Collaborative Intelligent Case Design Model To Facilitate Simulated Testing of Clinical Cognitive Load

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Abstract

EHR use has shown substantial growth, with the concomitant evolution of training paradigms for both clinicians as well as non-clinical EHR users. However no optimal or standardized training protocols for clinicians have been promulgated to date. Promoting EHR proficiency amongst clinicians has been challenging, in part because the clinical environment is not conducive to EHR training. The use of simulations may offer substantial advantages with respect to promoting EHR-use proficiency. One tenet of successful simulation-based EHR training is the development of robust cases that can be utilized to meet training goals. Default test cases included with EHR implementations are typically insufficient to meet these needs; therefore we propose Six Principles that allow the successful creation of Intelligent Cases for EHR simulation-related clinician training that emphasize error recognition and correction and generate a cognitive load commensurate to real-life clinical situations.

Introduction

Electronic health record (EHR) use has grown substantially in the last decade, primarily due to the disbursement of financial incentives mandated by the HITECH Act and the implementation of meaningful use (MU) criteria. Another factor critical to increased EHR use is the perception of the electronic health record as a tool not only to improve reimbursement and documentation, but also to enhance the quality of healthcare delivery and patient safety.

With the growth of rapid EHR implementation schedules, clinical and health IT personnel training with respect to EHR use has also evolved. The Office of the National Coordinator for Health Information Technology (ONC) defined 12 workforce roles for HIT professionals, and tasked five universities to create curricular materials that could be used to train the burgeoning HIT workforce. However no such defined training protocol for health care providers and other clinical EHR users has been promulgated, and many healthcare organizations develop and implement their own training protocols geared towards facilitating EHR training for providers, or depend on their EHR vendor to advise them with respect to training-related issues.

Additionally, promoting optimal EHR use amongst clinicians has been challenging. This is an important issue to consider, especially since studies have suggested that electronic health record use is influenced substantially by issues affecting physicians’ proficiency with the EHR. Thus improving clinician proficiency with respect to EHR use may improve efficiency and safety of care.

One particular issue associated with EHR training is that clinicians do not get to practice in a live or "production" environment. Typically training is conducted on instances of the EHR that do not contain protected health information (PHI). These training instances may be populated with some patient records, but typically these are artificial, small in number, and are simplistic in content. In many cases they are populated with little or no clinical data; and even patient records that contain data usually do not include information that is in any way coherent or reminiscent of real clinical scenarios.

Thus clinicians who train with bare-bones patient records face cases that are removed from reality, sparsely populated with data, and poorly representative of real-life EHR use. This is particularly the case with ICU EHR records, where in real-life situations patient charts may contain in excess of 1,500 data points per day.
While on the surface conducting clinician EHR training utilizing real-life cases, seems to offer advantages, there are substantial impediments that discourage this practice. Firstly, real life situations are unique and no two patients present with identical clinical presentations or EHR data, and thus standardization is difficult. Second, allowing training in a live environment increases the likelihood of introducing patient safety issues, for example if a clinician who is in a EHR training session introduces erroneous information into a real patient record. Further, use of actual cases can lead to breaches of PHI and thus violations Health Insurance Portability and Accountability Act of 1996 (HIPAA) privacy rules.

Using simulations to facilitate EHR training

Simulation-related modalities are now extensively incorporated in medical education to replicate real life situations, facilitate learning in a risk-free environment, and allow for a reliable assessment of clinician competence\(^7\). Not only can simulations facilitate the practice of clinical skills without endangering patients, but can recreate the challenges of complex real-life situations\(^8\). Simulations have also moved beyond traditional mannequin-based exercises, with comprehensive simulated environments closely replicating real-life, such as the creation of a realistic anesthesia simulation model in the operating room\(^9\). Techniques for assessing simulation activities have also become more robust and comprehensive\(^10,11\).

We have successfully utilized high-fidelity clinical simulations that incorporate complex clinical data to evaluate clinician EHR use in the ICU, and assess patient safety\(^12\). Our study utilized gaze tracking techniques to help enumerate the data that physicians were visualizing as they perused the EHR, and how the visualization (or not) of essential data helped (or hindered) their ability to find and correct errors built into the simulation cases. Other studies have subsequently validated this model of using high-fidelity simulations, for example one study employed usability testing utilizing think-aloud techniques and "near live" simulations where providers interacted with video clips of standardized actors posing as patients, and utilized the EHR during the scripted scenario. At the time of their interaction, screen capture software was used to record the activity\(^13\).

Desirable characteristics of clinical cases used for EHR simulations

Default test cases in EHRs, usually included in implementations by the EHR vendor, are unsuitable for high fidelity simulation because of their lack of clinical context and sparse data points. In order to effectively utilize EHR simulations either for research or for clinician training, we posit that the system needs to be populated with complex, data rich cases that mimic real-life clinical situations and offer a high amount of cognitive load to the clinicians who access them, thus representing real-life conditions and workflows in a convincing manner. Further, these high-fidelity simulations also need to replicate an important aspect of EHR use; they must possess characteristics that allow the replication of errors generated as a consequence of the cognitive load placed on clinicians.

These errors of cognition are associated with filtering, extracting, and appropriately using clinical information gleaned from the EHR\(^14\), which more simplistic simulations (which do not place an equivalent cognitive burden on the subject) cannot replicate. The fact these errors are not currently generated during EHR-use sessions utilizing current training paradigms makes them that much harder to identify and rectify them when they occur in real-life conditions.

Building Intelligent Cases

Typically EHR training cases are either created by IT personnel, who have no clinical background and therefore are unable to provide contextual realism to the case, or by practicing clinicians who are unfamiliar with simulation models or technical aspects of deploying cases within an EHR. Thus "Intelligent Cases", our term for complex, realistic cases that place an appropriate cognitive load on the subject, require a collaborative approach to their creation.
We built our test cases utilizing a collaborative interdisciplinary team-based approach, with practicing clinicians building details of the clinical scenario, clinical informaticians with expertise in usability translating desirable EHR use characteristics to clinical workflows, an EHR trainer and system builder with intimate knowledge of current training paradigms and the actual process of populating data into the EHR providing input into the optimal pathway for integrating the case into the EHR, and information systems specialists with technical expertise of the EHR architecture to assist with creation and maintenance of the EHR simulation instance, and with system modifications and interface redesigns which facilitate optimal EHR use.

Others have also utilized a multi-disciplinary approach; one study created a simulated ED patient case and deployed it within an instance of their emergency department EHR. Case building required coordination and collaboration with simulation staff and information system teams.

Principles of Collaborative Intelligent Case Design

We propose Six Principles for the successful creation of Intelligent Cases for EHR simulation-related clinician training that emphasize error recognition and correction and assume the generation of an appropriate cognitive load commensurate to real-life clinical situations.

1. Case-building must emphasize a patient-centric record, and involve a team composed of members of the interdisciplinary clinical care, informaticians, simulation experts, and information systems specialists.

2. Cases must allow subjects to recognize abnormal data as determined by the patient's clinical presentation, and not just by established norms. This is essential since many complex clinical situations require clinicians not only to differentiate "normal" and "abnormal" data, but also to contextualize them within the framework of the patient's individual characteristics or clinical trend.

3. Cases must incorporate both common as well are rarely encountered data, appropriate to the clinical scenario. This will allow training scenarios to allow clinicians to find both routinely available data as well as more uncommon facets of information that are essential to clinical problem solving.

4. Cases must contain a level of data density that is commensurate to the clinical environment the trainee is familiar with and expected to operate under. This requires the creation of specific cases for individual specialties and clinical settings of care. The data also needs to be represented appropriately in a temporal fashion, i.e. over an appropriate period of time for the clinical scenario under consideration.

5. Case design should test not only the subject's ability to find included data, but also recognize when relevant data is absent from the record, allowing the subject to calibrate diagnostic reasoning appropriately to compensate for uncertainty generated due to absent data.

6. Case design should align with current best practices and incorporate meaningful use criteria, reflecting both national standards of care as well as established practices of efficient use of the EHR.

Conclusion

Simulations allow advanced clinician training with respect to EHR use, but patient records created for simulation need to reflect Intelligent Case design principles, involve a collaborative interdisciplinary team in their creation, and adhere to Six basic Principles in order to successfully facilitate training regimens that foster optimal EHR use.

References

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