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## “e-Iatrogenesis”: The Most Critical Unintended Consequence of CPOE and other HIT

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In the September/October 2006 issues of JAMIA, Campbell et al.'s article “Types of Unintended Consequences Related to Computerized Provider Order Entry”<sup>1</sup> lays out an innovative and comprehensive framework for categorizing the things that can go wrong when CPOE systems are implemented. We commend the authors for helping to move forward our collective understanding of this important area.

As CPOE and other components of health information technology (HIT) logarithmically diffuse across the U.S. health care system, it is clear they will eventually become the standard all-encompassing platform for the delivery of medical care. As has been the case for all previous medical and non-medical technologies, HIT dissemination carries with it both positive and negative consequences. All nine types of “unintended consequences” outlined by Campbell et al. in their article should be of concern to health informaticists and others involved in health care.

We would like to suggest to the authors and your readers that one of the many unintended consequences they identified lurks as the most serious of all. Within Campbell et al.'s so-called “Type-7” category (new kinds of errors) is arguably the ultimate of unintended consequences: what we term “e-iatrogenesis.”

We define e-iatrogenesis as patient harm caused at least in part by the application of health information technology. Our team has coined this new term as part of an ongoing Commonwealth Fund/Robert Wood Johnson Foundation supported project to develop new frameworks for measuring and promoting ambulatory care quality and safety within the HIT context.

Using different labels, most scholarly discussion of actual or potential (i.e., “near-miss”) e-iatrogenic events have sur-

rounded CPOE ordering errors, particularly relating to drugs or diagnostic tests.<sup>2–4</sup> But we believe this is only the tip of the iceberg.

An e-iatrogenic event can be associated with just about any aspect of a comprehensive HIT system and it may involve errors of commission or omission. These unintended adverse events may fall into technical, human-machine interface or organizational domains. Some e-iatrogenic events will represent the electronic version of “traditional” errors, such as a patient receiving the wrong drug dosage due to a human click-error. But other HIT precipitated or enabled errors may have no exact analog in the non-electronic context. For example, a clinical decision support system (CDSS) embedded within an electronic health record might contribute to a clinician's incorrect diagnosis or treatment plan; this could represent either a “type-one” or “two” error (e.g., making a diagnosis that was not present or missing one that was).

Furthermore, while the focus of our discussion is human errors and technical design flaws, some e-iatrogenic events will not be due to errors, per se. Just as a properly used traditional medical intervention (e.g., a drug or procedure) may cause patient harm, it is inevitable that a well-designed HIT module used appropriately may also contribute to an undesirable outcome.

As part of our ongoing development effort (known as the “e-indicator” quality measurement project) we are working with a consortium of five advanced HIT enabled integrated delivery systems, and we have also interviewed numerous early HIT adopters across the nation. Universally, we are hearing reports that e-iatrogenesis, and the broader area of unintended consequences, is of concern at all of these top-notch organizations. What will happen as HIT is rolled out at organizations further down the diffusion curve?

By coining the term e-iatrogenesis and writing this letter our intent is to draw attention to this critical issue. We believe that both the health informatics and patient safety/quality communities must urgently collaborate to address this emerging problem. It is understandable that developers and vendors continue to promote the many ways that HIT can improve quality and reduce safety hazards. But we also believe it is imperative that all parties acknowledge that even with all its promise, CPOE and other types of health

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information technology represent a new 21st century vector for medical care-system induced harm—something we must all work to understand, measure, and mitigate.

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