Author’s response to reviews

Title: Participation in EHR Based Simulation Improves Recognition of Patient Safety Issues

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Author’s response to reviews: see over
Dear Prof Matthias Siebeck:

We are officially submitting our revisions to our manuscript "Participation in EHR Based Simulation Improves Recognition of Patient Safety Issues" for consideration for publication in BMC Med Ed. Thank you very much for your consideration of our manuscript. The comments from the reviewers are extremely useful and we have addressed these is a point by point response below. We have attempted to address all of the reviewers’ comments and made significant modifications to the manuscript. We feel these changes have improved the clarity and quality of the manuscript and now hope that our manuscript is acceptable for publication in BMC Med Ed. We believe the focus of this manuscript will be of great interest to the readership of BMC Med Ed and will help advance the field as a whole. Thank you for considering our manuscript for publication.

We hope that you find this manuscript as exciting as we do.

Sincerely,

Jeffrey A. Gold, MD

Professor of Medicine
Program Director, PCCM and CCM Fellowship
Co-Director OHSU Simulation Center
Response to Reviewers

Reviewer #1
1. Discretionary Revision.
   a) Abstract - Objectives- 1st sentence: "EHR are becoming...the clinical enterprise." Word "enterprise" may be better replaced by environment.
      Agree, changed
   b) Introduction paragraph 2; last sentence: authors mention that in a 24 hour period patients generate 1800 data points. What do they mean by data points? What is their definition? For the purpose of that study data points were defined as “fluids, respiratory and ventilation, vital signs, nursing care, neurologic, laboratory results, and dialysis-extracorporeal membrane oxygenation therapy (ECMO) data. Information from free text writing in the nursing, physician, and pharmacy notes, verbally communicated information, and medication orders and administrations was not included.” We have adjusted the introduction to first, to correct a typo (it is 1400 data points) and second, to mention what data items were not included in their analysis (notes, medications)

2. Minor Essential Revisions:
   a) Results - paragraph 3; last sentence: when discussing repeat takers mention that 20 participants had an interval between testing greater than 4 weeks. What was the time scale: i.e. was it between 4 weeks and 4 months. If there was a marked time between initial and retesting was there less improvement or more improvement in participants finding safety errors.
      For subjects who were tested at least 4 weeks after initial testing, the repeat period was up to a year later. There was no impact on outcome
   On same aspect: 5 participants interval of less than 4 weeks: how many retook at 2 weeks? 1 week? 3 weeks? etc. Any variability
      4/5 subjects retook 1 or 2 weeks after initial testing and there was no impact on outcome

Comment: Reading this paper I wondered if reason the participants ability to identify safety issues improved was as a result of being given information on how to access data from the system and teaching them how to use functions of the EHR. Also as mentioned in the discussion, those retested being more familiar with the system and being able to navigate around more competently, as well as, being able to bring up graphs of results would also be able to detect safety issues easier or have a better understanding of how to find these.
      We agree and hope that the discussion was able to emphasize this point.

Introduction- paragraph 2: the authors highlight unintended consequences associated with EHR may be as a consequence of inadequate training and education. The reason those "retakers" identification of errors improved is surely as a result of training they received?
      We absolutely agree. However, to our knowledge, that this paper is the first to use high fidelity simulation as a training modality. The information on paragraph 3 highlights the limitation of currently employed training modalities

Discussion - paragraph 2: I wonder if the identification of patient safety issues improved due to increased use of the system in period between tests rather than participation in the simulation as they suggest. The simulation exercise improved use of the system and thus, improved safety issues being identified. It served the purpose of improving patient safety.
      This is a fair criticism of the paper and we cannot full exclude this. However, given that performance of repeat test takers was greater than first time test-takers irrespective of level of training
makes this highly unlikely. In other words, an intern who participated in repeat testing still outperformed an R3 with 3 years of use of the system.

Discussion - paragraph 3: participants "degree of improvement was inversely related to baseline performance". Those who were least unfamiliar/understood the system with training were then able to use more efficiently and effectively and thus, their identification of patient safety issues increased.

This is correct

Discussion - paragraph 6: wonder whether participants doing the exercise in the ICU area at terminal (adds to realism) but may have been other distractors happening within the area which may prevent the recognition rate of patient safety issues reaching 100%: thus, indicating in the real environment 100% of safety issues may never be achieved. (Other factors also mentioned in Discussion- paragraph 7)

We agree and is a great point. We believe that for full testing and training of an EHR, it must include both relevant content and be used in the actual environment in order to understand both the limitations of the system as well as the user. However, we acknowledge that this may have biased the results towards reduced recognition, however it does not impact the main focus of the study which is to determine the learning effect of participation. We have added an additional statement in the discussion to address this.

Reviewer #2
1. Introduction Line 125—Authors state that the trainee identification of errors is independent of training level. Is it related to previous experience with either the tested EMR or any EMR experience?

This is an excellent point. Our clinical EHR has been in place since 2009 so all subjects, when they began their training at OHSU have used our current version. However, we do not have any information on prior EHR use and specifically which vendor(s) were used. We have added this into our limitations paragraph

2. Results: For readability purposes, the authors should consider renaming the cases something other than case 1 and case 2 (e.g. “sepsis” and “ARDS”). This would particularly help with paragraphs on pages 10-11 which are somewhat difficult to follow.

We understand the reviewers concern. We have previously been instructed not to label the cases based on content as to avoid misleading readers. We would prefer to leave the cases labeled as is, however, if the editor feels the names must be changed, we would gladly comply.

3. Results Figures 2-3 are somewhat redundant and can probably be combined.

While we agree there is overlap in the 2 figures, Figure 2 is combined for both cases, whose main purpose is to demonstrate that those who participated in the repeat testing were no different from the remaining cohort. We would prefer, for clarity and based on the queries from others who have viewed these data in presentations to leave both figures in to avoid confusion if the reviewer is ok with this.

4. Discussion Line 162: Do you have data as a function of time between testing sessions (e.g. did subjects tested a week apart demonstrate more or less improvement compared to subjects whose second test was further from the first). If more improvement was seen at shorter intervals, it might suggest a larger effect of the simulation itself whereas if more improvement was seen with longer intervals, this might suggest increasing familiarity with the EMR over time.
Given the small number of subjects we decided to divide into either retesting within the same or different block and failed to notice any difference.

5. Discussion Lines 285-287: This sentence needs to be clarified and only makes sense if the reader is familiar with the competencies required by the ACGME.

While a full discussion of ACGME competencies is beyond the scope of this manuscript, we agree and have added a clarification and reference to help with this.

6. Discussion Lines 304-305: The authors acknowledge that they cannot distinguish acquired EHR skill from improved cognition and this is a key limitation to the study. If the goal is to improve patient safety it may not matter, however, is there a way to correct for this by “normalizing” for cognition using board scores (though this does not test the same things as the case based simulations). Alternatively, is there a way to correct for EMR utilization or exposure both at baseline testing and with repeat testing as mentioned above?

This is a very interesting point. While we mention cognition, it, in this case, refers to cognitive decision making and thus unsure if board scores would accurately represent this. We currently do not have access to the board scores of the residents who participated and thus could not perform this analysis. However, it is interesting and something we will consider analyzing -- while we may not use board scores, we may try to use other objective measures such as inservice exams.

7. Discussion Lines 319-320: Is the inability to recognize specific errors or types of errors related to data presentation? While this may be beyond the scope of the current manuscript, perhaps the authors could comment on this.

We are not sure why certain errors were not recognized and probably a multitude of factors. Some issues were errors of omission (absence of data in the chart), other are related to the process in which data are viewed. This is the subject on an ongoing study with the incorporation of eye tracking and hope to have additional information t