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Electronic Health Records in the Academic World

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Electronic Health Records in the Academic World: A Literature Review

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Introduction

Technology is an ever-evolving part of society that is leaving education curriculums racing to match pace. It provides unique challenges in all aspects of life while simultaneously creating new opportunities for human advancement. The Institute of Medicine declared a need to embrace technology by calling for electronic health records to replace paper records by 2014.[1] They have even cited "using informatics" as one of their five core competencies for health profession education.[2] The reason for the call to use electronic health records (EHRs) is the true benefits that they provide to the healthcare realm. EHRs have been shown to improve patient care quality, time management efficiency, and cost effectiveness in the healthcare model.[3] They also increase patient safety, promote optimal patient outcomes, and reduce or even eliminate errors.[2] Utilizing EHRs leads to an increase in preventative care, enhancements in drug monitoring, and increased use of evidence-based guidelines for interventions.[1] Apart from patient-specific benefits, they also foster job satisfaction through better communication, quality of data, organization,[4] and the ability for multiple people to access and chart data more efficiently and legibly.[5] Increasing patient safety, employee satisfaction, and other features listed have improved the healthcare system as a whole and therefore must be integrated into student curriculum. The purpose of this literature review is to understand how EHRs have been used in academic settings to foster growth and what makes their use the most successful.

There are, however, some potential downsides to using EHRs that must be discussed. If users are not properly trained, there can be errors in decision making.[6] This is a major concern as "medical trainees" do not receive direct or formal training on EHRs or any kind of health information technology (HIT).[3] Insufficient knowledge leads staff teaching interns in the field to become nervous at the thought of allowing students to chart in EHRs due to not understanding

legitimacy of access and verification processes.[5] All technologies require a developmental learning process and a short time or "crash course" on EHRs does not allow for sufficient retention of features.[1] Initial documentation requires support and supervision so students cannot simply be sent into their professions with no exposure to EHRs. However, most education curriculums do not prepare students for properly using EHRs,[7] therefore they cannot feel confident or even proficient in using informatics upon graduation.[3] Though there is inconsistent logic at work, that being students are allowed full access to paper records but not electronic charts,[5] there is still a greater concern with liability, billing, and patient safety in regards to EHRs.[3] These are reasons used to restrict students from accessing EHRs at teaching hospitals or as student interns, but eventually all future professionals must learn how to use the system properly and cannot do so simply by observation.

In fact, almost all health professionals use EHR technology and so students and professionals alike must understand the basic benefits and drawbacks of their institution's program. Although there has been a recent increase in students learning to use EHRs professionally,[1] there are still too few opportunities for them to fully understand the systems.[8] This lack of access has reportedly frustrated students and made them feel less of a part of the team.[5] Even health informatics students do not often get to use EHRs.[8] Adding EHRs reinforces important behaviors that are required in a real healthcare setting.[3] This overarching absence of a piece so important to daily work makes it necessary to begin implementing EHRs into curriculums.

There are barriers to implementation, but student acceptance and want is not one of them. The generation of students currently in school is better with computers and students will only become more acquainted with technology as it grows in importance to society.[1] There are

simulation activities to help teach the use of other electronic medical devices such as ultrasounds and MRIs that have been proven to foster competence and proficiency.[6] Medical students often use PDAs or other portable electronic devices for looking up drug references and using clinical calculators.[1] This shows that students are comfortable using technology to further their understanding. Other professions such as engineering and computer science have the privilege to use their electronic tools in undergraduate programs to further their capabilities to understand their profession and grow as a student and future professional.[8] Not allowing healthcare students to utilize EHRs is comparable to banning accounting students from using excel or other accounting software. It is unheard of to stop engineering students from using the program their professional counterparts use daily, and so it should be the same for healthcare students using a software that directly impacts human lives.

Program Requirements

However there must be some modifications to this requirement of using just any EHR for education. Students using commercial EHRs cannot practice documentation or order entry and instructors cannot create and copy patient charts.[9] This lessens the point of learning the system and only teaches navigation. Health informatics professionals cannot focus on educational software because they are already in high demand,[8] so it is vital that universities take it upon themselves to find or hire someone to make them an educational EHR. Furthermore, students must be allowed to have full access to the educational EHR at all times and only allowing it in the classroom or laboratory detracts from students learning at their own pace.[9] Having one or two patients over their course of learning also detracts from the realism which discourages students from taking the practice seriously.[10] Additionally, students have expressed frustration with some EHR functions in the academic and clinical setting,[3] so an educationally tailored one must be

understandably easy to use. Intern experience with EHRs can be influenced by their mentor's use which can make them feel that an EHR is hard to use depending on how they are taught.[1] Technology is useless if the user does not accept and actually use it.[11] Therefore there must be a positive environment for learning and an adequate timing of the activity in the curriculum so as not to detract from finals or other important coursework that makes the educational EHR seem less useful or effective.[3] It is a delicate process to build any curriculum and educational EHR exercises must be integrated fully to have the most worthwhile effect on students.

Furthermore, putting together an educational EHR for the use of future professionals is a large task that requires many features to make it fully functional and acceptable for classroom use. First and foremost, faculty must be able to input the fake or dummy patient data.[7] This effort equates to a virtual patient with a simulated chart for student use.[3] There are many items and informatics that could populate a simulated chart. For the general use, the best are basic features such as demographic information, vital signs, laboratory results with any subsequent data, a list of administered medications, notes on patient and treatment progress, and reports from imaging or diagnostic tests.[9] This basic information is enough for most professions to work with, but it is ideal that an educational EHR could handle all specialties and healthcare professions.[10] More complex information could and should be added for the EHR to reach its full potential, such as a preloaded educational database about drug interaction information.[1] In order for this to be accomplished to the fullest extent, educational EHRs must be customizable per each healthcare profession.[12] For example, the educational EHR could be changed to have a higher emphasis on nursing data input for nursing students or to have emphasis on medication interactions for a pharmacy class. These points of commonality allow students to see how all healthcare professions have an impact on one another and must work together for the benefit of the patient,

while the ability to customize per profession allows instructors to emphasize current classroom literature or important concepts.

In order for an education-based system such as an EHR to be truly beneficial, it must be realistic. This realism helps students understand how a clinical EHR would function and allow for professional growth in documentation skills.[9] For instructors to utilize an educational EHR correctly, they should be able to create a saved bank of virtual patients with the capability to choose which patients students have access to over the course.[7] Once created, these cases must be saved and ready for future use. These cases must be data-rich in order to simulate reality and the fact that there is often an overwhelming amount of information on every patient that comes through a hospital or clinic.[6] Having whole patients with a plethora of information compared to have a patient with just laboratory data helps to teach higher level students that they must be able to find what they need and focus in on the important aspects of their care.[10] Though this may seem a daunting task to place in front of younger students, the ability to pick through cases at their own pace will help facilitate exploration of the EHR but more importantly exploration of the priceless data it holds in relation to the students' future professions.[7] In order to promote this investigation, students should have the ability to view all aspects of previous visits and feel as though the virtual patient is as close to real as possible.[1] Though having a seeming overabundance of information on a patient could seem unnecessary, it is important that students, especially those closer to graduation, learn there will always be more information than they truly need.

Though a wealth of information for more advanced students is an important need for an educational EHR, a scaling feature must be included as well. If the classroom population holds younger or more inexperienced students, instructors should have the ability to turn off or

disallow students from seeing certain features, such as laboratory data or imaging reports, until

they are needed or are cohesive with the current curriculum.[7] One study involving nursing

students in their first, second, and third years of study found that unscaled educational EHRs led

to a varying view on complexity and the amount of time spent with regards to frustration and

ease of use.[2] This is explained by the fact that patient cases can easily lack difficulty or have too

much intricacy[10] and a balance should be found for each classes requirement.[7] This adaptation

capability can be difficult if the initial program is not written to allow for it and so an educational

EHR must have this ability from the beginning.

A key component to the educational EHR, of course, is the ease of use. There is no point

implementing a program or system of any kind, let alone one used for educational purposes, if it

is not easily navigable.[12] When analyzing a study involving students using an educational EHR,

the results showed that students found the software easy to use regardless of their personal

confidence in using a EHR.[11] This demonstrates that even the most inexperienced or experienced

student will find an educational EHR easy to use if it is in fact intuitive and straightforward. An

example of this is data being inputted into sections and populating as a summary when entered so

the information is placed in units and available for examination.[2] Another feature that enhances

ease of use is the ability for users to search and export data.[12] These features are especially

critical in an educational setting where inputted data will be reviewed for accuracy and is

guaranteed to be double checked.

In addition to the educational EHR being student-friendly, it must also be controllable

from an instructor point of view. While students are benefiting for the application of theory

through the EHR, instructors must be able to see students' activities and log-ins to help facilitate

student growth.[7] One study with educational EHRs made the mistake of not allowing instructors

to immediately see their students' work which inevitably slowed down the teaching process,[2] therefore they should have an immediate summary of the student results.[7] As a note to the education process, instructors should remember to make their assessment of the results comparable between students so they can learn from one another as well.[10] The system itself, however, should have a feature that makes this more possible such as allowing for quizzes or tutorials.[7] Instructors play a major role in the ability of students to understand all aspects of their education, but when using an educational EHR to facilitate learning, it is vital that instructors are proficient in the system and that it meets their needs with equal validity to the students' needs.

As the internal features have been recommended fully, the system itself must also come under scrutiny. The program should have a cloud-based storage system for the bank of patient cases and student work.[7] To accomplish this, the program works best when it exists as a web portal with remote access.[8] This is most easily described as an internet-based website with the ability for students to log in at any time or in any place. It is key that this log in system allows for multiple persons to access it at one time so there is not a conflict of interest between students or classes.[7] These core features increase accessibility and when students were given a software-based program in a study, they actually specifically requested that the next program be web-based.[2] This is in part because software can have complex downloads or installations that take too much time or increase frustration with the program.[7] With this in mind, the web-based system allows for use across many devices such as desktop computers, laptops, and tablets. Working on different platforms is necessary to meet the needs of a diverse population of students.[7] In the study previously mentioned in this paragraph, the download software was not compatible with Mac or Apple devices.[2] As these are common and popular devices among students, this disability severely limited their capability to use the program with ease. It is unacceptable to create a

program for students to use and then limit their ability to employ it. Students cannot learn from a program they cannot access.

Current Usage

A study by the Oregon Health & Science University (OHSU) exemplified the proper use of an educational EHR with a brief training session followed by full integration into the curriculum. The curriculum had a scaled standard of grading which had first year medical students identifying errors and omissions from a patient's history and physical, second year medical students creating a problem list for each patient as well as diagnosing with test results, and third year medical students applying evidence-based practice guidelines to treat their patient. The first year students were therefore taught about patient safety through correct documentation and how to use a chart professionally. Second year students were given an opportunity to do osteoporosis screening of a 60 year old female with multiple risk factors for osteoporosis which aided in the application of clinical reasoning and data interpretation learned in classes. Third year students' experience culminated in applying prevention and intervention guidelines such as placing orders for referrals, consultations, tests, and medications.[3] Overall this is a prime example of the correct usage of the educational EHR to reinforce concepts being learned. The outcomes were positive and will be discussed later. However, it is important to note that this same exercise was completed with a tailor to pharmacy students who had specific prescription dispensing software.[9] Though that study was similar to the OHSU study and therefore are not outlined here, they also had positive results that demonstrated how to properly use an educational EHR for specific learning outcomes and professions.

Implementation Benefits

Once there is an understanding of how an educational EHR should be made and used, it

is important to look at how it helps student growth. Often, the largest barrier to students using an

EHR in a clinical or classroom setting is staff anxiety.[4] In order to avoid this and help encourage

instructors in the academic setting, there must be formal training and clear procedures for the

students.[5] Therefore the teaching will be uniform and the assessment will be comparable between

classes,[10] which allows instructors to focus on the important aspects of teaching instead of being

hindered by students using the EHR incorrectly. Furthermore, with standardized coding in the

educational EHR and full integration into the curriculum, instructors can be sure that students are

being treated equally and graded equivalently.[7] As the instructor-student relationship heavily

affect learning opportunities and development of skills,[5] having a standardized grading system

helps instructors fully utilize the educational EHR system and impart essential knowledge to the

student.[1] When nursing interns were asked about EHRs in their clinical use, they responded by

saying that they "wanted guidance on their EHR use," but that the review and feedback from

their mentors was minimal.[5] This reflects uneasiness on the part of the instructor with the EHR

itself, but also the pressure of being a healthcare professional and training a student at the same

time.

Therefore, students should have the opportunity to receive feedback about their notes.

Ideally this takes place in an academic setting as it allows for better feedback.[1] This feedback is

vital to student growth and aids in learning patient-centered care and safety.[13] The same nursing

interns previously mentioned also stated that they felt frustration with the process of their

mentor's reviewing and signing their notes as it slowed down their learning and was not uniform

throughout their rotations.[5] It is crucial that interns feel a sense of security in their learning and a

sense of accomplishment from a job well done or a new skill learned. Minimal and slow

feedback leads to the same mistakes being made because instructors do not have the chance to

correct them as they occur. This can be avoided in an academic setting where the instructors are

not trying handle a full case load and fostering a student's professional growth while having to

use a system with which they themselves may be unfamiliar or uncomfortable.

Therefore, this extra burden should be removed. Learning to use the technology of EHRs

should be integrated into course and class work.[7] This assimilation can identify weaknesses in the

curriculum, such as a deficiency in the knowledge of a particular disease management

guidelines.[3] This will benefit not only the individual instructor, but the coursework as a whole.

Because educational EHRs have a focused learning objective, they do provide immediate

feedback for the students, but also for the instructors.[4] Educational EHRs teach medical issues

through a hands-on exploration of a case study,[7] which are a hallmark of healthcare education as

is. Students must find problems that are embedded in a plethora of information which tests their

ability to identify complications and recommend solutions,[9] which can help instructors plan what

they need to focus on in the future according to current knowledge deficits or proficiencies.

Furthermore, it fosters a sense of closeness among students. It is possible for students to

begin working on a case study with an educational EHR individually and progress to working as

a group.[3] This promotes teamwork and allows students to explore their thought process as well as

getting feedback from others and learning how they think. Teamwork encourages patient-

centered care[13] and keeps students more actively engaged in the process.[3] Classroom integration

develops and new understanding of EHR use,[8] and the hands-on experience makes EHR

education more meaningful.[3] It provides a firsthand comprehension of the interface of the

technology and how it will be applied as they graduate and obtain jobs[10] which stimulates

awareness and acceptance of the EHR system before they begin clinical work and must apply

theory and principle learned in the classroom to real, living patients.[2] Classroom involvement

coupled with support tools and medical applications for evidence-based interventions,[7] such as

the Nutrition Care Manual or the University of Edinburgh's Cardiovascular Risk Calculator,[3]

allows students to get educational material and advice from the support tools they will use upon

graduation.[7] This, in addition to a graded review of their work by the instructor,[13] improves

subsequent performance, individual student effort, and group participation.[3] Overall, it advances

the students' educational experience and gives them another professional skill to use as they

develop into their occupation.

Indeed, students are not undergraduates forever. Instructors must give them tools and

experiences to use as they prepare for graduation where EHRs are used daily.[7] Any well-planned

education program provides optimal opportunities to prepare students for their future roles, be

that in healthcare, engineering, or finance.[5] Healthcare students must learn the theories of their

practice and of the technology they will use, what each section of EHR provides and how

working with the system and their peers will support decision making.[8] Educational EHRs

provide the opportunity to learn chart maintenance skills such as accuracy or correcting another's

errors for the safety of the patient.[3] Often a feature of the EHR is a visit template which can aid

in note taking and provide a more complete patient visit.[1] They can also learn skills such as

placing orders for interventions or medications,[3] which improves competencies for EHRs and

HIT in general. Having these competencies enhances student confidence for clinical use[2] and

allows them to use higher order thinking in documentation and patient care planning.[13] Students

have the opportunity for standardization and adaption to their skill levels,[6] something that is

uncommon when learning in the clinical setting, as well as the peace of mind that they can apply

their knowledge with no potential harm to their patients.[13] This removed, but clinical, context

fosters satisfaction, perceived usefulness of the EHR, and patient safety.[10] As many students

learn better with hands-on experience, this realism with a safety net promotes overall learning.

Though there is always the expressed concern about patient-care giver interaction

suffering, and in fact a study with clinical interns using EHRs showed 48% of them spent less

time looking at the patient as opposed to when they used paper recording methods,[1] there are

ways to train etiquette. Another study proved this by teaching their interns to follow certain steps

including to "let the patient look at the screen, use eye contact, value the EHR and let the patient

know that it is valuable as well, explain the processes as they occur, and log off to protect

sensitive information."[4] This process helps students learn that the EHR is a helpful tool and not a

hindrance to building rapport.

Building relationships is not only important to patients, but also to peers. EHRs help

nurture collaboration with other professions in managing a case.[13] Students do tend to have some

resistance to initial interdisciplinary work, but EHRs promote teamwork and help facilitate the

understanding of how essential cooperation is to healthcare.[10] EHRs are particularly good for this

as they allow for many users to have access to a patient's information at the same time, if

properly implemented, instead of competing for the paper chart.[8] Learning bedside manners and

how to appropriately interact with peers is essential to any healthcare profession as is and EHRs,

when properly taught and employed, promote patient-centered care.

Student Feedback

As aforementioned, correctly making and implementing the educational EHR system is

the key it its success. Many students have varied experiences with and attitudes toward EHRs

based on the system itself, how it was taught, and the setting in which they were exposed to it.[1]

However, many studies show that if the program itself is easy to use and the students are exposed

to it in an educational setting, there are positive results. Often students are excited to apply their

knowledge to a "real" patient and want to practice their practical skills and critical thinking.[13] In

the OHSU study mentioned earlier, 51% of the students involved and 92% of the student interns

found the exercise "effective" or "very effective."[3] Many students felt that it is a constructive

experience and a study of pharmacy students showed that they wanted to see the longitudinal

impact that they have on the patients as they implemented plans and strategies for

improvement.[13] A medical student in the OHSU study said "I think EHR navigation is a huge

part of the 'job' of being a doctor, and it should be explicitly taught like this."[3] As for the

pharmacy students, 97% believed EHR knowledge would help them document patient activities

and could help expand the role of pharmacy in the healthcare team.[13] Though the students found

the educational EHR introduction useful, they wanted earlier exposure,[8] and thought that it would

have helped prepare them for their advanced classes as well as future jobs.[13] It must be noted that

in one study however, the students closer to graduation found the experience more useful,[11]

therefore young students may not be as receptive initially. In the study with nursing student

interns, 96% felt prepared to complete paper records when they graduated, but only 48% felt

prepared to complete EHRs.[5] If they had been taught about EHRs earlier, these numbers would

be very different as most students find EHRs generally easier use for documentation and are

more accessibly when compared to paper charts.[1] This is because perceived usefulness changes

over the course of the curriculum.

Beyond doubt, the usefulness reported was overwhelmingly positive. However, it must be

noted that the student's attitude is very important in their intent to learn and subsequently use

EHRs.[11] As they went through the process, students felt more comfortable with finding

information and inputting orders,[3] which increased how they perceived the usefulness of the

EHR and changed their attitudes to a more positive outlook.[11] This can be explained by the

integration into the coursework. When given a single activity with students, course instructors in

a study of pharmacy students thought more than one exposure would improve performance and

acceptability.[9] Overall every study reviewed resulted in students feeling more positively about

and more confident using EHRs when they were given an educational EHR and all students

tested more than once improved their performance.

Furthermore, there are some characteristics about educational EHRs that improve its

acceptance and should be noted. When a formal orientation of the educational EHR was

provided, students felt more comfortable initially and more acquainted with the program.[9] One

study gave their students a handbook and a worksheet to help them explore the educational EHR

thoroughly.[2] Additionally, to help the realism and therefore attitude toward usefulness, it is best

practice to have the patient case load be larger and the complexity to increase as the students

progress if at all possible in the curriculum.[13] These supplemental materials and functions will

help students fully utilize and understand the functionality of an educational EHR which

translates to higher confidence as they transition into the healthcare world.

Clinical Site Use

While the benefits of learning how to navigate and properly utilize an EHR are proven to

be beneficial in the academic setting, they can also be beneficial for an intern in the clinical

setting. Generally, learning a new EHR system could take three to five days to fully learn.[6]

However, it is completely unreasonable to assume that any healthcare worker would be handed

even three days to fully comprehend the system. Though interns do tend to like using EHRs

more than paper records, they normally do not receive formal training and so do not utilize their

EHRs fully.[1] One study provided a simulated environment for physicians and nurses in an

outpatient center. Each simulation used real, debriefed volunteers that were tailored to their

profession, and the participants received classroom training prior to the simulation. The

researchers found that after completion, the participants improved their EHR documentation

skills and increased patient safety. They also felt more confident and prepared to use EHRs more

regularly.[4] This shows that even one exposure to a formal training on EHR systems improves

attitudes and benefits the healthcare model.

Similarly, a different in-field simulation study using physicians showed that they

correctly identified more patient safety needs after repeated trials. This was based on risk factors

such as inappropriate medication dosages, significant changes in hemodynamics over 24 hours,

and recognizing over sedation.[6] Other studies showed that physicians with EHR training ordered

40% more preventative services for patients (which is admitted a low number but any

improvement in the prevention sector is important), 72% asked more questions based on prompts

in the EHR system that do not exist on paper, and 69% felt that their documentation improved

overall.[1] There were long term effects in one study that had their simulations about a month apart

and still found growth in the abilities and improvement in scores of the participants.[6] Findings

also showed that those who benefitted most were those with the lowest experience in the field,[6]

and in nurses over physicians.[4] This promotes the fact that earlier integration can only benefit

students and interns,[1] and that there may be inefficiencies occurring currently in the healthcare

field, especially with those who spend extended periods of time charting such as nurses. In fact

80% of the nurses in one study found essential information easier and faster with electronic

charts than in paper charts once they were trained properly.[1] Furthermore, the importance of a

hands-on experience as opposed to simply theory is demonstrated by one nurse who said "I felt like I would remember a lot more from this encounter than training class alone."[4] With improvements being shown in the field as well as the classroom, it is evident that training needs to occur and that it would be more efficient and standardized if it occurred in the classroom as opposed to a more on-the-job training environment.

Conclusion

It has been made clear through a review of the current literature regarding use of electronic health records for education that adding this into course work is crucial to sculpting students into the best prepared professionals they can possibly be. Giving students ample opportunity to grow and learn in all sections of their profession is essential for the field of healthcare to continue to expand. Education requirements are changing as technology and knowledge steadily advances and curriculum must review current requirements and adapt to the transforming environment to help meet students' needs and match contemporary healthcare practices. Technology itself is rapidly growing and will impact the healthcare field greatly as the years advance. Future studies must investigate how students can collaborate with those at other universities for expanded relations. It is also important for future researchers to understand how health information technology can benefit healthcare even more, to create new decision support systems and integrate them into the classroom as well, and to investigate how clinical involvement in the manufacturing of software can improve patient care. Technology now connects the world more closely than ever and it is vital that healthcare education understands and utilizes this fact to improve in all facets.

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