

ARE EHRs UP TO THE **FIGHT?**

What Ebola has taught IT leaders about electronic records and infectious disease.

By Elizabeth Gardner

Several weeks have passed since America's first walk-in Ebola virus patient was mistakenly sent home from a Dallas ED with antibiotics, rather than put immediately into isolation. There was plenty of blame to go around when he returned a couple of days later with an obviously dire illness, but the very first scapegoat was the hospital's electronic health record system, which didn't flag data about the patient's origins in Ebola-stricken Liberia and his contact there with someone who had active symptoms.

The hospital, Texas Health Resources Presbyterian, backed away from that position pretty quickly, perhaps realizing that it raised more questions than it answered. (THR declined comment for this story.) Meanwhile, providers nationwide are tweaking their EHRs and clinician workflows to make sure they don't miss any travelers from West Africa who exhibit flu-like symptoms, and the incident has sparked an industry-wide conversation about what EHRs can and can't do in times of public health crisis.

Communication breakdown

"This wasn't an EHR hazard, but a problem of breakdown in communication and the culture of the organization," says Dean Sittig, professor of biomedical infor-

matics at the University of Texas Health Science Center at Houston. His research focuses on shortcomings in EHR usability. With two colleagues, he published an article in the October issue of the journal *Diagnosis*, analyzing the role of the EHR in the Dallas Ebola case. "There's way more information in the EHR than any clinician could be expected to review, and we have to address how to identify the important information."

The overall Ebola picture continues to develop, but the disease appears unlikely to affect day-to-day life in most U.S. hospitals. The original patient has died, but two of his nurses who became infected have survived, and no one else he came in contact with in the United States—even the rest of his care team and members of his own family—were infected with anything except wildly disproportionate worry. A Doctors Without Borders physician developed the disease in mid-October after returning home to New York from an Ebola-ravaged area of West Africa, and he took apparently adequate precautions to ensure he didn't spread it, despite public outrage over his city-wide rambles while asymptomatic and therefore not contagious.

Screening measures are in place at major airports, and several cities have designated specific hospitals to handle any Ebola patients who appear. While experts predict that isolated cases will pop up, they also say a

widespread outbreak in the United States is unlikely. Though Ebola currently has no cure and a mortality rate of up to 70 percent, it's relatively difficult to catch. Ebola's reproduction rate—the average number of people infected by each person who has it—is one or two, according to research on the current African outbreak. (The comparable number for measles is 18.)

But it's no time to relax. The brief, intense Ebola panic has done the healthcare industry a favor by highlighting the holes in the nation's shield against infectious disease, both inside and outside the healthcare system, without posing much actual danger to the general public. By fixing them now, hospitals and caregivers will be better prepared for more contagious threats. Properly configured clinical information systems and health information exchanges will play a key role in that shield, both domestically and internationally, by helping stop outbreaks at the outset. Within hospitals and clinics, they'll be able to flag potential cases and remind providers how to protect themselves and the public. In public health contexts, they'll be able to discern patterns and help authorities determine how to deploy limited resources most effectively.

Dog ate my homework

The persistence of the current Ebola outbreak in Africa, combined with increasing global mobility, virtually ensured that eventually an infected person would show up at a U.S. hospital. THR Presbyterian drew the short straw, and its initial missteps have been well documented, there and elsewhere. An early statement blamed the EHR for sending Ebola patient Thomas Eric Duncan home, because the physician treating him didn't spot a nurse's note about his recent travels in disease-stricken Liberia. The hospital quickly recanted when two things became apparent: first, that the physician could have read the note but didn't, and

One Hospital's Ebola Prep

At Loyola University Health System, outside Chicago, greeters in the emergency department and service representatives in ambulatory clinics began asking Ebola screening questions within a couple of days of the emergence of the first case in Dallas. Each patient is asked whether they've recently been in any of the Ebola-stricken countries in West Africa, or been exposed to the blood, body fluids or remains of a confirmed or suspected Ebola patient.

If the answer were "yes" (which at this writing it hasn't been), he or she would be hustled into isolation even before having a temperature taken. Once isolated according to CDC protocols, the patient would complete the triage process with a nurse, who would repeat the screening questions as an extra precaution. The county health department and the CDC would be notified, and clinicians working with that patient would see a "best practice alert" when accessing the patient's record, with CDC guidelines on symptoms to watch for and precautions to take. In addition, a bright red banner would appear anytime the patient's electronic health records were accessed.

"We use those patient banners infrequently but judiciously," says Chief Health Informatics Officer Connie Giere.

"They follow the patient no matter where you open up the record, so you can't miss them." A biohazard icon is attached to the patient's name when it appears on any type of list, so system users are aware of the risk even if they don't open the chart. The red flag would be removed promptly once Ebola had been ruled out.

All health system staff members have been instructed to ask the screening questions at every initial interaction with a patient: for example, when they call to make an appointment or give preoperative instructions. If staffers try to move past the screening questions without recording answers, the system stops them and makes them go back. Even transferred patients are asked, though presumably they've also been screened by the provider who transferred them.

The Ebola banner was implemented shortly after the first patient was identified at Texas Health Resources Presbyterian in Dallas, at the recommendation of Loyola's EHR vendor, Epic Systems (which also serves THR). Giere says Epic sent out a detailed white paper on how to adapt its systems to help in the crisis, and also facilitated information sharing among its clients.

"This procedure can apply to any kind of outbreak," she says.

second, that the EHR is meant to supplement and support, not replace, oral communication.

"In general, physicians didn't look at nurses' notes when they were on paper, and they don't look at them much on the computer, either," says Sittig. "That's something that needs to be fixed."

His paper in *Diagnosis*, written with Hardeep Singh of the VA Medical Center in Houston and Baylor College of Medicine and lead author Divvy K. Upadhyay of the Urban Institute, Washington, explored multiple causes for the missed diagnosis. Sittig says the sheer volume of information available in an EHR is the primary problem, and the systems don't do enough to help the user sort through it.

"The EHR, not just theirs but everyone's, causes such a large cognitive load that people can't do all the things they need to do," he says.

"To blame the EHR [for failure to find an Ebola patient] is beyond ridiculous," says Howard Landa, M.D., CMIO at Alameda County Health System, Oakland, Calif., and vice-chair of the Association of Medical Directors of Information Systems. "It's like any other tool—how you use it determines how well it works. Having the data in there doesn't mean everyone automatically knows it." (For more thoughts from Landa on information overload, see this month's "Executive Session," p. 32.)

In many hospitals, a Liberian patient

would automatically stand out, but THR Presbyterian serves a large enough immigrant population that apparently Mr. Duncan wasn't that unusual. The hospital had access to the same CDC Ebola warnings and guidelines as all other hospitals, but even so, Sittig says, it's not surprising that Duncan didn't get special attention. "The ER was busy, and they were supposed to make a diagnosis that hadn't been made in the U.S. before."

Co-author Singh says an alert flagging the combination of African travel and 103-degree fever might have helped, but only if it were properly structured and fired at exactly the right moment. "Otherwise it's going to be ignored," he says.

Ironically, a narrow focus on specific quality improvements can obscure data that's not directly related to those improvements, because system users can pay attention to only a limited number of details. "Our information indicates that the nurse was using a special form that allowed her to determine whether the patient was due for a flu vaccine," Sittig says. "You're so busy with the cognitive task of one form that you don't think about all the other things you should be thinking about."

That's something to consider the next time an institution enlists the EHR in its push to improve immunization rates, get diabetic patients in for a foot exam, or increase hypertension screening. A dramatic improvement in any of those measures is a good thing, but shouldn't come at the risk of missing a dangerous contagion.

Prepping for the unlikely

While it may seem obvious to the panic-stricken public that the search for Ebola patients should be a top priority, for most providers it will be like looking for a needle in a million haystacks. "You could set up your systems to catch lots of public health risks, but most of them are so minor that we'd be flashing false alarms way more often than true alarms," Sittig says.

An EHR to Fight Ebola at the Source

What could sophisticated health IT do to help at Ebola Ground Zero? The answer may lie in an open-source EHR created specifically for use by developing countries.

Regenstrief Institute in Indianapolis, creator of one of the first electronic health record systems and a center for cutting-edge medical informatics research, co-founded OpenMRS in 2004. Other supporting organizations include the CDC, the National Institutes of Health, the World Health Organization, the Rockefeller Foundation and Google.

The system, now in its second full version, is the most widely used EHR software in Africa. A small army of volunteer health IT professionals and medical informaticists work on developing and testing the software, which is designed both to serve as an EHR system and to collect data for public health purposes. It's written in Java for use with a Web browser, and its modular design allows users to adopt only the functionality they need. While implementation and maintenance still require some IT expertise, the development group is working on a pre-built implementation that would allow clinics without professional IT staff

to use the system.

Volunteers are now working on a version specifically for Ebola treatment units that could later be adapted as a general-use EMR. "Healthcare workers in the area have been gathering data on paper, or in Excel files, but we know we have to get a better handle on what the outbreak looks like," says Shaun Grannis, research scientist at Regenstrief.

Grannis says the software can also collect Ebola outbreak data for retrospective analysis to understand the risk factors of the people who contract the disease, analyze the differences between those who survive and those who die, track new patients and identify effective treatments. "We need to be able to answer questions like whether a patient had a central line in place, or what treatment center they were in, or whether they traveled outside their village in the past month," Grannis says. "We need to understand what factors we can influence to bend the curve."

Those interested in how they can help develop and test OpenMRS can find more information at openmrs.org. Ebola-specific information is at <https://talk.openmrs.org/c/projects/ebola-response>.

Alert fatigue is already one of the biggest obstacles to effective decision support, and the industry can't afford to let it get worse.

Howard Landa's team at Alameda County Health System is relying on humans, rather than the EHR, to spot any Ebola risks. It has an educational package for its clinicians, especially in the emergency department, to stress the importance of doing travel histories on each patient and alerting colleagues directly when they encounter the triggering combination of flu-like symptoms and recent travel in Ebola areas or contact with suspected Ebola victims. A packaged decision support alert would be nice, but Landa says it will take awhile for his vendors (Siemens for inpatient, NextGen for outpatient) to add that capability. "We're so

immersed in meaningful use that I can't see diverting all that attention to creating an alert for such an incredibly rare event," he says.

For most patients, travel history isn't relevant or helpful for their immediate treatment, and Landa hesitates to add to physicians' data collection burden. "If we could enable a system where the patient could enter that information, and have it available to decision support, that would be useful," he says. "If you have the doctor filling in three pages of check boxes whenever anyone comes in for any reason, we'll never get anyone seen."

Tiny Mt. San Rafael Hospital, Trinidad, Colo., a critical access hospital, is ready for an Ebola patient, says Director of IT Michael Archuleta. "It's a scary situation," he says, citing the hospital's proximity to

a major interstate highway and the randomness of THR Presbyterian's experience. "When we heard about the situation at Presbyterian, I immediately put a team together to build screening into our EHR."

The hospital's EHR, from Medhost, looks for Ebola symptoms noted in the symptom field (headache, vomiting, fever, bruising and bleeding), and then searches a comment field for notes about recent African travel or exposure to anyone with potential or confirmed Ebola. The combination triggers a CDC-recommended isolation and care plan, as well as a report to the state and the CDC.

Even if Mt. San Rafael never sees a case of Ebola, Archuleta is glad to have gone through the process of preparing for it. "We're definitely in a better position to deal with other threats as they come up."

Randy McCleese, CIO of St Claire Regional Medical Center, Morehead, Ky., is not as certain of his Meditech EHR's ability to cope (though at this writing Meditech is offering Ebola strategies for each of its systems through its customer website). "I'm not sure how many of our systems can throw up those red flags [automatically] and I don't know if we could do [an alert] without a manual intervention from someone at the front desk." The 159-bed hospital serves a rural area in northeastern Kentucky that may not seem like it would attract many travelers from West Africa, but McCleese says the institution's Catholic ownership could be a factor. "We've had folks from here go on mission trips [to Africa]," he says. "We don't expect to get Ebola here, but it's not impossible."

Vendors respond

Major EHR vendors have been quick to marshal their resources to support the CDC recommendations, and to help their clients think through changes to both their systems and their workflows. "Very few of our clients prior to this incident had any decision support related to Ebola," says Sarah Corley, M.D., chief medical

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—Dean Sittig

officer at NextGen. "A lot of them are taking advantage of user-defined fields and alerts. If they're in a setting where there's been Ebola, they might want to make travel history a mandatory field."

Epic Systems caught the flak because it's THR Presbyterian's EHR vendor, though it also supplies the EHR for the University of Nebraska, one of the first four sites nationally to be designated by the CDC to receive Ebola patients. President Carl Dvorak says the company is recommending to its clients, for the time being at least, that all patients with flu-like symptoms be asked for a travel history, with a hard stop if the question isn't answered. Not all sites will take that advice, though.

"Do you really need to ask the travel question to every four-year-old, or every grandma that's brought in from the nursing home?" he muses. "It's not popular to have the computer barking at you, and how forcefully the EHR inserts itself into the workflow is a subject of national debate." Even Epic clients in Florida, where international travelers are common, aren't all asking for travel history routinely, preferring to allow clinicians to make the call.

The company is recommending that the screening questions be asked at all points of patient contact—and that patients who raise a flag be steered away from the emergency department. "That's the last place you want them," Dvorak says.

Cerner is working with long-time client Emory University, another CDC-designated Ebola care site, to develop a set of

best practices for using the EHR to screen for Ebola and other infectious diseases. For now, Cerner's system can be modified so the combination of symptoms and travel history triggers an Ebola care plan and alerts to all providers, says Chief Clinical Officer Eva Karp.

National infection shield

Ebola has started many experts thinking about how to leverage health IT to create broader protections against deadly public health threats.

"What if, in the midst of a crisis in which workflows, policies, procedures and operations must be altered, the CDC could distribute an app to emergency departments as easily as a software developer submits an app to the Apple App Store?" asked Kenneth Mandl, M.D., chair of bioinformatics at Boston Children's Hospital, in a *JAMA* article published in October. "Such a hypothetical app could reshape emergency department triage workflow to emphasize travel history (perhaps on every page) and to immediately recommend rapid assessment and isolation exposure if there is a combination of fever and recent travel to Ebola-affected regions."

Epic's Carl Dvorak envisions a national standard vocabulary of symptoms integrated with a geographical database that would allow the CDC to publish outbreak information in a computer-readable format that could be accessed by an EHR. Clinicians could immediately see whether a given patient is likely to have been exposed to Ebola—or for that matter, to anthrax, MERS or the flu. "The trick will

be that government tends to over-alert, so it has to collaborate with the healthcare community to determine the right sensitivity and specificity," he says.

Something similar is being considered at HealthMap, a project by researchers at Boston Children's Hospital and Harvard Medical School that monitors miscellaneous news sources, social media and self-reported information to track outbreaks of everything from swine flu to plague. Its algorithms picked up the African Ebola outbreak long before the general public took notice. Epidemiologist John Brownstein wants to feed his information directly into the EHR, so a clinician can immediately see whether a patient's travel has coincided with any disease outbreaks. "We are all about trying to give context to providers," he says.

Howard Landa says the healthcare system could eventually leverage the data in health information exchanges to put the pieces together, finding patients who went to the ED for treatment but had their African travel history documented during a primary care visit. "Then we can start doing decision support at a high level," he says.

David Ross, director of the Public Health Informatics Institute in Decatur, Ga., sees great possibilities in analyzing the data from the current Ebola outbreak in West Africa, to see who's most likely to contract the virus and what factors determine survival. "The virus has been studied in maximum containment labs, but now we'll get a chance to understand it in a different way."

Completely computerized tracking

of domestic Ebola cases is years away, though. While uploading data to public health authorities is part of providers' meaningful use requirements, many of those authorities aren't yet able to accept the data, says Julia Adler-Milstein, assistant professor of health management and policy at the University of Michigan's School of Public Health. "Both sides need to have the infrastructure in place, and there's been lots of funding for providers but not much to public health departments."

Ross agrees. "This is a good opportunity to remind politicians and the public that the public health sector has lost 50,000 jobs, so our capacity to respond has been reduced. In the desire to keep control of public spending, we have threatened public health." ■

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