

Electronic Health Records Critical in the Aftermath of Disasters

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Abbreviations:

ED: emergency department
EDR: electronic dental record
EHR: electronic health record
IT: information technology
NDMS: US National Disaster Medical System
SAMHSA: Substance Abuse and Mental Health Services Administration

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A fundamental tenet of preparedness for public health emergencies is the reliance on systems that rest on a bedrock of day-to-day use. For public health, this means building strong surveillance, epidemiology and laboratory systems.¹ For health care, it means that providers, hospitals and clinics have the ability to deliver safe, high-quality, well-coordinated care daily *and* during emergencies. The increasing adoption of electronic health records (EHRs) has important implications for health care preparedness. In addition to the demonstrated daily benefits of EHRs²⁻⁵ there are now many examples of the benefits of EHRs in emergency response and recovery.

Care after Disasters Difficult Without Electronic Health Records

In the aftermath of Hurricane Katrina in 2005, thousands of patients were devastated by the loss of their medical records.⁶ In the chaos that ensued after this disaster, displaced individuals left their medications, medical records, and health care providers behind. Many of these individuals had pressing medical issues related to chronic health conditions, and their post-Katrina physicians were forced to provide treatment without a clear record of their new patients' previous care plans, medications or treatment. Dr. Regina Benjamin, the US Surgeon General, personally experienced the fragility of paper health records when her practice was devastated by Hurricane Georges in 1998. When Katrina struck, her practice was once again destroyed. She and her clinic staff had to leave soaked charts to dry in the sun in hopes of recovering the information needed for them to care for their patients.⁷ But portending what the future would bring, patients whose records were part of the ground-breaking EHR at the Department of Veterans Affairs (VA) fared better. They were able to receive uninterrupted care at other VA medical centers throughout the country in spite of being displaced by Katrina.⁸

Patient Care Resumes Faster with Electronic Health Records

We have been reminded of the critical role of EHRs in recent disasters with the one-year anniversary of the Joplin (Missouri, USA) tornado behind us. An EF5 tornado struck Joplin on May 22, 2011, inflicting significant damage to St. John's Regional Medical Center and claiming the lives of five of its 188 patients and one visitor. Patient files and X-rays were scattered to places over 70 miles away.⁹ In spite of this large-scale destruction, patient medical records remained intact and accessible thanks to the EHR system that the hospital had implemented three weeks earlier.¹⁰ A regional command center in nearby Springfield, Missouri was able to electronically access and send records to accompany the 183 patients who were evacuated from St. John's and transferred to other medical facilities, significantly contributing to continuity of care for these patients. Less than a week after the tornado, St. John's EHRs also facilitated the resumption of care provision from a sixty-bed mobile emergency department (ED) and hospital erected in the hospital's parking lot, and staffed by emergency physicians and other specialists and operational 24 hours a day. Moreover, the ability to access patient records electronically allowed St. John's-affiliated physicians whose clinics had been demolished to be able to resume their practices from alternate sites.¹¹ Unfortunately, several practices in Joplin that suffered physical damage and were still using paper-based record systems had to close their doors after the storm; some providers had to join local hospitals instead of reopening their practices. But a number of physician practices, including those affiliated with St. John's and several others working with the Regional Health IT Extension Centers,¹² were able to resume caring for patients from alternate sites due to the presence of electronic records (personal communication, Dr. Lanis Hicks, Project Director for the Missouri Regional Extension Center (REC)).

Lessons Learned and Best Practices

Many lessons can be learned from St. John's, a member of the Sister of Mercy Health System, with respect to the utility of EHRs in the aftermath of disasters. Recently, Lynn Britton, President and Chief Executive Officer of Sister of Mercy Health System, expressed how advanced information technology (IT) planning helped recover and reestablish information and workflow in the aftermath of the Joplin tornado. According to Britton, "the performance of our electronic health record was an amazing bright spot in the midst of devastation. Before the storm had settled and the patients evacuated from the hospital, the medical record of each one had already been readied to follow them through their recovery." Mercy Health System's ability to swiftly rebuild St. John's IT infrastructure was largely due to a strategy that included: (1) standardization; (2) consolidation; (3) virtualization; and (4) the discipline to follow through on IT planning.¹³

The focus of standardization in IT is on removing variance. Standardization, a key component in Mercy's IT strategy, is centered on the establishment of standard applications and infrastructure footprints across all of its institutions. Consistency of applications, tools, and technology across different facilities allows the interchangeability of resources during both daily operations and under emergency situations. This standardization of operational processes enabled rapid deployment of staff and technology resources in the aftermath of the tornado. Since all aspects of the IT system were uniform throughout the entire health system, when on-site staff was unavailable to help, Mercy Health System was able to deploy IT experts to Joplin who were familiar with all aspects of St. John's network and ensure it could come back on line as quickly as possible after the disaster. Another focus of Mercy's standardization strategy was the elimination of single points of failure by building in redundant expertise, processes and technology that can be leveraged and deployed when needed as in the wake of disasters. This includes ensuring that auxiliary power and internet connections are available if the day-to-day systems fail, or ensuring there is a back-up call list for those with expertise who can reconfigure a system from a secondary location. In the case of St. John's Hospital, eliminating the potential failure points enabled rapid system recovery after the disaster (personal communication, Will Showalter, Chief Information Officer, Mercy Health System).

The consolidation component of Mercy's IT strategy was focused on ensuring high availability of systems to allow high quality of clinical care to be rendered, and reducing the number of applications that serve a given function (for example, using a single, uniform radiology imaging archiving system instead of multiple systems) within and across facilities. On the other hand, consolidation also facilitates protection and redundancy of operations for business continuity through a focus on data processing capabilities, specifically allowing data processing capabilities in a new primary and one secondary location. By having a secondary data center, at a location outside of each facility, Mercy is able to operationalize servers in the secondary data center should the servers in the primary data center fail due to structural damage to a given facility or other problems. In Joplin, the secondary data center increased system management and monitoring capabilities, allowing the rapid identification of points of failure in the system and the assessment of overall operational capacity after the disaster.

Virtualization is the process of creating virtual operating systems, servers, or network resources to allow flexibility in

services delivery. In the case of St. John's, virtualization enabled the system to be recreated off-site making the remote printing of patient records possible, in spite of St. John's, itself, sustaining significant structural damage. Within 20 minutes of the tornado impact, by protocol, the remote printing of patient records began.

Successfully implementing the different components of such IT strategy will be largely dependent on the discipline to follow through on IT planning, reinforcement through education, and documentation. In Joplin, this discipline ensured the ability to quickly assess parts of the system that were down, and the speed with which they could be recovered and made operational.

Electronic Health Records in Disasters Help More Than Hospitals

The role of EHRs in providing continuity of care in Joplin was not limited to hospitals. A Substance Abuse and Mental Health Services Administration (SAMHSA)-certified Opioid Treatment Program (OTP) in Joplin was destroyed. According to the SAMHSA administrator, emergency treatment for the 68 patients who typically receive daily methadone through this program was facilitated via an EHR shared between the treatment facilities in Joplin and Springfield. The EHR data for these facilities are stored at a central location in Texas. The respective clinics have separate databases with security provisions that allow need-to-know access when patients present to a site outside of their regular clinics as guests or in the setting of disasters, allowing continuity of care between centers (personal communication, Pan Hyde, SAMHSA Administrator).

In addition, according to Dr. Tom Sizemore in the Office of the Assistant Secretary of Preparedness and Response (ASPR), electronic dental records (EDRs) played a critical role in the identification of fatalities in Joplin. Dental practices that had adopted EDRs, including digital X-rays, with off-site backup systems were able to make these records available to the National Disaster Medical System's (NDMS) Disaster Mortuary Operational Response Teams (DMORT), in spite of their practices having been physically destroyed. These EDRs proved invaluable in the timely identification of all fatalities over the six-day period after the tornado, as well as to the ability of dentists to provide care to their patients in alternate sites (personal communication, Dr. Tom Sizemore, Principal Deputy Director, Office of the Assistant Secretary for Preparedness and Response (ASPR), Department of Health and Human Services).

Electronic Health Records and Recent Disasters

Within a year of the Joplin tornado, on March 2, 2012, a tornado struck Harrisburg, Illinois (USA). Fifty-three injured people sought care at the Harrisburg Hospital ED in the aftermath of the tornado. Harrisburg Hospital's ED typically sees 20 patients in a 24-hour period. On the day of the tornado, the department managed 53 patients in six hours. The emergency physicians who cared for the presenting casualties reported that their EHR facilitated managing the flow of patients by registering patients quickly and efficiently. In addition, the care for 25 of these patients was facilitated by the availability of their health records from the hospital's EHR system which enabled the provision of care to these individuals with their previous health records at hand. This tornado resulted in significant structural damage to the Harrisburg Hospital, requiring evacuation of 38 inpatients and the transfer of 20 casualties who were treated in that hospital's ED to other facilities for further care. Using the

hospital EHR, the medical records of all the transferred patients were directly faxed to the receiving facilities allowing continuity of care. Harrisburg Hospital never lost access to its EHR system, thanks to backup emergency generators and other backup systems that allow access to the EHR and patient registration functions from any laptop with a virtual private network (VPN) connection, from any location (personal communication, Rita Prather, Director of Health Information Management, Harrisburg Hospital).

A different, but similarly important, role for EHRs was also seen during the US relief effort in Haiti. According to Dr. Allen Dobbs, Chief Medical Officer for the US National Disaster Medical System (NDMS), data collected through the NDMS team EHRs allowed the tracking of demographic and clinical information and identification of the most common injuries and health concerns. This information, which was electronically submitted to the Secretary's Operation Center (US Department of Health and Human Services) in Washington, DC, revealed a high proportion of pediatric injuries, resulting in the deployment of additional pediatric health professionals to aid in the relief effort (personal communication, Dr. Allen Dobbs, Chief Medical Officer, NDMS).

Yet, as demonstrated in Joplin and Harrisburg, realizing the full benefit of EHRs in disaster response and recovery takes more than simply adopting an EHR system. A robust IT strategy, including standardization, consolidation, virtualization, and discipline will ensure both day-to-day function of EHR systems and rapid resumption of health care delivery in the wake of an emergency. Detailed, careful planning is needed when EHRs are installed on computers located within a medical facility, taking into account weather, fire and other local conditions. Where EHRs are remotely

hosted and accessed over the Internet, planning for challenges to the communications infrastructure is needed, including having a disaster recovery plan that will help sustain practices and enable the ability to provide essential health care services post-disaster when patients may be most vulnerable.

Looking Ahead

Electronic health records have shown, through the real-life experiences of communities nationwide, that they are integral to preparedness by contributing to disaster relief and recovery efforts through enabling continuity of care, disease and injury surveillance, and the identification of fatalities. Incentive payments are available for doctors and hospitals that adopt EHRs.¹⁴⁻¹⁶ As the pace of EHR adoption nationwide continues to accelerate, it is becoming increasingly apparent that not only are EHRs foundational to improving care quality in a truly 21st century health system, but also that they are viewed as a critical component to what is considered adequate disaster preparedness strategy and capacity.

Given the dual vital roles for EHRs, in both day-to-day practice and disaster relief and recovery, health care systems, community clinics, and individual providers alike should consider the transition from paper health records to EHRs a higher priority. When a disaster like Hurricane Katrina or the Joplin tornado strikes, many patients—and sometimes providers—are left with few remnants of their pre-disaster lives. By adopting and meaningfully using EHRs, provider practices and hospitals can continue to deliver care with their patients' medical records and critical health information left intact and accessible when most needed.

References

1. Baker EL, Koplan JP. Strengthening the Nation's public health infrastructure: historic challenges, unprecedented opportunities. *Health Affairs*. 2002;21:15-27.
2. Beeuwkes Buntin M, Burke MF, Hoaglin MC, et al. The benefits of health information technology: A review of the recent literature shows predominantly positive results. *Health Affairs*. 2011;30:464-471.
3. Hunt JS, Siemienczuk J, Gillanders W, et al. The impact of a physician-directed health information technology system on diabetes outcomes in primary care: a pre-and post-implementation study. *Informatics in Primary Care*. 2009;17:165-174.
4. Bell LM, Grundmeier R, Localio R, et al. Electronic health record-based decision support to improve asthma care: a cluster-randomized trial. *Pediatrics*. 2010;120:e770-777.
5. Fiks AG, Grundmeier RW, Biggs LM, et al. Impact of clinical alerts within an electronic health record on routine childhood immunization in an urban pediatric population. *Pediatrics*. 2007;120:707-714.
6. Bower A. Katrina's lingering medical nightmare. *Time U.S.* September 2005. <http://www.time.com/time/nation/article/0,8599,1107826,00.html>. Accessed March 30, 2012.
7. Benjamin R. Finding my way to electronic health records. *N Engl J Med*. 2010;363:505-506.
8. Brown SH, Fischetti LF, Graham G, et al. Use of electronic health records in disaster response: the experience of Department of Veterans Affairs after hurricane Katrina. *Am J Public Health*. 2007;97:S136-S141.
9. Fluckinger D. What Joplin teaches hospitals about disaster recovery planning. *SearchHealthIT*. June 2011. <http://searchtarget.com/tip/What-Joplin-teaches-hospitals-about-disaster-recovery-planning>. Accessed July 14, 2012.
10. Atwal P. Nurse administrator discusses how EHRs helped patients in Joplin. *Health IT Buzz*. June 2011. <http://www.healthit.gov/buzz-blog/ehr-case-studies/nurse-administrator-discusses-ehrs-helped-patients-joplin/>. Accessed March 30, 2012.
11. CMIO. Weathering the storm: CT, EHR prove mission critical. Published June 2011. http://www.cmio.net/index.php?option=com_articles&view=article&id=28433. Accessed June 28, 2011.
12. Maxson E, Jain S, Kendall M, et al. The regional extension center program: helping physicians meaningfully use health information technology. *Ann Intern Med*. 2010;153:666-670.
13. Enrado P. Mercy Health rises from the ashes, thanks in part to IT. *Healthcare IT News*. February 2012. <http://www.healthcareitnews.com/news/mercy-health-rises-ashes-thanks-part-it>. Accessed March 12, 2012.
14. Sullivan T. Health care reform: electronic medical records and health IT. *Policy and Medicine*. April 2009. <http://www.policymed.com/2009/04/health-care-reform-electronic-medical-records-and-health-it.html>. Accessed June 29, 2011.
15. Office of the National Coordinator. EHR incentives and certification. <http://www.healthit.gov/providers-professionals/ehr-incentives-certification>. Accessed March 30, 2012.
16. Centers for Medicare and Medicaid. <https://www.cms.gov/ehrincentiveprograms/>. Accessed March 30, 2012.