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PROGRAMME DESCRIPTION

Using an electronic portfolio system to create simulated electronic medical records for pharmacy student skills application

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Abstract

Background: Course feedback identified the need for real-world patient assessment skills to facilitate learning in a general medicine elective course. A campus-supported electronic portfolio system was utilised to enhance these skills via novel, faculty-created, simulated electronic medical (sEMR) patient cases within a general medicine elective course. **Methods:** This IRB-exempt, cross-sectional review evaluated student perceptions after the implementation of sEMR clinical cases in an elective course for third-year pharmacy students. Student perceptions were gathered using an anonymous electronic survey. Faculty interrater reliability for grading student assessments was calculated via the intra-class correlation (ICC) coefficient. **Results:** Students reported positive experiences related to navigating the sEMR (mean = 4.25, SD = 0.99), ease of access (mean = 4.43, SD = 0.79), and confidence in finding relevant patient data (mean = 4.54, SD = 0.51). Most students preferred using the sEMR compared to traditional documents (mean 4.0, SD 1.06) and strongly recommended that the sEMR model be incorporated during future classes (mean = 4.61, SD = 0.58). **Conclusion:** The sEMR enabled students to positively experience simulated, interactive patient cases. Student feedback suggests the sEMRs functioned effectively and were well received. This model may be easily implemented at other institutions, and future investigations should evaluate the impact on educational outcomes.

Introduction

Although the first use of electronic medical records (EMRs) was documented in the 1970s, it was not until 2016 that over 95% of all hospitals routinely used this technology (Office of the National Coordinator for Health Information Technology, 2017). Over the last two decades, numerous studies have evaluated the role of EMRs developed for use in a student learning environment and their impact on the care of patients within health profession education (Hirschtick, 2006; Verghese, 2008; Peled *et al.,* 2009; Schenarts & Schenarts, 2012; Pageler *et al.,* 2013; Tierney *et al.,* 2013; Borycki *et al.,* 2014; Milano *et al.,* 2014; Welcher *et al.,* 2018). Healthcare literature has shown that the use of technology, including EMRs and simulated patients, enhances learners' ability to identify patient-care-related treatment areas and improves their level of comfort in engaging with real-life patients (Steadman *et al.,* 2006; Mintz *et al.,* 2009; Frenzel, 2010; Stephenson *et al.,* 2014; Biagioli *et al.,* 2017). One notable change from publications in the late 1990s and early 2000s to those over the past decade centres on an increased technologically savvy user base (Block *et al.,* 2013). With this shift in technological capabilities, faculty must also adapt to meet the needs of their student body.

Within pharmacy education, the Centre for Advancement of Pharmacy Education (CAPE) 2013 educational outcomes specifically mention the role of technology to aid in the medication use processes of student learning (Medina *et al.,* 2013). The 2013 revision intended to ensure that pharmacy students, as future pharmacists, will have adequate training to serve as highly functioning members of the multidisciplinary healthcare team. Additionally, the Accreditation Council for Pharmacy Education (ACPE) 2016 standards indicate that health informatics are effective and secure methods to "*capture, store, retrieve, and analyse data for use in patient care*" and that these tools may be used to enhance interprofessional collaboration and positively impact healthcare delivery (Accreditation Council for Pharmacy Education, 2015). Integration of simulated patient cases or scenarios has been successfully implemented into several pharmacy courses and programmes (Lin *et al.,* 2011; Seybert, 2011; Barnett *et al.,* 2016; Leibfried & Pisano, 2016; Coons *et al.,* 2018; Shin *et al*., 2018; Smith & Scholtz, 2018; Tremblay, 2018; Baumgartner *et al.,* 2019; Gibson *et al.,* 2019; Komperda & Lempicki, 2019; Ives *et al.,* 2020; Shaikh *et al.,* 2020; VanLangen *et al.,* 2020; Vlashyn *et al.,* 2020; Adeoye-Olatunde *et al.,* 2021; Cook *et al.,* 2021a; Cook *et al.,* 2021b; Wasynczuk & Sheehan, 2021; Bowers *et al.,* 2022). Many of these simulated patient cases and the utilisation of an EMR were conducted in the skills laboratory (Cook *et al.,* 2021b). These publications have demonstrated the benefit of simulated patient cases on pharmacy students' preparedness, proficiency, and confidence in various academic settings. Although the use of pharmacy EMR varies significantly between institutions, similar levels of student comfort in performing EMR tasks have been reported (Cook *et al.,* 2021a). Following the utilisation of EMRs, students expressed improved preparedness for future introductory and advanced pharmacy practice experiences (APPEs) (Vlashyn *et al.,* 2020; Wasynczuk & Sheehan, 2021). One study found that the implementation of a simulated EMR (sEMR) did not significantly impact student performance on general medicine or ambulatory care APPEs when compared to students who did not experience an sEMR (Smith & Scholtz, 2018). Thus, the incorporation of "*real-life*" scenarios, such as drug information questions and mock rounds, may provide a benefit by ensuring that pharmacy students have sufficient knowledge and training in clinical situations they are likely to encounter in a professional setting.

With each of these factors in mind, the authors sought to replicate real-world practice and provide students with an opportunity to interface with enhanced technology to further develop the skillsets needed to navigate complex clinical cases as part of a general medicine elective course. This work was undertaken, in part, based on previous post-course student feedback demonstrating a desire for more complex patient cases as part of their coursework. Commercially available simulation systems or EMR systems can be costly, cumbersome, and require additional resources and training (Seybert, 2011). To achieve the goal of providing exposure and experience navigating an EMR as part of a didactic course, the authors evaluated currently available resources within the institution that would allow for such innovation at a substantially reduced cost.

Methods

Activity description

This IRB-exempt, cross-sectional review evaluated student perceptions after the implementation of sEMR clinical cases within a 2-term hour, 16-week elective course offered to third-year pharmacy students (P3) between 2018 and 2020. Responses were obtained via a voluntary, anonymous online survey. Prior to dissemination, the survey tool was reviewed and validated via pilot testing and an expert committee review. This survey aimed to assess student perceptions after the use of sEMR cases during this course. Additionally, the authors sought to evaluate faculty grading within the clinical case presentations after the adoption of a novel grading rubric.

Development of clinical cases and electronic medical record

A sEMR was developed and implemented, focusing on the principles of general inpatient medicine using a readily available digital system. A template sEMR was developed by a core group of course faculty to ensure consistency across multiple users. This template was developed with the "*feel*" of a system-based EMR in mind, meaning that users were required to access different fields and tabs to find the needed information. From there, faculty content experts at the institution developed a series of cases for use. Curriculum mapping to core content and therapeutics sections was done to ensure the sEMR cases represented key areas of clinical knowledge, e.g. cardiovascular, endocrinology, and infectious diseases. After development, each case went through a second review by another content expert, and consensus was reached on the content. Once finalised, each case was uploaded into an electronic portfolio system that all students could access.

Deployment and assessment of clinical cases

Students were assigned multiple clinical cases within the sEMR as part of their coursework to ensure sufficient exposure to multiple therapeutic content areas. The electronic nature of this resource allowed it to be readily adapted into a team-taught course, as faculty and students had the autonomy to access a template-based profile that enabled end-user data input and modification for patient case generation. Furthermore, clinical sEMR case information could be strategically released to students progressively to mimic clinical development and reveal clinical changes to facilitate just-in-time learning.

All users could readily access patient profiles, and the course coordinators and faculty utilised designated answer keys. This course was designed to simulate typical student responsibilities during a general medicine APPE, including but not limited to mock inter-professional rounds, patient-based discussions, drug information questions, patient presentations, and healthcare provider communication. The sEMR was utilised by students in the classroom setting for weekly patient care discussions and a mock rounding experience. Furthermore, the sEMR was used as the primary method of delivering three major clinical case presentations. During these patient presentations, students were provided access to a patient case and given a pre-defined amount of time to actively review the sEMR, develop a comprehensive care plan using the Pharmacists' Patient Care Process (PPCP) established by the Joint Commission of Pharmacy Practitioners, and then present their findings to the course faculty (Joint Commission of Pharmacy Practitioners, 2014; Gonyeau *et al.,* 2018).

Survey instrument and data analysis

The survey instrument consisted of six questions using a Likert rating scale from one (strongly disagree) to five (strongly agree), with a seventh open-response question asking students to provide their individual assessment of the benefit and functionality of the sEMR. No demographic data was collected as part of the IRB exemption, nor was remuneration offered for participation. Additionally, as part of the course, students were required to present three distinct patient cases as part of their overall course grades. Grading was completed via a faculty-developed, validated rubric mapped to the PPCP competencies. Each student presentation was independently graded by two faculty, and faculty pairings were rotated throughout each term.

Student responses to the survey tool were assessed using descriptive statistics. The interrater reliability for patient case grading performed by faculty was determined via the intra-class correlation (ICC) coefficient with a two-way model using absolute agreement (SPSS Statistics, Version 25 for Windows).

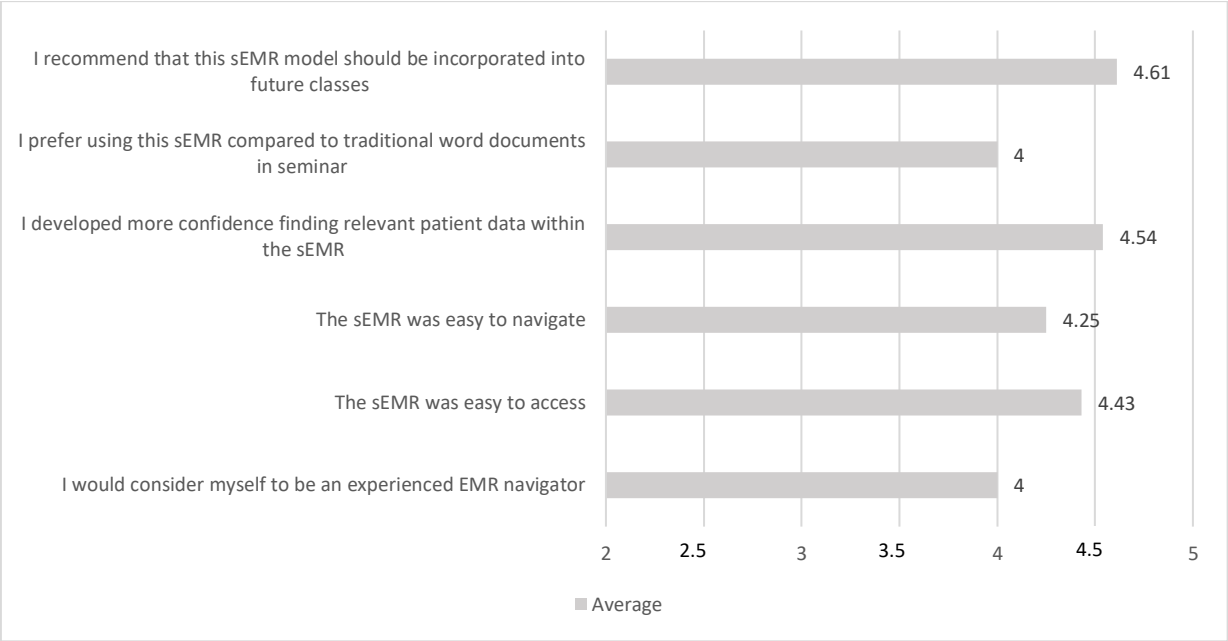
Results

A total of 50 students were enrolled in the elective course between 2018 and 2020, and 26 (52%) completed the post-course survey. All students (n = 26) agreed that the use of sEMR was a valuable addition to the elective course and their professional development. Most students reported having previous experience navigating an EMR, with a median rating of 4.0 (range = 2–5, SD = 0.85). Students also endorsed that the sEMR was easy to access (median = 5, range = 2–5, SD = 0.79) and navigate (median = 4, range = 1–5, SD = 0.99). All students reported more confidence in finding relevant patient data within the sEMR (median = 5, range = 4–5, SD = 0.51). Most students preferred using the sEMR compared to traditional paper-based documents in class (median = 4, range = 2–5, SD = 1.06). All students recommended that the sEMR model be incorporated into future classes (median = 5, range = 3–5, SD = 0.58) (Figure 1).

Some students identified the incorporation of sEMR as one of the most helpful class activities (average = 4.0, range = 3–4, SD = 2.01) compared to mock rounds, text pages, written and video-based drug information questions, patient presentations, and discussion board conversations. Out of the 26 students, 16 (61.5%) mentioned the sEMR when asked to comment on teaching strategies or technologies they found useful. Examples of comments:

> *"sEMRs were definitely helpful in preparing us for how the authors may come across looking at patient information during APPEs."*

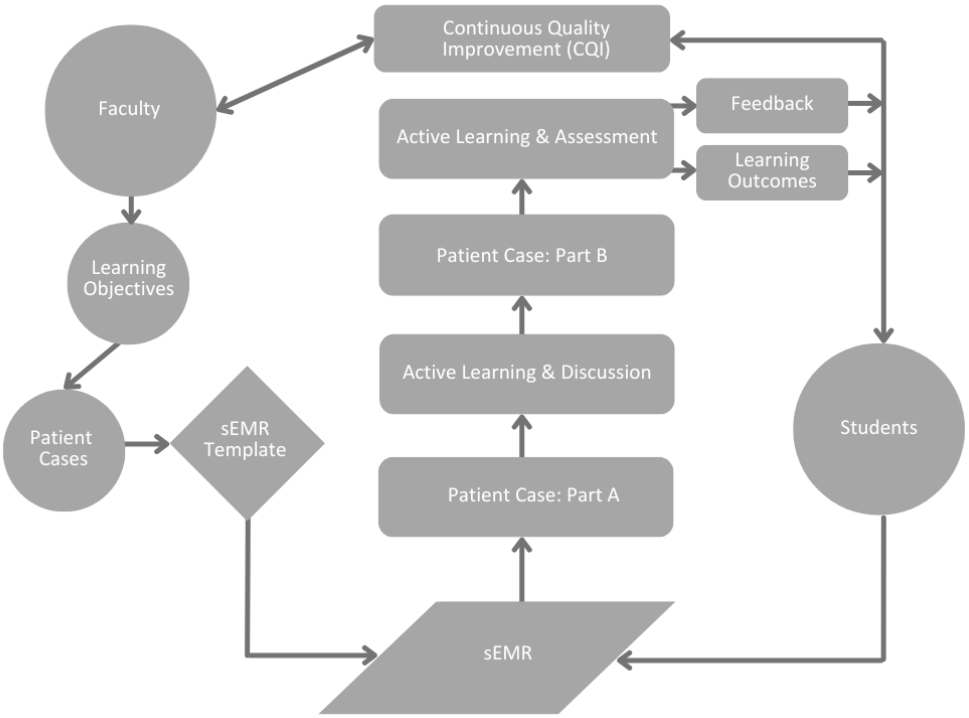
> *"I enjoyed and found the sEMRs helpful."*



sEMR: simulated electronic medical record; EMR: electronic medical record

Figure 1: sEMR survey student responses

Additionally, students were evaluated on their ability to provide a concise summary, patient work-up related to the Collect and Assess steps and competencies related to the Plan, Implement, and Follow-up steps, oral presentation and organisational skills, and the student's ability to respond to questions (Figure 2).



sEMR: simulated electronic medical record

Figure 2: sEMR process flow

Each student completed three distinct patient case presentations (N = 150) using a shared grading rubric. Each rubric had nine sections worth ten points each. The median score across all rubrics was 86.67, IQ1: 83.33, IQ3: 90, and IQR: 6.67. The ICC range was 0.4 to 0.949 (95% CI, 0.51 to 0.993), and 88% of all rubric grades demonstrated an ICC coefficient ≥ 0.7.

Discussion

Overall, students received favourably the incorporation of a sEMR into this elective course, as evidenced by the high scores and comments from the survey data. Additionally, the incorporation of a sEMR could be done without using high-cost or technologically advanced software. While there is nothing inherently unique or new about sEMR technology, several aspects of this study are worth highlighting. Firstly, the level of development and customisation was exceptionally high because faculty created the cases. While there are inherent upfront considerations in terms of time and resource allocation, the ability to incorporate real-time changes as clinical practice dictates was a key benefit. Again, the authors believe that this led to highly positive ratings by students as part of their survey responses. Secondly, the unique features of various disease states could be developed or enhanced beyond the scope of what is traditionally seen with static systems. This level of customisation was felt to be the most powerful benefit of an internally developed EMR, even beyond the cost associated with a professionally developed system. No significant additional resources were required to incorporate the EMR into this elective class, as this platform was readily available and has been used for alternative purposes in this programme, making it the most cost-effective option at this institution. Given their familiarity with this system, faculty and students alike were quick to adopt it because it required minimal upfront time and training. Furthermore, the electronic nature of this resource allowed it to be readily adapted into a team-taught course, as faculty and students had the autonomy to access a template-based profile that enabled end-user data input and modification for patient case generation.

Clinical EMR case information could be strategically released to students progressively to mimic clinical development and reveal clinical changes to facilitate just-in-time learning. Given that approximately 62.7% of schools or colleges of pharmacy currently report utilising EMR in their didactic curricula, this sEMR may provide a feasible and cost-effective path forward for institutions looking to incorporate these skills into their curricula (Ives *et al.,* 2020). Thus, ensuring compliance with CAPE and ACPE educational outcomes can be achieved using readily available technology within an existing programme, and schools and colleges of pharmacy should not be stymied by cost-prohibitive systems or tools. Lastly, when faculty develop and implement the use of any new assessment tool, it is imperative to not only validate the tool but also ensure consistency with its use. Failure to do so can skew student grading and have a direct impact on their overall success within a course. The authors demonstrated that, with little additional effort, this process can be done and does not require significant statistical knowledge.

This study has several limitations that should be considered. First, these results were derived from a small sample size with an approximate 50% response rate. Additionally, the authors only incorporated the sEMR into a single course provided to a subset of the overall student body. Thus, there may be bias present due to student self-selection and enrollment within this elective course and survey completion. Furthermore, as with any technological introduction, challenges may arise, including the information presented in a medically complex patient case. While each case was developed and validated before use within the classroom setting, the possibility that errors in the transcription of data may have occurred cannot be ruled out. With each successive offering, the clinical cases were reviewed to update and improve their quality. Thus, refinement of a case may demonstrate a higher overall experience for a student in the latter years of its use compared to its first use.

As the health industry continues to develop rapidly and new technologies and innovations become available on the market, the educational system must also strive to integrate new technologies into the curriculum. While EMRs are no longer considered novel, a review of the published literature demonstrates that, despite their widespread adoption in healthcare settings a decade ago, the implementation of EMRs in pharmacy curricula has been lacking. Since that time, the data show less than 40% of schools or colleges of pharmacy have integrated the use of EMR into their curricula. Additionally, several methods exist for creating and incorporating an EMR into the pharmacy curriculum, some of which may currently be available within existing platforms. By adapting these platforms to develop and implement a low-cost sEMR environment, the authors can provide the students with exposure to this necessary learning opportunity. Continued evaluation of the exact mechanisms behind student learning, the development and growth of technical and clinical skills, and the measurement of increased readiness to practice are all areas that require further

study. The authors believe that these findings demonstrate a way for colleges and schools of pharmacy to begin their own integration of sEMR into the classroom, especially for those institutions that may not have the resources to purchase a pre-packaged system and demonstrate the value of said integration into student-learning outcomes.

Ethics approval and informed consent

This project was deemed to be exempt by Northeastern University IRB.

Conflict of interest

The authors do not have any competing or conflicts of interest.

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