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INNOVATIONS SUPPLEMENT (SRSIS)

# Low-cost electronic medical record interface for healthcare simulation

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## Introduction

Simulated medical records guide experiences in simulation by providing key clinical information [1]. As educators, we observe a range of interactions with medical records in team-based simulation. For example, facilitators may reference them as prompts, novice learners apply new skills in gathering information, and senior clinicians filter information quickly to make complex decisions. It naturally follows that participants should have access to familiar and realistic medical records to allow understanding of scenario context and communication of the patient's story.

Simulated medical records are usually paper based rather than electronic, which may conflict with the participants' normal experience. This incongruence risks distraction and may limit 'suspension of disbelief' and scenario engagement, potentially inhibiting transference of learning [1]. While electronic medical record (EMR) use in simulated system testing and individual learning is widely described, there is little reporting of its use in team-based simulation [2–4]. Therefore, this pilot study describes and evaluates a low-cost EMR interface designed for team-based simulation.

## Innovation

Four commonly used simulation scenarios were designed using slide presentation software with consultation of local simulation stakeholders. High-resolution screenshots of the current EMR (Cerner™) were captured and patient identifiers were removed (Figure 1). Substitute patient information was transferred from soft copies of existing paper cases into the new simulated EMR, including demographic information, documentation, laboratory results, medications chart and observations chart.

Populated sections were hyperlinked to facilitate realistic interaction, while non-populated areas were hyperlinked to the current slide to prevent unwanted slide progression. The final version is available as a free open-access education (FOAMed) file at [www.emergencypedia.com/EMR](http://www.emergencypedia.com/EMR).

## Evaluation

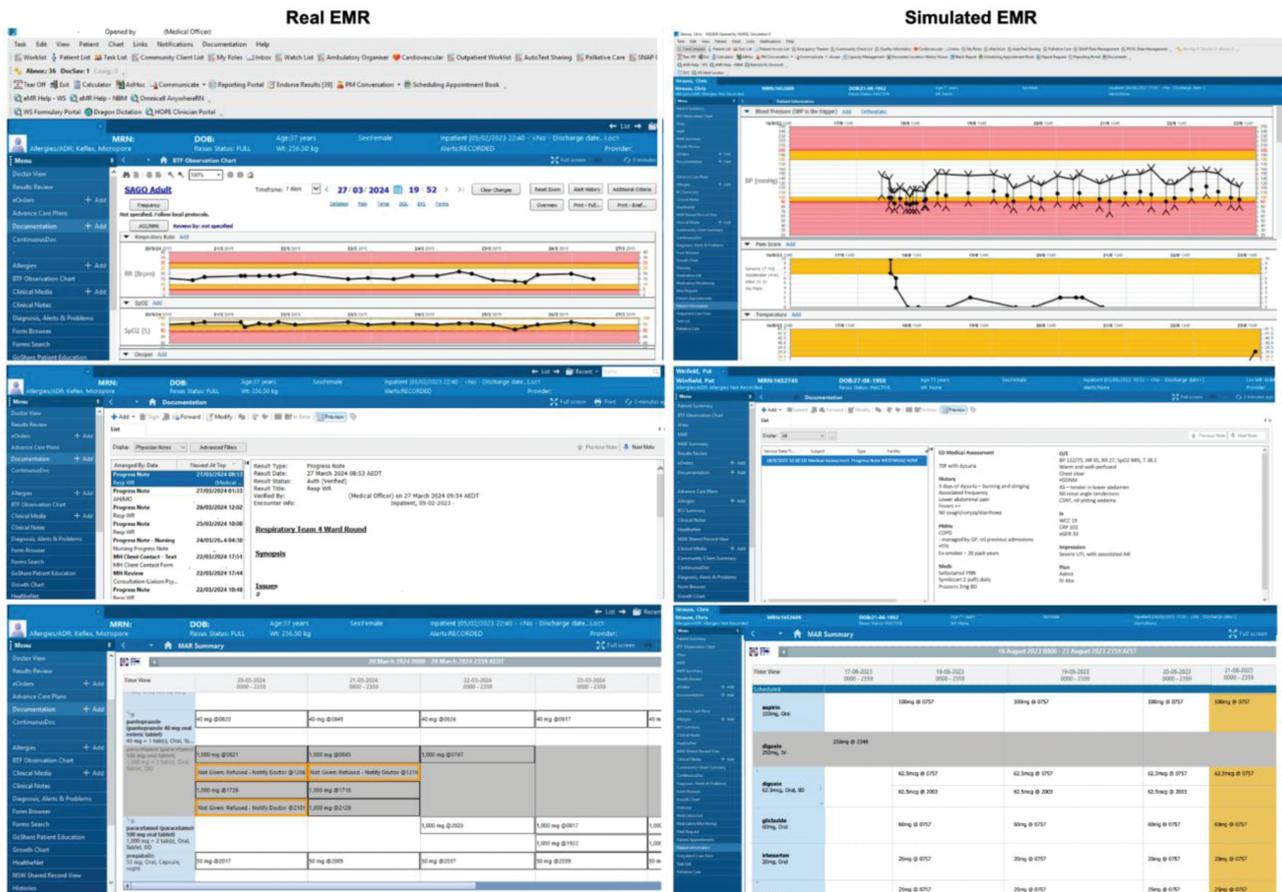
To evaluate the simulated EMR, we enrolled in consecutive simulation courses that used four eligible scenarios from January to March 2024. Paired rooms ran the same scenario after being allocated by location to either paper record or EMR. Participants (faculty and learners) were then invited to complete a brief simulation survey including questions evaluating the medical record (Table 1). Outcomes included clinical role (doctor, nurse and staff) and experience (years),

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**Figure 1:** Screenshots of the simulated electronic medical records (EMRs) and the institution equivalent (Cerner™). Comparison of real (left) and simulated (right) EMRs with three sample screen captures comparing the observation chart (top), documentation (middle) and medications chart (bottom).



7-point Likert scale questions (Table 1) and optional commentary. Likert scale questions were analysed with Mann–Whitney non-parametric testing. Given the limited quantity and detail of free-hand responses, qualitative analysis was performed using a manifest content approach to identify repeated ideas. These concepts were then evaluated against the data iteratively using deductive analysis to form thematic conclusions (Table 1).

**Outcomes**

Approximately one-third of course participants completed a survey (n = 76). Of those, the majority had a medical background (n = 63). There was a wide range of clinical experience (nil experience n = 24). Table 1 summarizes the major outcomes of the study. There was a statistically significant improvement in participant perception of how satisfactorily patient medical records were simulated with the EMR version but no difference in perceived clinical usefulness, contribution to learning or overall realism of the scenario.

Key qualitative themes emerged around medical record realism, user experience, contribution to learning and future improvement. The simulated EMR was rated highly in terms of realism and user experience, whereas paper records were found to be ‘awkward’ and unfamiliar. Regarding learning, participants did not directly comment on the contributions of the EMR but found paper records to be ‘sufficient’ for learning, despite not accurately representing

clinical norms. Improvements were suggested by users such as discrepancies in patient names for paper and future functionality for EMR.

Table 1 summarizes a quantitative and qualitative comparison of electronic and paper medical records as evaluated by our post-simulation survey. EMRs more satisfactorily simulated records compared to paper, with a statistically significant higher median score. While EMR had a higher median score reported for clinical usefulness and contributing to learning, this was not statistically significant. There was no difference in the overall scenario representation. Key themes of the qualitative feedback in terms of realism and fidelity, user experience and functionality, contribution to learning, and future improvements, are discussed by comparing the EMR to paper records.

**What’s next?**

Quantitative and qualitative evaluation showed this simulated EMR improved realism and engagement. We observed that the impact of realism on learning was more complex, which previous researchers have suggested to be due to the increased cognitive load that enhanced realism may impose [5]. It is thus important to design simulations with appropriate equipment selection, including medical records, to achieve the desired learning outcomes.

**Table 1:** Comparative summary of survey responses by the users of simulated medical records

7-Point Likert questions in survey (Median, IQR)	Electronic medical records (n = 44)	Paper medical records (n = 32)	Mann-Whitney test, p-value
1. Satisfactory simulation. Overall, the medical records satisfactorily simulated clinical patient records, for example, observations, medication chart and documentation.	6 (IQR 5–6)	5 (IQR 4–6)	0.001 <sup>a</sup>
2. Clinical usefulness of the records. The patient records represented useful clinical information for the simulation.	6 (IQR 5–6)	5 (IQR 5–6.5)	0.261
3. Contribution to learning. The patient records in their form contributed positively to my experience and learning in the simulation.	6 (IQR 5–6)	5 (IQR 4–7)	0.244
4. Overall scenario representation. Overall, the simulation satisfactorily represented the clinical scenario.	6 (IQR 5–7)	6 (IQR 5–7)	0.987
Thematic qualitative feedback	Electronic medical records (EMR)	Paper medical records	
Realism and fidelity	Participants commented on the highly 'realistic' nature of the simulated EMR, which 'looked like the real thing'. This extended to authentic equipment like the 'Workstation on Wheels'.	Participants had mixed reactions about realism with some commenting paper records 'do not represent reality' while others suggested they were a 'good representation'.	
User experience and functionality	There was positive feedback from participants who reported the simulated EMR 'worked well' and was 'familiar'. An instructor noted this solution removed the possible legal implications of using a 'fake patient on the real EMR'.	Participants were 'not used to' paper medical records and found them 'very awkward', given that clinical settings now use electronic records.	
Contribution to learning	Participants did not directly make conclusions about the value of the electronic records to the process of learning, but they were described as 'appropriate' given the use of EMR clinically. Some participants found the simulated EMR was not utilized in scenarios that were already 'overwhelming'.	Participants found that paper records were able to 'sufficiently provide a narrative', which was required for patient context. It was suggested that paper records make the simulation 'process easier' despite not reflecting 'real life'.	
Future improvements	Participants suggested future improvements including access to resources like 'guidelines or drug' databases, as well as versions to simulate future EMR systems.	Participants commented on confusing errors on the paper records, including mismatched names and previously charted medications.	

<sup>a</sup> Denotes statistically significant value  $p < 0.05$ .

The key strengths of the simulated EMR are its simple, low-cost design using accessible resources. When used with redundant institutional Workstations on Wheels, its realism was further enhanced. Additionally, this resource does not require specific technical proficiencies and is now easily downloaded and modifiable. It avoids the use of the institutional EMR for simulation, a likely suboptimal solution given community concerns for potential inadvertent access to real patient records [6]. Cost and time resources are also a barrier because institutional EMRs require dedicated network computers and detailed governance.

The simulated EMR and observational evaluation have limitations. The appearances (Figure 1) are superficially realistic but not fully interactive. While it passively provides clinical information, learners cannot document, prescribe or order investigations directly. This did not detract from participant experiences reflected in Table 1, likely because

verbal prescribing is acceptable in emergency situations and documentation is usually delayed until the clinical situation is stable. However, in scenarios requiring urgent imaging or pathology ordering, the simulated EMR would not realistically represent the required clinical actions. This is also a limitation of paper medical records.

Regarding the study evaluation, the sample size and observational methods limit the external validity and generalizability of the findings. Readers should consider whether this solution is appropriate for their context. To increase the reach of the tool, we plan to expand versions of EMR beyond Cerner™ to others such as Epic™.

In summary, we observed that learners and educators using a new simulated EMR reported it realistically portrayed medical records when compared with paper. This EMR solution is a low-cost and accessible way to improve

realism in simulation, and it is now an open access and modifiable resource for simulation educators.

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### Declarations

### Authors' contributions

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### Availability of data and materials

None declared.

### Ethics approval and consent to participate

None declared.

### Competing interests

None declared.

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