

Too Many Ways to Make an Error

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Abstract— Over the last decade, new unintended adverse consequences (UACs) related to all aspects of electronic health record (EHR) design, development, implementation and use have emerged. This requires re-focusing our research, development, and evaluation efforts to address these UACs to facilitate a safe, effective and efficient EHR infrastructure.

I. INTRODUCTION

In large part due to the \$35 billion HITECH Act, more than 96% of acute care hospitals now use EHRs, up from under 10% just 10 years ago [1]. Despite considerable progress, we have not achieved all that was originally envisioned. Additionally, there have been numerous unexpected adverse consequences (UACs) i.e., unpredictable, emergent problems associated with health IT implementation, use and maintenance [2]. We identified six new categories of UACs, each of which poses unique opportunities for the applied clinical informatics and engineering communities [3].

II. ADVERSE UNINTENDED CONSEQUENCES

Complete clinical information unavailable at the point of care

EHRs were supposed to stimulate a tremendous increase in availability of patients' clinical data. This increase in data availability depended on the assumption that once clinical data were in a computable format, they could be transmitted, integrated, and displayed across EHRs. This has not yet occurred.

Lack of innovations to improve system usability leads to frustrating user experiences

Although EHR usability has improved considerably since the days of hard-wired, keyboard-based, VT100 terminals connected to a mainframe computer, little has changed since the current mouse-based, point and click, GUIs were introduced over 15 years ago.

Inadvertent disclosure, or temporary loss, of large amounts of patient-specific information

Health care is increasingly a victim of large patient privacy breaches and ransomware attacks. Some of these are the result

of external bad actors trying to take advantage of the increased monetary value of personally-identifiable health-related data. Others are the result of health care organizations' failure to take the necessary precautions to protect their systems.

Increased focus on computer-based quality measurement negatively affects clinical workflows and patient-provider interactions

The move from fee-for-service to pay-for-performance payment models requires EHR-based clinical quality measurement. This push has necessitated an increased need for capturing complete, accurate, structured data that can be extracted, aggregated, and reported. Structured data entry requirements have resulted in increases in clinician work load.

Information overload from marginally useful computer-generated data

As the breadth and depth of computer usage has increased, so has the amount of information that clinicians are required to review. The capability for patients to generate, capture, and transmit information about various physiological or physical processes exacerbates the amount of information available.

Decline in the Development and Use of Internally-developed EHRs

Over the last decade, the number of EHRs developed and maintained by small groups has declined as large academic centers adopted commercial EHRs and acquired small practices. Many of the previously developed innovations are not being translated to the new EHR products.

III. CONCLUSIONS

Each of the UACs identified is a significant challenge to EHR developers and users, but each also suggests new research directions. Opportunities to leverage health IT to impact health and health care have never been greater. We must re-focus our policy, practice and scientific efforts to address UACs and facilitate a safe, effective and efficient EHR infrastructure.

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