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Commentary

Computerized physician order entry and medication errors: Finding a balance

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Koppel et al's recent report on computerized physician order entry (CPOE) evaluated its role in facilitating medication errors [1]. Such studies are important because they can inform us regarding how to improve technologies like CPOE. This evaluation is also valuable because the authors studied a vendor-built product, and vendor-developed applications are the predominant type used in the U.S. today. To date, many of the studies of CPOE have been done in organizations like Wishard Memorial and Brigham and Women's Hospital, with "home-grown" applications [2–4]. The performance characteristics of these home-grown applications may be different from vendor systems in domains such as medication safety. This is both because the decision support has been improved over years in these institutions, and because the software has been targeted to the workflow in the individual institution, although the extent to which these represent an issue is uncertain.

A main limitation of Koppel et al's study is that it did not count errors or adverse events, but instead measured only perceptions of errors, which may or may not correlate with actual error rates. Further, it did not count the errors that were prevented. As such, it offers no insight into whether the error rate was higher or lower with CPOE. Unfortunately, however, the press interpreted the study as suggesting that CPOE increases the medication error rate. While the authors did not state this, a press release put out by JAMA did so.

In their paper, Koppel et al. were critical of other studies for "focusing only on its advantages." In fact, other studies that we performed at Brigham and Women's Hospital counted *all* the errors, both those caused by CPOE, and those prevented, and found that the net was a more than 80% decrease [3,4]. We also reported errors that were caused by CPOE, notably errors in potassium chloride ordering, but also other errors [3,4]. This area has recently been reviewed [5,6] and many recent studies have demonstrated large reductions in medication error rates, mostly in pediatrics [5–11]. In fact, all the published studies of which we are aware in which medication error rates were measured have found rate reductions with introduction of CPOE. The situation is much less clear for preventable adverse drug events, in part because studies to date have lacked sufficient power to detect even important differences.

The authors assert that there is no reason to believe that the CPOE application they studied is worse than any other. In fact, there are a lot of reasons to believe that—the CPOE application the authors studied is a very old application that requires multiple screens for many activities, a limitation that caused some of the problems identified. The authors' own institution has since moved toward implementing a much newer version of the software, which was not mentioned in the article. Most new software works better than old software. Unfortunately, the healthcare industry continues to use a great deal of outdated software. Koppel et al. have conducted another similar study with the newer software, and the results will be of interest.

However, newer software will not resolve all the issues noted. Many of the issues mentioned by the providers have little to do with the software, and much to do with changing the medication use process. As one example, their institution should have fixed the incorrect doses the authors identified. Any organization implementing

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CPOE must go through a continuous improvement process after implementation. We identified many of the problems the authors noted years ago, and nursing, pharmacy, and physicians worked together to address them. After implementing CPOE, we routinely tracked errors and problems that were created, and made thousands of changes to the original application. If I had one thing to "do over" in our CPOE implementation, it would be to have devoted more resources to this area—it is just impossible to "get it all right" at the outset, because the processes involved are so complex.

In the accompanying editorial, Wears and Berg suggest that information technology in healthcare has not delivered on its promise because more attention to socio-technical issues is needed; clearly these issues need to be better addressed. But in many respects they overstate their case. For example, they assert that 75% of all large projects in healthcare IT failed [12]. However, on closer examination, the original citation for this statement is a 1993 discussion paper published in the Oxford Institute of Information management, and it seems uncertain that this assertion is still true given the changes since that time such as the blossoming of the Web. They suggest the current situation is "waiting for Godot," implying that IT will never have an impact. But I believe that is far too gloomy a perspective. Similar reservations were raised when other technologies including the stethoscope were introduced.

Healthcare needs to change, and as the Institute of Medicine has suggested, one of the keys to improving safety and quality will be greater and more effective use of information technology [13]. Healthcare has long under-invested in HIT relative to other industries [14]. Wears and Berg are correct that HIT is only a tool, and that for it to have the desired impact socio-technical factors must be considered and addressed. But HIT is an extraordinarily powerful tool that should not be underestimated—to just give one example, the gains that are possible today with forcing functions that require, for instance, all the key fields in a prescription, and suggest the right dose for a patient simply cannot be realized with paper [4].

Koppel et al's paper generated a tremendous amount of attention and discussion within the informatics community. Most of the reactions were that the issues that the authors identified were already well known to those working in this area [15], and that the application being evaluated represented very old software with a long history. The Technicon System was originally developed at the Mayo Clinic in the 1960s by Lockheed, but was "judged too tedious for practical use." [16] Mayo wrote off tens of millions of dollars and went back to paper. It was then brought to El Camino Hospital in the 1970s, where it evolved further and was a success, at least for its time. While it has been updated since that time, many of the problems noted by the authors are likely still present because the software was written so long ago. But the overriding concern of the informatics community was that this report would slow the move toward increased use of IT in hospitals in the US, and in particular, the adoption of CPOE. Nearly, everyone agreed that the authors' main point—that when a new technology is introduced, it must be aggressively monitored and fixed—is essential. But many feared, especially given the press' response to this report that the adoption rate will decline.

We do need to learn how well the different CPOE systems perform, and in particular how well they perform with respect to medication safety. To this end, the Leapfrog Group has developed a test—which will be released later this year—that hospitals can run on their decision support capabilities, to provide at least a rough assessment of whether their CPOE application has the needed decision support. We will also need additional studies such as Koppel's, and also quantitative studies assessing the impact of CPOE, especially in small hospitals.

CPOE represents a transformative technology. It has many benefits beyond medication safety. Saying that "CPOE causes medication errors" is like saying that "cars cause accidents." Of course CPOE can cause medication errors. Clearly, we should strive to make it work better. Accident rates were high with cars early after their introduction, but few today want to go back to the horse and buggy. CPOE is here to stay, and it is vastly better than paper.

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