Expedited Electronic Entry: A New Way to Manage Mass-Casualty Radiology Order Workflow

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Abbreviations:
CT: computed tomography
EHR: electronic health record
MCI: mass-casualty incident
RIE: rapid improvement event

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Abstract

One of the important tenets of emergency preparedness is that planning for disaster response should resemble standard operating procedure whenever possible. Electronic order entry has become part of the standard operating procedures of most institutions but many of these systems are either too cumbersome for use during a surge or can even be rendered non-functional during a sudden patient surge such as a mass-casualty incident (MCI). Presented here is an experience with delayed radiology order entry during a recent MCI and the after action programming of the system based on this real experience. In response to the after action analysis of the MCI, a task force was assigned to solve the MCI radiology order entry problem and a solution to streamline disaster image ordering was devised. A "browse page" was created that lists every x-ray and every CT scan that might be needed in such an event with all required information defaulted to "Disaster." This created a way to order multiple images for any one patient, with 40% time saving over standard electronic order entry. This disaster radiology order entry solution is an example of the surge preparedness needed to promote patient safety and efficient care delivery as the widespread deployment of electronic health records and order entry continues across the United States.

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Introduction

A surge can be described as an unexpected increase in patient arrivals compared to typical patterns; "surge capacity" typically implies the ability to accommodate these unexpected patients.[1] Most studies that have examined the ability to generate surge capacity have focused on tangible resources such as personnel, supplies, equipment, structures and the systems required to manage these resources.[2] One of the important tenets of emergency preparedness is that planning for disaster response should resemble standard operating procedure whenever possible.[3] In this era of electronic health records (EHRs) and standardization of medical care, the deployment of electronic order entry within EHRs has become common and is part of the standard operating procedures of most institutions. Despite widespread deployment, without significant preplanning and programming, many of these systems are either too cumbersome for use during a surge or can even be rendered non-functional during a sudden patient surge such as a mass-casualty incident (MCI). When this occurs, health care providers may be forced to utilize a completely different system for order entry than used in standard operating procedures, causing significant delay or even opportunities for error and patient harm.[4]

Methods

Presented here is an experience with radiology order entry during a recent MCI and the after action programming of the authors' system based on this real experience. On July 20, 2012, the University of Colorado Hospital cared for 23 severely-injured trauma victims who arrived within a 15-minute time frame with essentially no pre-entry notification. At the time of arrival, the Emergency Department was at over 100% capacity with a full waiting room and holding 25 inpatient boarders.

Upon notification, the hospital activated the disaster plan and deployed the incident command system. The patients were all victims of penetrating trauma; many required immediate resuscitation including invasive procedures and administration of blood. As many of the patients had complicated injuries, the requirement for imaging was high, as was the commensurate need to order these images. In an effort to standardize workflow and decrease variability in the use of imaging, the radiology order entry system requires entry of detailed information including patient symptoms, indications and contraindications prior to allowing the order to be entered and the systems in place cannot produce images without a valid order. Under usual circumstances, this is good practice, allowing the radiology technicians to safely obtain images as well as providing the radiologist sufficient information to advise on the appropriateness of the studies and accurately interpret the images. During the mass-casualty response, it became clear that the radiology order entry system was too cumbersome and detailed for use and an alternative needed to be put in place immediately. An impromptu verbal system was created whereby three radiology technicians and a medical records specialist took physicians' verbal radiology orders, entered them into the EHR and then matched them to the patients in the PACS (picture and archiving communication system), allowing the radiologists to open and interpret the images. Over the course of 15 minutes, more than 150 imaging orders were requested and it was impossible to get the information into the EHR in a reasonable time frame.

In response to the after action analysis of the MCI, a task force was assigned to solve the MCI radiology order entry problem; a mini-rapid improvement event (RIE) with one radiologist, one emergentologist and one computer analyst was performed. Initial analysis revealed that in this institution's EHR (Epic, Verona, Wisconsin USA), a minimum of seven different clicks are required to order a plain radiograph and 10 clicks are needed to order a computed tomography (CT) scan. At that rate, approximately 1100 clicks would have been needed to order the 140 radiographs and 12 CT scans needed within the first hour of the MCI. Based on performance metrics of the fastest physician, that equates to 24 seconds per x-ray and 26 seconds per CT, which means it would have taken a minimum of 61 minutes to place the orders needed that night, which is not feasible during an MCI.

Results

The result of the RIE was a recommended solution for streamlining disaster image ordering. A "browse page" was created that lists every x-ray and every CT scan that might be needed in such an event; every required answer is defaulted to "DISASTER". This created a way to order multiple images for any one patient with six clicks plus the number of images ordered. Calculated for the same number of patients and images as on the night of the mass casualty, the total number of clicks was reduced from 1100 to 212. This change also decreased the time to 15 seconds for an x-ray and 16 seconds for a CT scan, which equals 38 minutes of order entry. This translates into a 40% time savings if every image was ordered separately and an even greater savings given that multiple images were ordered for each patient. For example, it took a physician 24 seconds to order seven x-rays and three CT scans using this new system, which means it would have taken 360 seconds (six minutes) to order all the images needed that night.

Discussion

At the University of Colorado Hospital, there is a robust history of emergency preparedness and response to mass-casualty care. Since the MCI on July 20, 2012 there have been myriad tabletop as well as live drills with many different internal and external scenarios. In response to after action reports from these exercises, an EHR surge capacity was developed in the form of virtual medical records and inpatient beds which can be assigned immediately when needed. These "disaster patients" are already in the system and it takes only a few seconds to activate them, allowing all the downstream processes to remain electronic as well as allowing providers to function within the EHR environment with which they are familiar.

To continue to improve the EHR surge response, other processes will be streamlined similarly to the new process for radiology ordering by identifying instances where multiple clicks are required for input and where the process can be tailored specifically to default to disaster. For example, in the EHR, ordering blood is a multiple-step activity, but creating a specific blood order that gets "trauma blood" with the requested number of units without any other information will save numerous steps. Another process that can be made more efficient for crisis situations is the admission and bed finding order. During an MCI, all that should be required is an admit order without the usual information such as admitting team and service. Ideally, all these "disaster-specific" orders should be in one order set that the providers can open, and with the minimum number of clicks, place all orders without any extraneous information required.

The main limitation of this kind of "disaster-specific" order entry is that providers may try to use these orders when there is not an MCI. It is important that these types of streamlined processes are used only during surge where rapid assignment of resources is required in crisis. Otherwise, there will not be sufficient information communicated to assure transfer of knowledge such as indications for imaging or smooth pass off or to determine typical nursing and bed resource requirements.

Conclusion

The disaster radiology order entry solution described in this report is an example of the enhancements needed for patient safety and efficient care delivery as widespread deployment of EHRs continues, and, perhaps, can represent a valuable lesson learned from a horrible tragedy. Continued review and optimization of all EHRs to prepare for any type of surge is recommended, and it is imperative that the medical community shares this kind of innovation amongst itself to promote disaster preparedness.

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