

## Situational (Un)Awareness

September 1, 2011

Abramson EL, Kaushal R. Situational (Un)Awareness. PSNet [internet]. 2011.

<https://psnet.ahrq.gov/web-mm/situational-unawareness>

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### The Case

A 75-year-old man was admitted on a Tuesday evening with abdominal pain, jaundice, and elevated liver function tests, including a bilirubin of 10.3 mg/dL. His CT scan demonstrated clear signs of acute cholangitis (an infection in the biliary tree, in this case due to blockage by gall stones). An order for IV antibiotics every 6 hours was placed electronically at 8:00 PM, and arrangements were made for an endoscopic retrograde cholangiopancreatography the following day to relieve the obstruction. On Wednesday morning rounds, the attending physician learned that the patient had not yet received any doses of antibiotic.

Subsequent analysis of the delay found the following: When an order is entered in the computerized provider order entry (CPOE) system, the computer assigns it a "next logical time for administration." In this case, the order placed at 8:00 PM on Tuesday was assigned a "next logical administration time" of Wednesday at 00:00. The pharmacist, uncomfortable with a 4-hour delay, manually overrode midnight and entered "9:00 PM," but the computer converted that to 9:00 PM on Wednesday, a change he did not notice. Nurses from two shifts—the night shift on Tuesday and the day shift on Wednesday—cared for this seriously ill patient, and none questioned why he wasn't receiving antibiotics or why the antibiotics were not scheduled to be given until 24 hours after admission.

### The Commentary

Medication errors are the most frequent type of medical error and can lead to significant patient morbidity and mortality.<sup>(1)</sup> Although health information technology, such as computerized provider order entry (CPOE), is viewed as a powerful tool to improve medication safety, CPOE can also facilitate medication errors. This elderly patient with acute cholangitis experienced a critical delay in antibiotic administration through a series of events related to CPOE use and poor communication between members of the patient care team.

In the inpatient setting, ordering errors are one of the most common types of medication errors.

Approximately 1% of inpatients experience an adverse drug event as a result of a prescribing error.<sup>(2)</sup>

Antimicrobials, as in this case, are the medication class most frequently associated with prescribing errors.(3)

Multiple studies have shown that CPOE can improve inpatient medication safety.(4) Linking a CPOE system with an electronic health record (EHR) offers additional benefits, including giving providers access to all patient data in the EHR. This not only helps facilitate medication prescribing, but also aids in coordination of other steps of the medication process including administration. However, use of CPOE is not a guarantee against errors. In fact, a recent review of literature from 2000–2009 found many studies highlighting safety issues related to CPOE use.(5)

For this patient, an initial focus on the process of electronic order entry is critical to understanding why antibiotic administration was delayed. The ordering physician appeared not to understand how the CPOE system generated medication administration times. This CPOE system seems to have been designed around the organizational principle of standardizing nursing medication administration times and defaulted to the nearest standard time for medication administration. This principle is commonly utilized to ensure temporal coordination within an organization, thereby optimizing workflow and improving patient care.(6) For example, within one hospital CPOE system, "q12" might always be translated into a medication administration time of 9:00 AM and 9:00 PM so that nurses don't have to remember distinct medication administration times for each patient. However, in select circumstances, failure to reset a default administration time can be catastrophic.

Recognizing this potential catastrophe in the case at hand, the pharmacist attempted to manually override the "next logical administration time" default setting, which would have resulted in a 4-hour antibiotic delay. However, in doing so, the pharmacist unintentionally worsened the situation when the computer automatically changed the start date from Tuesday to Wednesday. Careful checking and rechecking of orders on the part of the prescribing physician and the pharmacist might have avoided these errors. Clinical decision support (CDS) in the form of an alert notifying the pharmacist of the 25-hour delay might also have prevented the error, as there are few circumstances (exceptions such as surgical or procedural prophylaxis) in which an antibiotic is ordered more than 24 hours in advance. However, a major problem with reliance on CDS to avert errors is alert fatigue, whereby alerts are routinely overridden due to the high volume of alerts perceived as clinically irrelevant.(7) Indeed, override rates as high as 96% have been reported.(7)

Perhaps most essential to preventing errors such as the one in this case, however, is effective communication between members of the patient care team. Despite the fact that the patient was admitted with a clear and potentially life-threatening diagnosis requiring urgent administration of antibiotics, the doctors and nurses failed to recognize that the patient was not receiving any antibiotics overnight. In addition, the fact that no antibiotics were dispensed by the pharmacy signals a breakdown in communication between the pharmacist who received the order and the pharmacy technician responsible for delivering the medication to the unit.

Reliance on health information technology such as EHRs and CPOE to transmit important patient care information, rather than direct communication between providers, can negatively impact patient care. Research by Ash and colleagues found that implementation of CPOE can lead to overdependence on

technology, including a tendency for providers to assume that because a medical order has been entered into the system, the requisite action was performed.<sup>(8)</sup> In this case, both the admitting physician and pharmacist assumed that the patient had received antibiotics, although neither confirmed that this was the case. Had the physician communicated the plan of care with the patient's nurse, or the pharmacist instructed the pharmacy technician that dispensing this medication was a priority, failure to administer the antibiotic would likely have been avoided.

Furthermore, because CPOE allows orders to be entered remotely, physicians are frequently off-site when entering orders. This reduces direct communication between physicians and nurses, replacing it instead with the illusion of communication.<sup>(9)</sup> Research has shown this to be particularly problematic for emergency orders, when interpersonal communication is critical to effective execution of a care plan, but providers instead falsely assume that electronic communication is sufficient.

Additionally, providers who become too reliant on technology to facilitate clinical care may develop a blind obedience to the technology, such that there is no questioning of the accuracy of information provided.<sup>(8)</sup> For example, the two nurses caring for this patient did not question the fact that the patient was not receiving antibiotics. Although the nurses might have mistakenly assumed that the medications were administered on a previous shift and simply not yet charted, they failed to clarify this assumption with their colleagues or reach out to the physician team to ensure that the lack of a current, rather than future, antibiotic order in the CPOE system was intentional. As all of these factors highlight, stepping back from technology and using clinical judgement to determine if management is appropriate is essential to ensuring safe health care delivery, no matter how sophisticated our health information technology becomes.

## Take-Home Points

- Prescribers and pharmacists must check, then recheck, all medication orders.
- CPOE systems can help improve medication safety, but can also unintentionally facilitate errors.
- Direct communication between members of a patient care team is essential—electronic communication is not a sufficient substitute in emergent situations requiring time-sensitive action.

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### **Acknowledgment**

*The authors would like to thank Samantha Brenner, MD, for her time and effort in helping to review the literature used to write this commentary.*

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*This project was funded under contract number 75Q80119C00004 from the Agency for Healthcare Research and Quality (AHRQ), U.S. Department of Health and Human Services. The authors are solely responsible for this report's contents, findings, and conclusions, which do not necessarily represent the views of AHRQ. Readers should not interpret any statement in this report as an official position of AHRQ or of the U.S. Department of Health and Human Services. None of the authors has any affiliation or financial involvement that conflicts with the material presented in this report. [View AHRQ Disclaimers](#)*