

*Editorial Comments* ■

# Physicians, Information Technology, and Health Care Systems: A Journey, Not a Destination

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Two papers in this issue of *JAMIA* discuss computerized physician order entry (CPOE) and a third one discusses patient clinical information systems (PCISs), which often include CPOE. The first paper, by Ash and colleagues, simply reports the rate at which U.S. hospitals and their care providers are adopting physician order entry systems.<sup>1</sup> The other two challenge the current push toward rapid adoption of CPOE and PCIS in the health care industry—Berger and Kichak,<sup>2</sup> by challenging the evidence base for the push, and Ash et al.,<sup>3</sup> by calling attention to many failure points that occur when rigid computer system designs meet the reality of really complex clinical systems.

Before commenting on these papers, we should confess our long-term infatuation with computers and a 30-year conviction that computers could be the “chicken soup” for many illnesses of the health care system. We proved that computer reminders systems *are* chicken soup for preventive care in a series of studies starting in 1976.<sup>4–7</sup> Then, during the early 1980s, we spent our nights and weekends and as much time as we could scrape from our workday writing, testing, implementing, and studying software for what would become the *Medical Gopher*,<sup>8</sup> the first PC-based order entry system used, and studied, in outpatient care.<sup>9–11</sup> More years were required to tune and adapt this system, born in an outpatient setting, for an inpatient service. Then we performed the first, and what may be the only, randomized trial of CPOE in the hospital and proved that our *Medical Gopher* order entry system *is* chicken soup to hospital inefficiency. It

reduced the cost of care and improved the workflow among CPOE users by 13% compared with the control group who used the traditional paper orders. An example of its benefit to work flow improvement is the 12-fold reduction in the delay from writing admission orders to the execution of those orders: from an average of six hours to 30 minutes. And physicians liked it. Because the hospital liked it too, we then extended it to include all hospital services. This hospital (perhaps coincidentally) now has the lowest mortality rate and the third lowest costs of all hospitals in the University Hospital Consortium (UHC).<sup>11</sup>

While on the subject of this controlled trial of the *Medical Gopher*,<sup>12</sup> we have to quibble with Berger and Kichak’s statement that it included only one internal medicine service. In fact, it included all six internal medicine services at the hospital, half of which used the computer order entry system and half of which did not. As we published papers on this system in the late 1980s and 1990s, some reviewers criticized the work as being irrelevant because no one else used or ever would use CPOE. So it tickles us to read that as many as 13% of U.S. hospitals now have CPOE.<sup>3</sup>

The principal argument for the push to adopt CPOE has been the promise of lifesaving benefits. While we believe CPOE has great potential to improve the health care process, we have to agree with Berger and Kichak’s position that a convincing case for lifesaving benefits has not been made. As Berger and Kichak point out, the keystone for these arguments—namely, the Institute of Medicine’s (IOM’s) claim of 44,000 to 98,000 deaths due to medical errors—crumbles on close inspection. The 98,000 figure was extrapolated from the 173 deaths (13.6%) among selected New York patients who were hospitalized in 1984 *and* had an adverse event. The extrapolation assumes that none of these fairly sick hospitalized patients would have died in the absence of the adverse event, and ignores the fact that the patients with adverse events had a death rate no different than the death rate (13.8%) of the target population from which they were drawn.<sup>13</sup> Any arbitrary criteria—such as being assigned a hospital number ending in the digit 3—used to select patients from the same target population would have led to the same high death rate.

Leape has suggested that one reason why airplanes are safer than hospitals is that the pilot goes down with the plane.<sup>14</sup>

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What he apparently fails to realize is that (1) hospitals are substantially more complex than airplanes (with more people and moving parts and systems that need to integrate), and (2), for a large number of disastrously ill patients, *the plane is already on its way down when the physician-pilot climbs on board.* Errors happen more often in the most complex situations, where mortality risk is highest to begin with.

Berger and Kichak also remind us that new technology is never completely virtuous. CPOE eliminates illegible orders and provides opportunities for better ordering, but computer systems also introduce errors of their own. As we were writing this editorial, the United States Pharmacopeia (USP) published a report to reinforce this point. Based on one year's worth of reports from 480 U.S. hospitals, the USP found that 8.2% of potentially harmful medication ordering errors arise from computer order entry errors.<sup>15</sup> (The majority of these errors were likely due to medication orders entered by a pharmacist or nurse.) A slip of the mouse on a computer menu can lead to an order for the right medication for the wrong patient. Ash et al. also testify to the existence of this problem in their paper.<sup>3</sup> This risk is unlikely to outweigh the other benefits of CPOE but should encourage developers to build traps for catching and preventing such errors.

Finally, there is the question of what added safety benefits arise from having one health care professional (e.g., the physician) instead of another (e.g., the pharmacist) enter an order when the computer system can apply exactly the same safety checks regardless of who enters the order. One might say physician order entry is needed to solve the prescription legibility problem, but when examined closely, this problem does not loom as large as assumed. Illegibility is not even listed in the top causes of medication errors in any of the large studies—probably because pharmacists call physicians to clarify illegible prescriptions.<sup>16,17</sup> Further, the legibility of physicians' writing is better than its reputation.<sup>18–19</sup> Finally, the problem of ambiguous medication names and doses can be ameliorated by Joint Commission on Accreditation of Healthcare Organization (JCAHO) regulations that will banish certain abbreviations and prescription writing conventions.<sup>20</sup>

Ash and colleagues raise a host of similar issues related to the ability of rigid computer systems to tame and serve the enormously complex and time-critical processes that churn within health care institutions.<sup>3</sup> Their report should be required reading by every health care system institution's CEO and CIO. Ash et al. remind us that highly structured clinical data are usually more difficult to enter, and almost always more difficult to read and to digest, than human-crafted text. Confirming their position, we noticed that our physicians choose the last hospital discharge summary, not the data flow sheet, as the first thing to read when reviewing a patient new to them in our computer system. The use of a structured entry form does more than convert what the provider would have said as narrative into computer-understandable content. Depending on its design, a structured questionnaire may also inhibit the recording of subtleties and details that would have flowed naturally as narrative. Structured entry forms *may* also demand more information than would have been recorded as free text. This can be bad or good, depending on the relevance of the extra questions to the patient at hand. Our profession lacks

evidence about the value and predictive content of most of the discrete history and physical elements it collects. The Ottawa ankle rule,<sup>21</sup> whose authors analyzed more than 50 candidate variables to find the eight that predict ankle fractures, illustrates the advantage of careful study of the value of clinical data collection. But since only a tiny fraction of history and clinical findings has had such careful study, computer systems that gather history and physical information through structured forms are prone to asking too many questions of unknown informational value.

In addition, Ash and colleagues teach us about the interruptive nature of the health care process.<sup>3</sup> Health care workers use computers in short bursts and flit among computers like honeybees among flowers. This usage model is quite different from the dominant model in the business world, where users log onto their computers once at the beginning of the day and stay with the same machine all day, making a 1-minute log-in tolerable. Health care workers may log into a different computer 10 times an hour and cannot afford a 1-minute or even a 20-second delay every time they log in. But CIOs and security officers are not always sensitive to this difference, and thus may employ the same slow operating system log-ons used in business settings, with disastrous effects on user efficiency.

Finally, Ash and colleagues call attention to decision support overload.<sup>3</sup> Too many nonspecific and repetitive reminders are the moral equivalent of e-mail "spam" and cause the same justified annoyance to the recipient. Further, such overload will dull the physician's attention to the less common reminders that really matter. The antidotes to excessive and inappropriate reminders are strict constraints on what reminder rules are adopted, i.e., rules that have a strong evidence base, that can be decided based on the kinds of information that the computer carries, and that are vetted by a balanced committee of the providers who get the reminders. Alternatively, physicians could decide what things the computer should remind them to do, turning "computer" reminders into "self" reminders.

No study has shown any direct health outcome benefit from CPOE, and we doubt that CPOE (order entry by the physician per se) systems will produce lifesaving benefits that cannot be delivered by other computer processes (e.g., checking on drug dosages when pharmacists enter the orders or reminders delivered to physicians through other mechanisms).<sup>22</sup> On the other hand, CPOE systems definitely can have large and important benefits on institutional efficiency and costs. Our study of CPOE showed a 13% improvement in care efficiency, but a zero difference in measures of patient outcomes either during or after the hospital stay. Others have shown similar results. Eighty percent of all care costs are initiated by a physician order<sup>23</sup> and CPOE systems can induce more cost-effective choices among their physician users. CPOE order menus can guide providers to the more cost-efficient test and treatment options by making it easier to choose them. CPOEs can pop up counter-detailing information about costs and better alternatives as the provider makes his or her choices.<sup>10,24</sup> Through rules and templates, CPOE systems can focus providers on the least expensive choice of medication within a class or the one for which the patient will have to make the least copay.<sup>25</sup> The CPOE system can even pick the most appropriate cardiac stress test for a given patient. CPOE

systems can also improve and simplify compliance with regulatory requirements, such as the management of short-stay patients, the implementation of medical necessity rules, and more. We have more rules in our system for controlling costs and facilitating regulatory compliance than for improving quality. Cost issues are crucial to our inner-city county hospital, which incurred a \$40 million deficit this year, even with all of our efforts. These dollars are ever more important for safety net hospitals such as Wishard in a world of reduced reimbursement.

CPOE systems can reduce unnecessary repeat testing<sup>26</sup> and the delays between writing and completing orders. They can also reduce labor costs directly by reducing the time spent by nursing, pharmacy, and other ancillary services on callbacks to clarify orders and by eliminating the personnel time of transcribing orders. So, health care institutions have much to gain in efficiency and cost savings from CPOE systems.

Sadly, this is a win-lose game. CPOE systems generally cause physicians to lose efficiency. It takes physicians longer to enter orders into computers than to write them on paper, and this can mean 30 or more extra minutes out of the physician's day<sup>11,27</sup>—time that cannot be used caring for patients. So the physician is being asked to pay the price for the efficiency and/or cost reductions that are enjoyed by the institution or payer. But because the imbalance is an economic one and the cost to the physicians is much less than the potential gain to the institutions and/or payers, many good options exist to make this a win-win game. First, institutions should not try to extract all possible communication efficiencies by forcing extreme or unfamiliar coding on the physicians, for the reasons articulated by Ash and colleagues.<sup>3</sup> The menus from which physicians choose their orders should correspond to what physicians now name as concepts (e.g., oxygen orders or ampicillin caps), not items defined by the inventory system (e.g., ampicillin 500-mg caps in 250-mg capsule bottles from Wyeth) or the billing system (e.g., oxygen 30% ventilator mask). Physicians should be allowed to select an order called "miscellaneous medication" and type in the name of the medication they want, when they cannot easily find the order in the menu displayed. And physicians should be allowed to write their instructions (Sig) for an order as narrative (e.g., 500 mg 4× per day × 10 days for earache) as they do now and/or edit the default instructions provided by the CPOE system. Institutions should not push for the capture of data that are not a part of conventional order-writing just to make life easier for their ancillary services, because this adds to the physician's time burden.

We have seen CPOE systems that demand the provider enter the start and end time as a specific time and date, and others that require the writing of sliding scale insulin as four or five separate orders instead of a single insulin order with the sliding scale given in the Sig. Yes, making such compromises will require that the institution invest some personnel time coding some physician-entered orders, but this is a fair *quid pro quo* for a physician commitment to CPOE. Furthermore, human reviews of some kinds of orders, for example, medication orders, will continue to be needed for safety reasons.

Second, the institutions and/or payers who gain the economic advantage of CPOE systems should recognize the

time cost to physicians and provide economic adjustments. One care system has provided an incentive for its employed physicians by adjusting downward the number of patients the system expects physicians to see each day. We can imagine other approaches, such as higher reimbursement rates to physicians who agree to write all of their inpatient orders through an order entry system.

Third, vendors and institutions have to be more focused and more inventive in simplifying physician order entry to eliminate (or at least minimize) the time disadvantage. The answer may lie with "bigger," more protocolized orders—e.g., a single order that could/would request the institution's preferred statin drug and also order appropriate testing for that drug.<sup>28</sup> Or perhaps for the occasional physician user, an option could exist for real-time dictation of orders to an operator who enters the orders into a remote computer, which echoes these entered orders back to the physician's computer where he or she can react to reminders and alerts and confirm or adjust the orders. Such a system has been implemented.<sup>29</sup>

We were glad to see the papers by Berger and Kichak<sup>2</sup> and Ash et al.<sup>3</sup> because they bring some needed balance to the current excessive expectations about CPOE and computer decision support and will lead to more successful and sustainable PCIS and health care outcomes in the long run. The political energy that is now being directed toward CPOE should instead be focused on encouraging faster improvements in the National Health Information Infrastructure (NHII)<sup>30</sup> and deployment of useful clinical data repositories. The NHII is a prerequisite to affordable health care information systems and such repositories are a godsend to physicians and necessary for useful decision support. These developments are also critical if CPOE and PCIS are to achieve their promise of enhancing the quality of health care while controlling its costs.

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