lot and believe it has helped us work with primary care physicians in their offices, a much more technology-friendly environment.

Chaiken: You refer to your product as a diagnostic clinical decision support tool. Why focus on diagnoses?

Clinical problem solvers are a heterogeneous group.

Papier: Autopsy studies show that 15 to 20% of all diagnoses are incorrect. And with dermatological diseases, I think it is a little bit higher once you remove common diagnoses such as acne. Rates are very dependent upon the specialty. Pediatricians have lower diagnostic error rates than internists and family doctors because they see a lot more skin-based presentations. These are more common in children than adults. So, overall, it's probably somewhere between 15 and 30%, depending on the specialty.

Chaiken: Are physicians pretty consistent within and across specialties in their effort to make a diagnosis?

Papier: Clinical problem solvers are a heterogeneous group. There are some physicians who do not really try to diagnose anything difficult, and they refer almost all the time. I just had a conversation with a Veterans Administration (VA) dermatologist who told me that the internal medicine physicians in his VA hospital diagnose few cases, referring almost all dermatology cases to other doctors. So it really depends on the site and the physicians you're talking about. There are some physicians who are diligent, try to diagnose all the time, and limit their referrals.

Of course, if you are a physician in a rural area and your only option is to have the patient drive 100-plus miles to see a specialist, you are likely to make the diagnosis yourself. This is different from an environment where there are several specialists right down the hall and appointments can easily be made.

Contrast this with a community health clinic where the patients are on Medicaid and few of the specialists in that community want to see these types of patients. So, it really depends on the community, the specialty of the physician, and the personal characteristics of the physician. There are some who are

innately curious and derive personal job satisfaction out of helping the patient figure out what's wrong and others who feel like there is just too much pressure on them and the best course is to refer patients. There is a huge range out there.

Chaiken: VisualDx contains images of lesions of the skin and mucosa linked to various diagnoses. Can you describe to me how it is actually used?

Papier: Well, I would say that varies among specialties and across practice settings. The rural physicians are trying to diagnose on their own, so obviously they would tend to use it more as a diagnostic tool in these situations, entering their patients' symptoms to build a differential diagnosis. Alternatively, in a more urban area where there are more specialists available, VisualDx might be used more as a teaching and education tool.

We frequently get user reports that physicians are using our images to inform and reassure patients about their illnesses. It should not be underestimated, the power of a concerned physician swiveling the computer screen to the patient and saying, "Here's an image of this, and it's very close to what I'm observing on you, and I believe in this diagnosis." It reassures the patient on a number of levels. It reassures them that, "Yes, this is probably what I have," but it also reassures them that their physician cares and that the physician is up to date and using modern resources. As you know, patients are on Google, WebMD, and other healthcare sites all the time, and sometimes they are just scratching their heads wondering why their doctors are not using technology. So even for the doctors who use it as a patient education tool, it's something that is really important in today's modern practice.

Chaiken: In what other areas do you think your diagnostic support tool can be helpful besides skin infections?

Papier: Well, you know, there's a risk of making a wrong visual diagnosis across all diseases. In 15 to 20% of diagnoses, you have a pattern recognition

question. If we cover 1,000 diagnoses, which are probably 99% of the diagnoses that clinicians see, then we address practically all diagnostic questions.

As a group, we study diagnostic error. Patients who present with a rare diagnosis are often given a wrong diagnosis because rare diagnoses, by definition, are rare. But it is also the variation in presentation of common diseases that leads physicians to an inaccurate diagnosis. Herpes simplex is a common diagnosis—the cold sore—that physicians know presents in most patients on the lips or genitals. Yet, these infections can occur anywhere on the body. We know that herpes infections frequently occur on an arm, a palm, or on the lower buttocks, so we do have a particular emphasis on studying all kinds of common diagnostic errors.

The other common problem area is drug-induced disease. Often after physicians prescribe a medication, the patient comes in with a skin complaint. These problems get dumped into a kind of generic wastebasket of "drug rash." Well, there's a lot more specificity that could be derived through IT to help the physician make a much more precise diagnosis that prevents a referral and saves money.

Chaiken: The recently passed ARRA and released Obama budget plans hint at the need for better clinical decision support tools. What evidence do you know of that highlights the need for these tools?

Papier: There are a couple of recent reports and research studies that point to the need for physician support. The National Research Council (NRC) published a report in which they interviewed a panel of experts in academia and in industry (Stead & Lin, 2009). These experts identified assistance with the use of cutting-edge health IT as the greatest need for healthcare enterprises. What they found was that even physicians at these leading institutions were not using physician decision support as they should be. The report really is a call to action by the NRC, saying that we need to make physician support a priority.

The other report that I hope Congress and staffers in the Office of Information Technology are looking at is a study published recently in the *Archives of Internal Medicine*. In that study, Amarasingham et al. (2009) showed that high-quality electronic records and physician support were linked to real cost savings at Texas hospitals. There is new information in the literature pointing to the need for and success of physician support tools. We are very proud that our product is the most used diagnostic physician support system in health-care. When you look at the healthcare IT legislation, there is certainly language speaking to the need to develop systems that improve quality of care and reduce medical errors. So, with the emphasis on improved quality, reduced medical errors, and lower costs, we feel we are at the focal point of all these needs in healthcare.

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Chaiken: You say that these clinical decision support systems can save money. What experience can you cite to support this?

Papier: Well, the one area that we have the most experience with is looking at the problem around skin infections. We have done quite a bit of research trying to understand this better. Statistics show that there are at least a quarter of a million patients presenting with a skin disease annually, and that's just in the United States. We have run two studies, one at the University of Rochester by a colleague of mine, Dr. Noah Craft, and another by an infectious disease specialist, Dr. Loren Miller, at UCLA. Both groups looked at the diagnostic accuracy concerning cellulitis. The pilot study, which we presented at the Diagnostic Errors in Medicine meeting last year, showed a 20% error rate—false positives—in the diagnostic accuracy of cellulitis. Our further studies seem to confirm that, and we'll be publishing that data soon. There is potential for VisualDx is to chip away at that 20% error rate.

The cost of an admission for cellulitis using diagnosis-related group (DRG) rates is somewhere between \$6,000 and \$9,000 per admission. If we do the math, with a 15% error rate and at least 50,000 cellulitis admissions nationally, the potential savings exceeds \$50 million.

In addition, the unnecessary use of antibiotics driving bacterial resistance and causing other problems is prevented. This is another source of savings. The cost to the healthcare system of antibiotic resistance is not met by one individual, but by everybody in society as a whole, underscoring why it's so important for the government to start focusing on these definable problems.

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We are not a group that says you can just drop in the software and physicians will change their behaviors instantaneously. The problem of unnecessary antibiotic use is much more complex than just one intervention. We believe that we have a mix of education and technology that can really reduce errors in healthcare and save money. **IPSQH**

Art Papier is the founder of Logical Images and coordinates product research and design. He is an associate professor of dermatology and medical informatics at the University of Rochester School of Medicine and Dentistry and an affiliate of the Healthy Skin Consortia, Center for Future Health, University of Rochester. A dermatology and medical informatics expert, Papier's research focuses on the development and study of real-time reference systems for physicians and consumers, concentrating on visually rich knowledge areas. A graduate of Wesleyan University, Papier completed his premedical studies at Columbia University, received his MD from the University of Vermont College of Medicine, and completed his graduate medical training at the Berkshire Medical Center and the University of Rochester Medical Center. He may be contacted at apapier@logicalimages.com.

Barry Chaiken is the chief medical officer of DocsNetwork, Ltd. He has more than 20 years of experience in health IT, patient safety, clinical transformation, and public health. Chaiken is board certified in general preventive medicine and public health and is a Fellow, Board member, and chair-elect of HIMSS. During his career he has worked with the National Institutes of Health, UK National Health Service, McKesson, and BearingPoint. Chaiken also serves as an adjunct assistant professor in the Department of Public Health and Family Medicine at Tufts University School of Medicine. He may be contacted at bchaiken@docsnetwork.com.