EDITORIAL

Clinical Decision Support: A Tool of the Hospital Trade

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The adoption of electronic health records (EHRs) in US hospitals continues to rise steeply, with nearly 60% of all hospitals having at least a basic EHR as of 2014.[1] EHRs bring with them the ability to inform and guide clinicians as they make decisions. In theory, this form of clinical decision support (CDS) ensures quality of care, reduces adverse events, and improves efficiency; in practice, experience in the field paints a mixed picture.[2,3] This issue of the *Journal of Hospital Medicine* presents 3 examples of CDS that illustrate the distance between what we see as CDS' full potential and current limitations.

In the study by Herzig et al.[4] investigators took on the challenge of implementing stress ulcer prophylaxis guidelines developed by the Society of Hospital Medicine. The investigators first demonstrated that targeted electronic prompts captured patients' indications for acid suppressive therapy, and could be used to prohibit prescribers from ordering acid suppressive therapy among patients outside the intensive care unit (ICU) setting. Through an elegant interrupted time series study design deployed across 2 hospital campuses, the investigators were able to demonstrate immediate and clinically significant reduction in acid suppressive therapy outside the ICU. They further found that the impact of this reduction was augmented over time, suggesting that the electronic prompts had a sustained impact on provider ordering behavior. However, below the headline—and relevant to the limitations of CDS—the investigators noted that much of the reduction in the use of acid suppressive therapy for stress ulcer prophylaxis could be accounted for by providers' choice of another acceptable indication (eg, continuing preadmission medication). The authors speculated that the CDS intervention prompted providers to more accurately record the indication for acid suppressive therapy. It is also possible that providers simply chose an alternate indication to circumvent the decision-support step. Perhaps as a result of these 2 offsetting factors, the

actual use of acid suppressive therapy, regardless of indication, only decreased in a modest and statistically nonsignificant way, casting the true effectiveness of this CDS intervention into question.

Two other studies in this issue of the *Journal of Hospital Medicine*[5,6] provide valuable insights into interactions between social and technical factors[7–10] that determine the success or failure in the use of technology such as CDS to drive organizational performance. At the technical end of this sociotechnical spectrum, the study by Knight et al.[5] illustrated that a minimally configured and visually unintuitive medication decision-support system resulted in a high number of alerts (approximately 17% of studied orders), leading to the well-reported phenomena of alert fatigue and substantially lower response rate compared to those reported in the literature.[11–13] Moreover, the analysis suggested that response to these alerts were particularly muted among situations that were particularly high risk, including the patient being older, patient having a greater length of stay, care being delivered in the internal medicine service, resident physician being the prescriber, and the medication being on the Institute for Safe Medication Practices list of high-alert medications. The investigators concluded that a redesign of the medication decision-support system was needed.

The study by Chen et al.[6] illuminated how social factors pose challenges in implementing CDS. Investigators in this study were previously successful in using a combination of an education campaign and interruptive decision-support prompts to reduce the inappropriate ordering of blood transfusions. However, even with a successful intervention, up to 30% of transfusions occurred outside of recommended guidelines. This finding prompted the investigators to analyze the free-text reasons offered by providers for overriding the recommended guidelines. Two key patterns emerged from their structured analysis. First, many of the apparently inappropriate transfusions occurred under officially sanctioned protocols (such as stem cell transplant) that the computer system was not able to take into account in generating alerts. Second, many orders that reflected questionable practices were being entered by resident physicians, physician assistants, nurse practitioners, and nurses who were least empowered to challenge requests from senior staff.

Several practical and actionable lessons can be drawn from the 3 sets of investigators featured in this issue of the *Journal of Hospital Medicine*. First, all

investigators defined metrics that should be tracked over time to demonstrate progress and to make iterative improvements; this discipline is needed in both academic and community settings to prioritize limited CDS resources in an objective and data-driven way. Second, as the Herzig et al.[4] article illustrated, when it comes to evaluating the impact of CDS, we cannot be satisfied merely with process measures (eg, change in clinical documentation) at the expense of outcome measures (eg, decrease in inappropriate use of therapies). Third, as Chen et al.[6] recognized, CDS is but a component of an educational program to guide and alter clinical behavior, and must be deployed in conjunction with other educational tools such as newsletters, traditional lectures, or academic detailing. Fourth, clinicians with a stake in improving quality and safety should be on guard against the well-documented phenomena of alert fatigue by ensuring their organization selects an appropriate framework for deciding which CDS alerts are activated and—where possible—display the highest-priority alerts in the most prominent and interruptive manner. Fifth, CDS must be maintained over time as clinical guidelines and clinicians' receptivity to each CDS evolve. Alerts that are not changing clinical behavior should either be modified or simply turned off. Sixth, free text entered as part of structured data entry (eg, while placing orders) or as reasons for overriding CDS (as in Chen et al.[6]) offer significant insights on how to optimize CDS, and should be monitored systematically on an ongoing basis to ensure the EMR addresses users' changing needs and mental models.

So what is the clinician with an interest in improving healthcare outcomes and organizational efficiency to do given CDS' limitations? One option is to wait for the science of CDS to further mature and have those advances embedded in the EMR at your organization. Another option might be to rely on the information technology and clinical informatics professionals at your organization to decide how CDS should be used locally. In 2014, these may be untenable choices for the following reasons. First, given the universal pressures to improve healthcare outcomes and contain costs,[14] healthcare organizations must use all available tools to achieve challenging performance goals. Second, as EMRs with CDS become commonplace, and as the 3 articles in this issue of the *Journal of Hospital Medicine* and others have illustrated, there are many opportunities to misuse or poorly implement CDS, with potentially dire consequences.[15] Third, design and deployment of effective CDS require information technology and informatics professionals to collaborate with clinicians to gauge the quality of EMR data used to drive CDS and clinicians' receptivity to CDS, illuminate the sociotechnical context in which to deploy the CDS, and champion the CDS intervention among their colleagues. Clinicians' input is therefore an essential ingredient to success. Fourth, organizational trust, a key

aspect of a healthy safety culture, is hard to build and easy to erode.[9,16] If clinicians at an organization lose trust in CDS because of poor design and deployment strategies, they are likely to ignore CDS in the future.[17]

Like tools introduced into medicine such as magnetic resonance imaging and highly active antiretroviral therapy, CDS will need to evolve as the clinical community grapples with its potential and limitations. As EMRs move toward ubiquity in the hospital setting, CDS will become part of the fabric of hospital-based practice, and the *Journal of Hospital Medicine* readership would do well to learn about this new tool of the trade.

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