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Fire and Ice

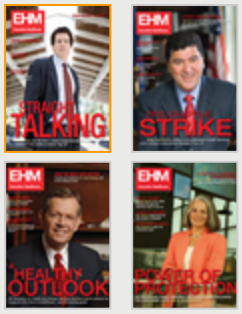
When natural disasters like fires and ice storms strike our communities, it's up to the National Center for Public Health Informatics to track and manage the impact on local health systems. Director Leslie Lenert takes EHM's Marie Shields through the programs that help keep the country safe.

In October 2007, a series of devastating wildfires burned across Southern California. Hundreds of thousands of acres burned and 900,000 people were evacuated. The immediate repercussions were obvious: there were nine fatalities and at least 70 people were injured, 500,000 acres of land burned and 1500 homes were destroyed. These are horrifying statistics, but what about the greater impact on the state's healthcare system, and its ability to cope with an influx of related conditions?

It's in situations like these that the National Center for Public Health Informatics steps in. A division of the Centers for Disease Control and Prevention based in Atlanta, NCPHI's primary mission is to link public health at all levels with the clinical care system. In other words, one of the center's mandates is to collect data from hospitals and other healthcare sources in the community, and analyze them to determine whether a public health threat exists, and how the system is coping.

SELECTED ISSUE

PAST ISSUES



As NCPHI's Director, Dr. Leslie Lenert, explains, "We need data in order to understand what the health of a population is and design interventions to improve it, monitor it and take appropriate actions when a health threat is detected.

"My center is the arm of the CDC that's devoted to working with this – not just in disaster situations, but to facilitate this flow of information to all levels of public health. Along with that, there is a large amount of data in state and local public health activities that needs to find its way selectively and anonymously to national public health levels, to facilitate the flow of data from state and local public health."

In the case of the California fires, NCPHI called on one of its flagship programs, BioSense, which creates national real-time situational awareness of what's happening in emergency rooms across the country – the types of patients being admitted and the symptoms they have. The system was used to monitor emergency rooms to assess how they were dealing with the health threats caused by the fires; for example, to identify that cases of asthma had increased, and that there was a spike in burns that resolved rapidly, and even to watch how mental health problems crescendoed in the population in response to the stress from the fires, and then rapidly resolved.

"BioSense is run by one of our five divisions, the Division of Emergency Preparedness and Response," Lenert explains. "About 500 non-governmental hospitals and 1300 government hospitals are connected to it. This allows us to look in the core hospitals that are connected to see on a daily basis what the distribution of patients is and whether there's been a shift in those things that might indicate either attack by a bioterrorist agent or the presence of a pandemic.

"There's also a group within that called the Bio-Intelligence Center, which looks at the data every day, to try to understand what's going on and to monitor the health of the nation today and the health of its healthcare system."

The Division of Emergency Preparedness and Response also runs a system tracking counter measures and where they are in the supply chain, and their availability to provide full response to a pandemic and other issues that may arise.

Staying connected

“BioSense is a very large program,” Lenert specifies. “It processes over 175,000 messages a day. About 12 percent of the people seen in emergency departments in the United States are reported into it, and we’re continually looking at ways to expand the system to gain complete epidemiological coverage. We also have tools linked to BioSense that allow people to look at other sources like influenza monitoring and reporting, to give an integrated picture between more traditional surveillance sources with dedicated networks and what we’re seeing in the emergency rooms today.”

“There are a number of users in state and local health departments who use a secure web-based interface to access data either from a hospital or their region or their state to view disease trends.

“The program gives public health officials at the state and local levels strong situational awareness of what’s happening in the community and what they need to do to respond to any health threats. We think it’s an important part of the security of the United States, though of course we still have a long way to go. We’ve been in business for about four years, and obviously 12% of Americans still leaves 88 percent who are not covered. That means that we need to keep working on the system and expanding it until we have the tool that we really want.”

Currently, BioSense operates a large central database that collects all the data from these various sources. Lenert and his team are investigating ways to achieve the same capability while giving state and local officials better control of their data, and allowing less data to move out of the healthcare system, protecting patients’ privacy.

Stormy weather

BioSense has also been used to track data showing how ice storms affect the rates of slips and falls and injuries in hospitals, allowing researchers to determine the effectiveness of public health campaigns. Lenert says that if a city has been wired with BioSense, when there’s an ice storm, you can tell that people are slipping and falling.

“The way we detect that is very interesting: from the BioSense system in certain cities, we have hospitals sending us reports of their X-ray data and we use simple natural language processing techniques to figure out which X-rays indicate that people have a fracture. We can look to see how fractures are correlated with slipping and falling due to ice: it’s a logical chain that propagates right through the healthcare system. You can then devise public health campaigns to encourage people to be more careful, and cut down on the number of broken bones.

“The same thing applies to situations like the fires around San Diego: the number of people who come in with asthma goes up and you have to wonder whether the hospitals’ capacity or emergency departments’ capacity cope. The area is being challenged, and it may need to set up auxiliary hospitals or clinics and other services. BioSense allows us to look at the rate of people coming in with as

Breaking down silos

The second of NCPHI's five divisions is the Division of Integrated Surveillance Systems and Services (DISSS), which focuses on a variety of activities that support public health practice in the US, including the National Notifiable Diseases Surveillance System (NNDSS).

As Lenert points out, in most of the developed world, public health operates by having doctors and nurses fill out cards that report notifiable infectious diseases, which go to state and local public health departments, are investigated and confirmed, and are then forwarded to national public health organizations to track diseases.

In the past, part of the problem with such systems, Lenert says, is that the computerization efforts were siloed. "They were highly vertical product lines. There would be one for tuberculosis, one for hepatitis, one for cancer if that's reportable in the jurisdiction, one for measles. Each one of these would have its own computer system, and as a result you might need to have four or five different desktop computers in a public health office to communicate with each one of these systems, and there was much redundancy in data entry and other areas.

"Eight or nine years ago, the people of the United States decided to invest in a program called the National Electronic Disease Surveillance System (NEDSS). NEDSS produces integrated surveillance systems, where the disease issues of reportable conditions in public health are tracked in an environment that allows you to see that patients who have HIV also have hepatitis C and tuberculosis, and you can take integrated public health actions. This program has been very successful. It has developed software that's used daily in 14 states, and it has standards that allow the public health departments to electronically transmit cases to the CDC, speeding up processing.

"It's also been a successful granting program to the states to encourage the development of electronic laboratory reporting between hospitals and public health laboratories and commercial laboratories and public health practitioners at a state or a regional level. Such reporting is used to identify people who have notifiable infectious diseases; for example, reports of hepatitis A that were positive would be forwarded under such conditions to the state or local public health department, opening a file that would then allow an investigation of the lab case to see if it was actually an infectious event and reflected some public health problem that needed to be addressed."

Lenert is clear about why these efforts need to be pushed all the way back into the clinical care system. "It's obviously an academic exercise to count how many people had hepatitis in the United States six months after the cases have happened. We can take large system changes with us, and yes we can improve processes for monitoring the safety of food and health workers and look to see if these have improved. However, if we want to do anything in real time, if we want to actually respond to an outbreak in some way, we're going to have to compress the time from the data moving from the clinical care system to the state and local public health departments to the CDC, particularly when it's a disease of national interest or importance such as pandemic influenza or a suspected bioterrorism related condition."

Fast response

Because of the speed at which that data crosses the system, going from hospital to state and local public health to state, the CDC has to react very quickly – within days to a week at the most – and even in that period of time it may need to accept less than complete information on critical diseases to allow public health officials at state and national levels to respond appropriately to threats. What NCPHI is doing with the NEDSS program is working with data from the clinical care system to bring it into the public health domain and then using it to enhance public health practice with a particular focus on accelerating the transmission of that information across all levels of public health as needed to prepare a response.

NCPHI's grant program helps states to both develop integrated disease surveillance systems, where they can manage the cases of notifiable infectious diseases together knowing that one person has multiple diseases and what the impact is of that; and also to have a better link between the clinical care system and the state and local public health departments.

The DISSS manages programs that are related to more direct response to outbreaks. One of its famous programs is Epi Info, which was one of the first software programs created to help epidemiologists track and manage outbreaks. This software, another of the center's flagship products, dates from the 1980s and has a broad following throughout the world's public health departments.

This division also looks after an outbreak management system designed to facilitate the linking together of large groups of people in multi-state collaborations, and to allow coordination of the investigation of complex public health problems; for example, tracking down cereal boxes that are contaminated with salmonella. As Lenert explains, this might require different states to work together, passing information back and forth. "Only at the end of the picture do we find out the cause was the cereal. Until we get to that point, it's all a mystery and there's a huge amount of data that need to be collected and managed in order to 'find the smoking gun' in a Sherlock Holmes fashion."

Information management

Within the DISSS, the center's third division, the Division of Informatics Shared Services, works on developing the services and informatics science necessary to drive public health systems. One of the areas it works on is Public Health Information Network (PHIN) messaging, the secure and reliable delivery of one copy of a message about a patient.

"Because we deal at the national and sometime state levels with anonymized data, if we get multiple descriptions to send something over the internet, it's possible to get multiple copies of data on the same patient," says Lenert. "We need a reliable and secure method of sending data to people. PHIN can handle any type of a package and it's very widely installed."

"The DISS also manages vocabulary services for the agency: how to name things, what the values of different things are, what code from standard classification methods like SNOMED should be used for particular items and how we can harmonize our definition to help create some of our data warehouses and information products for people."

The center's fourth division, the Division of Knowledge Management, has two elements: it contains the library for the CDC and provides information support across the agency. The group also works on decision support systems in technologies for search and retrieval, and is developing technologies that would allow public health practitioners to get references to articles that are relevant to potential cases that they might be investigating.

The final of the five divisions is the Division of Alliance Management and Consultation (DAMC), which is focused on reaching out to state and local public health officials and to their departments to bring them together into a community, to develop interoperable systems for exchanging information in public health. This division is the custodian of the PHIN, which sets out standards for interoperability and a certification process for public health departments so they can understand where their deficiencies are and work to improve them. It's also a community of practice where public health practitioners who are interested in informatics issues can come and get user support and assistance. Each year NCPHI puts on a large PHIN conference, bringing together all the public health practitioners who are engaged in informatics efforts across the country.

"The Division of Alliance Management will also play a key role in our future structure, managing our open source efforts, creating working groups and helping people in different areas work together to advance software for public health. This is a program that we're just rolling out this year at the 2008 PHIN conference."

Ringing the changes

NCPHI is currently in the process of a reorganization, which will see the number of divisions reduced from five to three. As Lenert explains, "The current divisions are organized along grants and product lines, but we need to have a center where different divisions are supporting each other in different programs and there's no overlap. For example, with NEDSS and BioSense, if you have one program that's championing getting labs out of the clinical peer system and another championing getting labs plus other data from emergency departments that are often connected to the same laboratories and parts of the same hospitals that you're getting the laboratory data from for NEDSS, there are obvious synergies in the process.

"We're reorganizing to a new center, which will have three divisions. One division will be focused on public health practice systems and will talk about all types of systems that are relevant for public health practice and on the engineering of those systems, along with user requirements, defining what the needs are, creating communities to support each other in user requirement definitions, and the processes of actually practicing public health.

Applied informatics science and services will continue to do what it's doing now, but would assume the responsibilities of the entire organization for creating the infrastructure that runs systems and provides the glue that pulls the data out of the clinical care system, and the mechanisms to take data from clinical care and make it available to state, local and CDC programs. Then there is alliance management, which will be expanded to include open source development."

Protecting rights

According to Lenert, one of the problems faced by public health sector is data stewardship. People collect data for

various reasons and once someone has collected the data, he or she is responsible for it, and some of that responsibility is statutory if it deals with patient privacy. The person who has collected the data may not be want to share it and or let other people to take control of it, even though public health has to be essentially a collaborative enterprise.

How do we then develop systems that allow state and local public health departments or other groups engaged in population health efforts – for example, assessment of quality – to have access to patient data for quality purposes in a way that maintains data stewardship, so that the rights of the individual are protected and financial interests aren't compromised? "This is a very tricky issue, Lenert says, and it's something that we're working on inside the National Health Information Network and with the office of the national coordinator for Health Information Technology in the Department of Heath and Human Services in Washington.

"Some people call public health use of data secondary use, but I don't think it is. I think everybody who is part of society has to recognize the greater good and if we don't recognize that, we're going to be in big trouble. Health data to protect the population's health is critical.

"There are policy level issues of how do you manage data coming from diverse environments with different owners and with many people who would be potential users. Some of those users are commercial and that would violate privacy. Yet some of those commercial users would create new markets and opportunities without violating privacy. Some of the users are for the public good through government agencies."

These policy issues go hand in hand with technology. One of the most interesting technological issues is how to link computer systems while maintaining stewardship of data. A whole group of technologies around federation of databases has been evolving, which are sometimes referred to as the grid or grid technology.

Lenert would like to set up systems with which public health departments at state and local levels can exchange summary level data automatically tailored to public health needs using grid technologies. He says NCPHI is actively engaged in research in this area, deploying a public health grid based on Globus technology and working with groups in the UK to develop advanced tools for a public health grid for queries.

Combined with this, he sees the surveillance systems in this country evolving toward a more grid-based approach, where the state health departments control most of the data. "We have technologies that allow us to look at databases at the CDC, but more importantly, we'll group the states together into regional collaboratives where they can look at each other's data and figure out what's going on in the region and then link up the regions into a national picture. We'll do this without the data leaving the state.

"Public health statutes focus on state and local regions and to create a national picture we either have to get them to forward the data in an anonymized fashion or we can create systems that allow regions to interchange data without it actually leaving the state. We think this is the way to get capability while allowing appropriate data stewardship."

Alert triggers

Another thing Lenert is interested in is what he calls case detection technologies: technologies that allow the monitoring of clinical streams of data behind firewalls, anonymously looking for potential cases of public health relevance. When those are found, an alert is triggered to the doctor or nurse in the hospital, and is also forwarded automatically to state or local public health officials so they can begin an investigation right away. NCPHI is investing in this technology because it can dramatically cut down the time to identify an outbreak.

There are a couple of different approaches that could be used to do this, Lenert says. “One of the ones we’re most focused on is the use of ontologies, and computational methods based on ontologies. Ontologies are systematic descriptions of knowledge in a computable form. We combine them with rule sets and listeners that look at the transactions within a hospital information system to recognize when a case of interest is likely to be present.

“There are a lot of other uses for this type of technology, and we see synergies in teaming up with other agencies like the National Institutes of Health and the Agency for Healthcare Research and Quality, and developing them so that their missions in quality and in clinical research can be fulfilled by the same technologies that would serve public health. We believe that we need to work on research on computing systems that are shared.

“We need to have systems that are really, truly collaborative that meet the needs of several different user groups at the same time, mainly because installing three separate systems is prohibitively expensive and logistically impossible. Learning how to build things or learning how to take on problems in a multi-faceted way is one of the hot informatics research issues.”

Becoming more open

Lenert is determined to see NCPHI’s information products and software systems become open source tools – meaning the software code would be freely distributed and there would be an organized system for maintaining that code amongst the practitioners in public health who are using it.

In his view, government systems, especially systems for public health, should not be based on proprietary technologies, and when government writes software, it should be available to other members of the community that that government is serving. He points out that there would still need to be a process for the validation and review of the code to avoid the potential for malicious content.

What does that mean in practice? NCPHI works with a lot of contractors in the government to develop its software systems, and Lenert would expect their activities to change in the future. “What we’re likely to do is to create communities of practice: public health officials who are technical and non-technical working on critical problems. Linked to that will be product teams that are developing open source systems. Those teams will have both government and government contractor participants, as well as participants in the public health communities.

“Many government officials working on computing developments see the value in open source, much of our military is moving to open source technologies. It’s a better way to do business, where people can benefit from the work of the past and we can lay out the problems and the risks that arise from making code public. They’re always discussed at a theoretical level, but I think the greatest risk in software development is always the code that is not

well scrutinized, the code with large backdoors and other elements where nobody has really looked at it and there are routes into and obvious problems that have not been addressed and have been hidden by its proprietary nature."

Under Lenert's leadership, then, NCPHI is not just there to help communities coping with natural disasters or disease outbreaks or bioterrorism threats, but also to ensure the highest levels of public health are maintained on a day-to-day basis, through the use of the latest technologies to promote collaboration and openness.

"This is a real win-win here as far as the structure is concerned. This is the way for public health to advance, and as we move forward over the next five years we're going to be transforming NCPHI into an open source organization where standards development, software development, and even evaluations, are all as open as possible."

Dr. Leslie Lenert is Director of the National Center for Public Health Informatics (NCPHI), one of 12 centers of the Centers for Disease Control and Prevention. The work of NCPHI is focused on the link between the clinical care system and public health, and between state and local public health and CDC programs. Prior to joining NCPHI, Lenert was a professor at the University of California San Diego, researching technologies to help first responders at the site of disasters or terrorist attacks.

Health informatics Q&A

EHM. What is health informatics?

LL. Thirty years or so ago, Morris Collin, one of the inventors of the CT scan and a Nobel Prize winner, defined health informatics as the application of information technology to medical domains. People often think that public health informatics or medical informatics is just doctors who do IT or public health officials who do IT – that would have been right in the past, but the ground has changed since then.

EHM. How has health informatics evolved as a field?

LL. In 2008 we need to think about health informatics as an interdisciplinary field that looks at how information technologies affect the processes of care and prevention that cut across systems. That includes human factors, systems engineering, organizational behavioral models, software design, artificial intelligence and a number of other sub-disciplines. Medical informatics and health informatics is an interdisciplinary field.

EHM. How would you define the specialty of public health informatics within this wider definition?

LL. If you look at the whole field of health informatics, it covers a wide range of activities, from bio informatics, which looks at the genome; to translational informatics, which looks at how to take experimental data and apply it to patients; to clinical informatics, which furthers the healthcare system at the individual level. Finally, there is public health, which is about how we apply the same principles to population health issues. Public health informatics is the application of the interdisciplinary field of health informatics to population health and health promotion.

EHM. What are the critical components of the field?

LL. One is the surveillance in population health and the criticality of linking into the clinical care system and pulling data out of that and being able to integrate it into population health protection. E-health is an increasingly important component of consumer health informatics, where there's an opportunity for governments at all levels to work directly with their constituents to promote their health using the internet and other electronic media.

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EHM talks to Louis Bigliani of the American Orthopaedic Association on the future direction of the organization and the industry as a whole.

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Dr. Marc Gillinov of Cleveland Clinic tells EHM about the advances in mitral valve surgery and the treatment of atrial fibrilliation.

Healing Powers
Founded in 2001 with the aim of accelerating wound healing while preserving and enhancing the quality of life for patients, the American Wound Care Association is a unique organization. President Dr. Robert Gunther provides EHM's Frances Davies with a deeper look at its mission.

A New Era for Genetic Testing
The passing into law of the Genetic Information Nondiscrimination Act was met with great fanfare, and should help calm fears about genetic discrimination. But GINA is an imperfect law, and issues remain. By Diane J.

Allingham-Hawkins.

To Screen or not to Screen
Biomarkers hold out great hope for the early detection and even prevention of some cancers, but how does the reality live up to the potential? EHM talks to the James W. Jacobson of the National Cancer Institute, NIH, HHS, about the latest developments in the field.

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A round-up of concerns, developments and opportunities in the field, by Winston Parris

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The heart is a vital organ, and keeping it healthy and in excellent working order is a top priority. Lawrence Rosenthal , Director of Clinical Electrophysiology and Pacing at the UMass Memorial Medical Center discusses some of the treatments available to keep hearts in peak condition.

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Dr. Daniel S. Berman, Director of Cardiac Imaging at Cedars-Sinai Medical Center and President Elect of the Society of Cardiovascular CT, speaks to EHM about the evolution of nuclear cardiac imaging.

Effective Therapy
Each year 30,000 new cancer patients make their way to The University of Texas M .D. Anderson Cancer Center for treatment. The center's mission is simple – to eliminate cancer, and with a department which boasts some of the most advance technology in this area, patients could not be in much better hands. EHM talks to James Cox to find out more.

Healthcare in the Electronic Age
Cleveland Clinic has been on an important journey to enhance the patient experience through the use of information technology. Here C. Martin Harris looks at how systems have been improved at the institution and how these could be adopted to improve the healthcare system overall.

Innovate to Integrate
Calling up accurate patient information should always be a straightforward procedure for any physician, but a lack

of integrated patient information systems is a problem throughout the US. Donald Holmquest of the California Regional Health Information Organization looks at some potential solutions and how their adoption could revolutionize the industry.

What Lies Beneath

For many years, magnetic resonance imaging (MRI) has been one of the most important imaging methods in medicine, providing a peek into the inside of human bodies. Here, Jonathan Lewin of Johns Hopkins follows the development of the technology at the hospital.

Improving Health IT

Back in 2006, President Bush signed an executive order stating that improving the quality and efficiency of healthcare delivery is dependent on the standardization and use of interoperable health IT. With this in mind, Mike Nelson of Universal Health Services provides his insight on progress made in this arena, along with technological developments at the organization.

High Tech Imaging

Studying the Genetics of Breast Cancer

J. Dirk Iglehart, Chief of the Cancer Biology Section in the Department of Surgery at Brigham and Women's Hospital and Program Leader for Breast Cancer Program in the Dana-Farber/Harvard Cancer Center, speaks with EHM about the four distinct types of breast cancer and the sea changes in the understanding and treatment of breast cancer based on the influence of genetics.

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EHM's Leslie Knudson speaks with Dr. Kenneth L. Noller, Professor and Chair of the Department of Obstetrics and Gynecology, Tufts University School of Medicine, about the latest cervical cancer screening technologies and guidelines for ensuring optimal cervical health in women of all ages.

Greater Options for Breast Cancer

EHM's Leslie Knudson speaks with Dr. Shawna Willey, President of the American Society of Breast Surgeons and Director of the Betty Lou Ourisman Breast Health Center at Georgetown University Hospital, about the latest advances in breast cancer detection and treatment.

The Healthcare Informer

President and CEO of The Henry J. Kaiser Family Foundation, Dr. Drew Altman, emphasizes the special role of the foundation as an independent, trusted source of information amid the hotly debated national healthcare scene.

By Leslie Knudson

Riding the Wave

Practice Makes Perfect