# Bringing Electronic Patient Records into Health Professional Education: Towards an Integrative Framework

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Abstract. In this paper we discuss our approach for integrating electronic patient records into health professional education. Electronic patient record (EPR) use is increasing globally. The EPR is considered the cornerstone of the modernization and streamlining of healthcare worldwide. However, despite the importance of the EPR, health professional education in much of the world provides health professional students (who will become the practicing health professionals of the future) with limited access or knowledge about the EPR. New ways of exposing students to EPRs will be needed in order to ensure that health professionals will adopt and use this complex technology wisely and effect the positive benefits EPRs are expected to bring to healthcare globally. In this paper we describe: (a) a framework we have developed for integrating EPRs into health professional education and (b) an innovative Web portal, known as the University of Victoria Electronic Health Record (EHR) Educational Portal (which houses a number of EPRs) that can be used to explore the integration of EPRs in health professional education. It is hoped that adoption and use of EPRs will ultimately be improved through the use of the portal to allow students virtual and ubiquitous access to example EPRs, coupled with principled educational approaches for integrating EPR technology into health professional curricula.

Keywords. EHR, EMR, EPR, education, medical education, nursing education, health informatics education, biomedical informatics education, adoption

## 1. Introduction

Electronic patient record (EPR) use is increasing globally. The EPR is considered the cornerstone of the modernization and streamlining of healthcare worldwide. The EPR itself integrates information and allows health professionals to document, communicate and integrate health information about patients such that it may improve the quality of clinician decision-making and patient care [1]. However, despite the importance of the EPR, health professional education in much of the world provides students (who will become the practicing health professionals of the future) with limited or no access to EPRs. Effective methods for exposing students to EPRs through education will be needed in order to ensure that health professionals will adopt and use this complex

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technology wisely. Indeed, recent reviews of the health professional educational curricula (including medicine, nursing, allied health and health informatics) reveal that exposure to EPRs and their components is limited in the classroom setting [2-4]. Classroom learning in the form of formal lecture, discussion as well as hands-on use, access, and opportunities to work with EPRs and their components is limited. Many health professional students have limited exposure to EPRs during clinical practice. Here, student and novice clinicians must learn about how to use EPRs in real-world clinical settings using real patient data, often without having prior classroom exposure to this complex technology. In contrast, the expectations among policy makers and healthcare organizations is for health professionals to be knowledgeable, computer savvy and prepared to use EPRs. The issues are much the same for undergraduate and graduate health informatics students as for other health professional students (e.g., medical and nursing students). Current educational opportunities involving EPRs is limited in the academic setting – only a few academic undergraduate and graduate programs for health informatics have been able to incorporate EPRs and their components into their undergraduate and graduate curriculum as a learning tool [3]. This situation is similar in both North America and Europe [4]. This is very unlike the opportunities afforded to other disciplines (e.g., business, computer science and engineering) who have the opportunity to work with the tools of their profession before entering the work setting. Providing undergraduate and graduate health professional students (e.g., health informatics, medicine, nursing) with opportunities to work with differing EPRs would allow students to gain the necessary design, development, implementation, work, evaluation and maintenance experience required to ensure EPRs are both adoptable and can be easily appropriated by health professionals [5]. Towards this goal we have developed a framework for considering the integration of EPRs into education that has served to guide our educational initiatives (described in this paper) in health professional education (including health informatics, medical, and nursing education).

# 2. Towards a Framework for Integrating the EPR into Health Professional Education

In our work we have considered integrating EPRs into health professional education along a continuum ranging from loose coupling of the technology with the educational curricula, to tight coupling of the technology with the educational curricula. Loose coupling refers to an informal or a weak level of integration of the EPR into curricula, while tight coupling refers to a high level of integration of the EPR into curricula (see Figure 1). Examples of loose coupling would include exposing students to demonstrations of technology prior to class or lecture time to form the basis for openended discussion of technology. The loosely coupled end of the continuum would also include giving assignments or providing laboratory work as a side component of a course (i.e., designed to introduce the EPR to health professional students but not integrated into the main classes or lectures). Examples of a more tightly coupled integration include requiring students to use an EPR for fundamental aspects of the health professional's training (e.g., requiring health informatics students to design EPR system components or assess the usability of EPRs in system design courses, forming an integral and fundamental focus of the student's overall learning experience). In the next section we will describe the University of Victoria EHR Educational Portal, a unique web-based portal designed to allow for remote access to a range of EPRs for educational use. This will be followed by discussion of our experiences with several projects that we have conducted aimed at integrating EPR into health professional education using the portal (based on the integration framework depicted in Figure 1).

#### Loose Coupling

**Tight Coupling** 

| ←   |   |   |   |
|---|---|---|---|
| Demonstration<br>of EPRs prior<br>to class time | Laboratory or<br>assignments<br>involving EPR<br>(outside of<br>lectures/class) | Access to<br>patient cases<br>discussed in<br>class through<br>EPR only | Full<br>integration<br>into labs,<br>lectures and<br>testing of<br>students |

Figure 1. A continuum for considering integration of EPR into health professional education

## 3. Methodological Approach

The University of Victoria EHR Educational Portal was created by the authors in response to the educational needs described above. The portal allows for remote access (over the WWW) to a range of working EPRs that can be integrated into health professional education. Figure 2 illustrates the portal's resource page and list of working EPRs that users can select to directly interact with over the WWW. This unique, web-based portal was designed to allow users (i.e., health professional students, practicing professionals and health informaticians) to directly access and interact remotely with a range of representative EPR solutions over the WWW [6]. Currently, the portal houses differing EPRs (e.g., Digital Anthrologix®, the Veteran's Affairs OpenVista, OpenMRS). Differing EPRs were selected in order to provide health informaticians and health professional educators with opportunities to teach students about a range of EPRs with differing design metaphors, features and functions (with new EPRs being added to the portal constantly). Exposure to these EPRs in the classroom and the laboratory setting gives students the opportunity to learn about those aspects of EPR design (e.g., usability and safety) that influence clinical practice, adoption and appropriation using dummy patient data. This gives students the opportunity to work with differing EPR's and their components prior to working in the real-world. The portal also provides students with high fidelity simulated EPR system experiences that are representative of the real-world. This helps give educators the opportunity to teach students how to effectively and efficiently use an EPR in the safety of the classroom and laboratory setting.



Figure 2. Resource page of EHR Educational Portal

# 4. Results from Integrating EPR into Health Professional Education

The portal has been used in several projects aimed at exploring potential integration of EPR into health professional education. To date this has included use in nursing, medical and health informatics educational programs. As described below the approach taken to using the portal has been based on the continuum described above.

# 4.1. Example of Integration: Loose Coupling

As an example of loose coupling, we recently introduced 150 fourth year nursing students to an example EPR (the Veteran's Affairs OpenVista). Students were given passwords and access instructions for logging onto OpenVista remotely through the University of Victoria EHR Educational Portal. Students were instructed to explore the software (and in doing so, consider the implications of such technology for nursing practice) a week prior to a class in a course on new trends in nursing. Classroom activities included an open-ended discussion of the impact of EPR technology (i.e., which parts of the EPR worked well or did not work well from the students' perspective and why). The role that nurses could undertake as change agents using such technology formed the basis for further classroom consideration [7]. Discussion with students after the session indicated that they felt that access to a working system had greatly informed their classroom experience. A similar approach was taken in the integration of EPR into a fourth year medical program where 150 medical students accessed an EPR system (i.e., Digital Anthrologix®) in order to motivate discussion of use of such technology by physicians during a week long educational module [7].

# 4.2. Example of Integration: Tight Coupling

As an example of tight coupling, the University of Victoria EHR Educational Portal has been used to educate health informaticians at the undergraduate and graduate level in the design, development and evaluation of EPRs. At the undergraduate level, health informatics students have reviewed and used the portal EPRs as part of their coursework (both in labs and classes) to develop health informatics competencies. The open source EPR's allow for assignments where students can work on designing, programming and testing new modules and functionalities. Graduate level health informatics students are also designing, developing and evaluating EPR systems. Students now have the opportunity to see and work with differing types of EPRs in the classroom and laboratory settings. The use of representative EPRs has become an integral part of classroom training in both a course on Health Information System Design (with students developing EPR components as the major focus of the course) as well as a course on Human Aspects of Healthcare Systems (with students focusing their studies of usability of systems by critiquing and suggesting modifications to EPRs on the portal). Current application includes work by graduate health informatics students in development of on-line educational packages for use in developing countries, based around OpenMRS (as a core part of research training at the graduate level).

# 5. Conclusions

In this paper the authors suggest a continuum of approaches to integrating the EPR into health professional education. This continuum ranges from loose to tight coupling of the EPR into curricula. The continuum can be used to guide the development of educational initiatives aimed at bringing the EPR into educational contexts. The paper also describes a portal developed by the authors that provides access to several differing EPRs and their components over the WWW. The portal can be integrated with classroom and laboratory education, providing health professional students with opportunities for in-classroom, laboratory and hands-on experience in using EPRs.

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