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Differential Perceptions of What Constitutes a Medical Error Associated with Electronic Medical Records

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Abstract. Perceptions of errors associated with healthcare information technology (HIT) often depend on the context and position of the viewer. HIT vendors posit very different causes of errors than clinicians, implementation teams, or IT staff. Even within the same hospital, members of departments and services often implicate other departments. Organizations may attribute errors to external care partners that refer patients, such as nursing homes or outside clinics. Also, the various clinical roles within an organization (e.g., physicians, nurses, pharmacists) can conceptualize errors and their root causes differently. Overarching all these perceptual factors, the definitions, mechanisms, and incidence of HIT-related errors are remarkably conflictual. There is neither a universal standard for defining or counting these errors. This paper attempts to enumerate and clarify the issues related to differential perceptions of medical errors associated with HIT. It then suggests solutions.

Keywords. healthcare information technology, perception of errors, point of view, professional pride, medical systems

1. Introduction

The definition of an error associated with healthcare information technology (HIT) is remarkably subjective and depends on the viewer's frame of reference or lens of analysis. HIT vendors often attribute sources of error to implementation teams and software end-users, including clinicians. In our collective experience, we have seen HIT vendors blame

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hospital implementation staff, local software modifications, conflicting or misaligned priorities of hospital management, delays installing software upgrades, outdated hardware infrastructure, bespoke business processes and workflows, and failure to stay abreast of vendors' instructional messages. Vendors cite lack of user training, software knowledge, and failure to follow designated procedures when assigning problems to clinicians.

Within a local medical facility, departments and services often blame errors on other departments. For example, physicians or administrations may claim that pharmacy informatics staff incorrectly coded medications or that nurses wrongly administered medications in the format required (e.g., wrong route, dose, time). They may also implicate patient escort and transport staff for placing a patient in the "wrong" room.

While it is possible that one or more of these hypotheses are correct, more often it is a combination of errors or "latent" failure modes embedded within a system [1,2]. These system factors can be error-provoking (e.g., understaffing, inadequate equipment) or weak defenses (e.g., missing reminders, faulty alerts). Furthermore, in a complex adaptive sociotechnical system like healthcare, errors are often due to the interaction of the technology, the people, and the organizational climate – including leadership, values, and resources. The "cause" is so often the system, not any individual component. It is deceptively easy to blame an individual, software process, or implementation teams.

By contrast, the totality of the system is often beyond the perception of most participants who are embedded in one or another element of the operation, and not at the synoptic level. Concerning the root causes of error, all system actors, individually or collectively, are often involved in generating errors. The perceptions and detection of the cause will differ as a function of where each exists within – or above – a system.

Our challenge is to characterize the frequency of HIT-related errors and to better understand how perceptions of errors systematically differ across stakeholders and actors.

2. Counting Errors

Studies of HIT-related errors suffer from vast underreporting gaps impacting the denominator (the totality of errors) and the numerator (errors linked to IT). To illustrate this concept, we can use studies of medication errors. Most studies rely on clinician or patient self-reports, near-miss reports, and the use of signal or trigger drugs, e.g., drugs to counteract overdoses. Considering the vast number of medications prescribed, dispensed, and administered daily in any healthcare setting, we can safely assume that most errors are never detected or reported. Worse, harm caused by these errors may be unknown to the patient and to the provider! Why? Because patients are often very sick, take many drugs, are very young or very old, and suffer from acute and chronic medical conditions – often involving the organs that process and clear medications (i.e., the liver and kidneys).

By extension, HIT-related errors are even more complex and challenging to detect, report, or track. This can be for many reasons. An organization usually has multiple programs, processes, and devices working in concert. The sheer complexity of the ecosystem can make it difficult to isolate or characterize a discrete problem. There is the "black box" problem, wherein the users may not understand the algorithms or calculations the software uses, making it impossible to detect a failure. Finally, it can be impossible to detect a "non-event." How can a user know when an alert was supposed to fire but did not?

3. Differing Datasets

In the United States, the Electronic Health Record Association (EHRA) created a website enabling clinicians to report errors associated with their EHRs. The website, however, required clinicians to quit their current work, log into another website, answer many questions about their current tasks and IT systems, and then report the "perceived" problem. After that, the clinicians were obliged to return to their institution's IT system, find their patient and specific EHR screen (often requiring repeat identify authentication), complete the needed tasks, and continue with their work. Unsurprisingly, few, if any, clinicians reported problems via this process. The vendor association cited the lack of reporting as proof of EHR safety rather than as evidence of a reporting barrier.

In a United States Food and Drug Administration-sponsored project examining HIT safety, two teams offered new insights into HIT-related errors. They reviewed all patient safety medication reports during the medication ordering phase at six participating sites. After sifting through 1.4 million reports, they focused on errors that appeared to be related to the HIT [3,4]. In the two studies, the authors (including RK for both papers) reviewed all patient safety medication reports. For those related to CPOE, they assessed whether CPOE facilitated (actively contributed to) the error or failed to prevent the error (i.e., did not directly cause it but could have potentially prevented it). The researchers used a previously developed taxonomy to classify the reports. They concluded that 79.5% of the errors were associated with suboptimal software design and protections.

Magrabi et al. found that very few *reported* patient safety events were related to the HIT but emphasize that further work is needed on the classification of errors and on improving interface design to detect and reduce errors [13].

In another case, Graber and colleagues reported on the role of EHRs in patient harm, errors, and malpractice claims [5]. The article is remarkable for its data source and the analysis focusing on their findings' direction of causation. The authors identified errors not because clinician-reported EHR-related problems, but because the patient was harmed, the clinician or hospital was sued, and there was an insurance payment. Thus, Graber et al.'s database reflects the minuscule fraction of harm that results in payouts. And very, very few of these harms are identified, go to court, and result in payouts.

They found that over 80% of the reported errors resulted in horrific patient harm, including deaths, strokes, delayed cancer diagnosis, hemorrhages, drug overdoses, and missed critical lab results. These authors contend that we can address EHR-linked medical problems by reporting the [very few] known errors. We disagree! This method likely detects less than 1% or 2% of all errors. Worse, it deflects attention away from problems related to EHR design, user interfaces, and the lack of data and system interoperability. In sum, the article by Graber and colleagues – while a significant contribution to our understanding of errors – offers a mere pinhole view of the problems associated with poorly designed HIT.

4. Where We Look and Where We Sit

There's the old joke about the man who loses his keys at night in a field but limits his search to an area under a lamppost. When a bemused bystander asks him why he is only looking under the lamppost, he explains that it is the only place he can see at night. Our search for systematic measures of errors is similarly constrained and biased. For example, we often fail to consider how EHRs increase risk by isolating and fragmenting data

needed for patient care. These problems include lazy data visualizations, poor usability and organization of features, hidden or missing information (e.g., drop-down lists that continue for several screens), intrusive alerts that obscure parts of the screen, medication lists and problem lists that can't be seen when placing orders, and erratic or confusing reports. In our work, we often see data that should be contiguous, but instead are separated across three screens and require multiple clicks. Informational screens and interactive features rarely match intuitive or common clinical workflows. Finally, critical information on the patient may be lost because of proprietary EHR software, idiosyncratic data formats, inconsistent data standards, and a lack of interoperability [6,7].

4.1. A Disproportionate Focus on "User Errors"

There is a tendency in the technology industry to ascribe problems to "user error". This is unfortunate. More often than not, the causes of the errors are due to incomplete needs assessment, poor design, and lack of usability testing. While users are, indeed, a critical part of the equation, they are often the victims (along with patients). It's easier to blame users than to fix the EHRs and the system workflows. More than 20 years ago, Reason developed the "swiss cheese model of system accidents" arguing that for an error to occur all the holes in the defensive layers of a system must align [8]. Often Reason's models suggest the root causes of most technology-induced errors can be traced to upstream organizational issues. Hopefully, vendors will embrace a more user-centered ethos. Also, as patients gain access to their personal health information and participate in shared decision-making, they will be more empowered to express concerns, and in some situations, help identify problems and intervene to protect against error.

4.2. Usability Error Ontology

The "Usability Error Ontology" is a promising strategy proposed to advance our understanding of the perception problems inherent in error detection [9,10]. This ontology characterizes error types and recognizes root causes, thus helping designers avoid these mistakes in future work. It seeks to integrate this ontological framework into the person-centered design paradigm. Currently, few EHR developers systematically employ a person-centered design process throughout the product lifecycle. Failure to include the user and invest in usability testing leads to usability errors and the inability to specify the errors' causes. When usability takes a back seat to functionality, the lack of clarity about causes perpetuates ambiguities about responsibilities for those errors.

5. Discussion and Conclusions

Too often, we tightly couple our understanding of errors to a specific technology rather than the bigger health system where people, processes and technology interact. A key to surmounting this limitation is to adopt *Systems Thinking* — a concept we raised above in our argument for a synoptic perspective, i.e., encompassing the entire enterprise, including its technology, its people, its workflow, and all of the external factors that influence its operation [11,12]. We must draw on systems thinking to help understand the landscape of HIT-induced errors. For example, it is critical for data interoperability to standardize structured data, which, in turn, can force users to change their workflows to accommodate the new system and retrain on the software. All of these actions, alas

can lead to new errors that require additional analyses. As we look to track and categorize HIT-induced errors, we need to appreciate that the seed of the error may be planted in the larger ecosystem. This ecosystem includes modern delivery models such as team-based care delivery, where errors may arise from the interface among individual and collaborative workflows [6,12].

One way to practically build on this broader view of errors and their causes is to establish a governance structure that incorporates the many players: clinicians, technology staff, HIT vendors, and, yes, patients. HIT is a system, users are a system, the context is a system. HIT-induced errors cannot be represented by simplistic, unidimensional, or reductionist approaches as those fail to account for the system complexity where HIT is used. Thus, the organization needs an empowered governance process that embraces these many contexts and the people who build both the HIT and maintain the organization; those who build it, implement it, and depend on it. An important lesson is that identifying errors and their origins demands a culture that encourages the users and builders to speak up and loudly about their perceptions of problems and their sources. Achieving this may require new means of engaging with users to identify errors such as an anonymous website, or daily rewards for speaking up. Indeed, rather than punish users for asking about usability issues, errors, coordination, etcetera, we must honor those who help identify and question the system; as well we must honor those who seek to address errors in all of their complexity.

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