Electronic Health Record Training in Undergraduate Medical Education: Bridging Theory to Practice With Curricula for Empowering Patient- and Relationship-Centered Care in the Computerized Setting

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Abstract

While electronic health record (EHR) use is becoming state-of-the-art, deliberate teaching of health care information technology (HCIT) competencies is not keeping pace with burgeoning use. Medical students require training to become skilled users of HCIT, but formal pedagogy within undergraduate medical education (UME) is sparse. How can medical educators best meet the needs of learners while integrating EHRs into medical education and practice? How can they help learners preserve and foster effective communication skills within the computerized setting?

In general, how can UME curricula be devised for skilled use of EHRs to enhance rather than hinder provision of effective, humanistic health care?

Within this Perspective, the authors build on recent publications that “set the stage” for next steps: EHR curricula innovation and implementation as concrete embodiments of theoretical underpinnings. They elaborate on previous calls for maximizing benefits and minimizing risks of EHR use with sufficient focus on physician–patient communication skills and for developing core competencies within medical education. The authors describe bridging theory into practice with systematic longitudinal curriculum development for EHR training in UME at their institution, informed by Kern and colleagues’ curriculum development framework, narrative medicine, and reflective practice. They consider this innovation within a broader perspective—the overarching goal of empowering undergraduate medical students’ patient- and relationship-centered skills while effectively demonstrating HCIT-related skills.

With a thoughtful approach, you can maintain focus on the patient.
—Ventres, Kooienga, and Marlin

Health care information technology (HCIT) is becoming integral to the practice of medicine. Electronic health records (EHRs) in particular are becoming state-of-the-art. Potential benefits of computerization in health care are numerous. The Institute of Medicine has strongly encouraged EHR use for improving quality of care and patient safety. More recently, the Health Information Technology for Economic and Clinical Health provisions of the American Recovery and Reinvestment Act of 2009 highlighted health care transformation in the United States, citing HCIT as enabling new delivery models for improving health care.

The actual teaching of HCIT competencies, however, is not keeping pace with the burgeoning use of HCIT. For example, few medical schools have explicit processes for assessing medical informatics competencies within the Association of American Medical Colleges’ Medical School Objectives Project. Currently, no EHR-related competencies are indexed in the Accreditation Council for Graduate Medical Education (ACGME) requirements framework, nor are EHR-related questions included in the United States Medical Licensing Examination. Given the scarcity of existing formal pedagogy, medical education curriculum and professional development initiatives for preparing both future providers and seasoned clinicians to effectively use EHRs are warranted. In particular, medical students need to be “informed consumers who understand both the power and vulnerabilities of the tools they will be using in their practices.”

Furthermore, interest in preparing learners for effective use of information and communication technology for professional practice is growing within the health care professions. Recent emphasis in nursing education, for example, includes removing barriers to adoption of such technology, stimulating critical thinking, and improving decision making through evidence-based care.

Despite the EHR’s potential to improve health care, concerns center on the impact of computer presence, or “triangulation of physician-patient–computer,” on the physician–patient relationship. Challenges include empowering effective communication through skillful simultaneous accessing.
of the EHR with the patient present\textsuperscript{16}; minimizing diversion of attention from a patient,\textsuperscript{17} which can alter the patient’s narrative\textsuperscript{13}; and avoiding the diminishment of dialogue, particularly in the psychosocial and emotional realm.\textsuperscript{18} Medical students themselves express worry about their ability to effectively integrate EHR use into clinical encounters.\textsuperscript{14} Such concerns, part of the broader issue of the fine balance between benefits and risks of EHR use for physician–patient communication,\textsuperscript{19} are relevant given the integral role of physician–patient communication in quality medical care,\textsuperscript{20} patient satisfaction,\textsuperscript{21} and clinical outcomes, including patient concordance, or sharing in treatment planning.\textsuperscript{22,23}

These valid concerns can help inform curriculum design for systematically incorporating EHR use within undergraduate medical education (UME). Medical schools must now be responsible for teaching EHR use within the context of providing competent patient-\textsuperscript{24} and relationship-centered (PRC) care.\textsuperscript{25–28} Given increasing recognition of the nature and quality of physician–patient relationships as central to health care and healing,\textsuperscript{25} Lown and Rodríguez\textsuperscript{15} emphasized the importance of creating and evaluating curricula that include teaching communication strategies, enabling learners to “foster rather than diminish” relationships and effective communication as they integrate EHRs into patient encounters. More recently, Tierney and colleagues identified key issues of EMR use for ACGME core competencies as well as potential future directions for leveraging the EMR for an optimal educational experience.\textsuperscript{29} Still, literature review and our collective experiences in UME indicate that formal educational frameworks for developing and improving competence in EHR use are few.

Recent efforts to initiate effective EHR use have been described. These include a skills-based model, applied in educational interventions for family medicine residents and practitioners\textsuperscript{30,31} and communications workshops.\textsuperscript{32} Such efforts also include theory-based approaches for teaching and evaluating clinical documentation skills using EHRs through the Reporter–Interpreter–Manager–Educator scheme\textsuperscript{33} and “tips”\textsuperscript{14} for effective physician–patient communication during EHR use. A 22-item communication skills checklist for first-year medical students\textsuperscript{44} and an online self-study module for second-year students\textsuperscript{35} are initial curricular efforts for supporting teaching of EHR-specific communication skills in medical school. The development of a medical informatics curriculum with key facets of HCIT, including ergonomics, decision support, computerized physician order entry, e-mail and portal engagement with patients, and use of social media, was recently described.\textsuperscript{36} Not surprisingly, a recent thread (“virtual discourse”) within the Michigan State University Office of Medical Education Research and Development DR-ED listerv (http://omerad.msu.edu/dr-ed/) on the topic of Teaching Communication Skills with an Electronic Medical Record (EMR) highlighted current interest in developing, implementing, evaluating, and disseminating UME curricula in this domain.\textsuperscript{37}

As curriculum design efforts move forward, we propose four curriculum objectives for a UME EHR training curriculum innovation: (1) introducing students to the presence of a computer within a clinical encounter, (2) training students in EHR-related skills, (3) empowering patient- and relationship-centered interviewing skills while incorporating EHR skills, and (4) fostering students’ appreciation for added value of integrated computer use within the clinical encounter.

### Challenges and Opportunities

The challenge of designing and implementing a UME curriculum for effective EHR use offers opportunities for a more integrative pedagogic approach. Such an approach can include simulated as well as real learning experiences, didactic and interactive methodology, humanities-based learning, multisource feedback including reflective self-assessment, and assessment for learning\textsuperscript{38} to “scaffold”\textsuperscript{39} (i.e., provide instructional support for) transformative reflection and learning.\textsuperscript{40} A spiral developmental, longitudinal curriculum\textsuperscript{41} taking into account level of learner, as well as the six-step model of curriculum development proposed by Kern and colleagues,\textsuperscript{42} can be useful frameworks for innovations aimed at developing core competencies. An additional caveat within the HCIT domain is the need for medical educators to guide students in recognizing key aspects of health care that are not solely technical, such as appreciating the integral role of the narrative in patient-centered compassionate and competent care.\textsuperscript{43} Narrative medicine\textsuperscript{49} (i.e., medicine practiced with narrative competency) can help. Benefits of engaging in narratives of clinical practice include promoting reflection in practice, empathic engagement, and professional development.\textsuperscript{49,50} In addition, harnessing the power of patients’ stories for acquiring medical knowledge has recently been highlighted within flipped-classroom innovations in medical education, as “messages become stickier when they come in the form of a story that elicits emotion in readers or listeners.”\textsuperscript{51}

There is increasing recognition of the value of including critical “non-conventional” competencies\textsuperscript{45} such as attentiveness, critical curiosity, self-awareness, and presence within a comprehensive definition of professionalism.\textsuperscript{46} Such “relational, affective, and moral components”\textsuperscript{47} are in line with Lown and Rodríguez’s encouraging the cultivation and maximization of mindful presence, self-awareness, and self-calibration for effective PRC interaction when implementing curricula focusing on use of HCIT, including EHRs.\textsuperscript{15} Furthermore, they elaborate on such qualities potentially altering the nature of communication, relationships, and physicians’ sense of professional role.\textsuperscript{15} Such critical “non-conventional” professionalism competencies\textsuperscript{45} are generally perceived as being more aligned with humanities than basic science, supporting the inclusion of humanities (such as physicians’ stories\textsuperscript{47} or other literature) within curriculum innovations of this domain for an integrated or more holistic approach.
Emerging paradigms within health care professions education can contribute to our theoretical formulations and practical curriculum applications. A recently developed and validated HCIT learning model within a nursing curriculum, for example, focuses on cultivating positive attitude toward using EHRs and increasing perceived usefulness to boost students’ intention to use EHRs in learning and enhancing clinical practice. Of note, the features of this model are consistent with a major motivational theory in psychology: self-determination theory, proposed as assisting our understanding of teaching and learning processes in medical education. The practical application of such contemporary educational scholarship can help realize an integrative approach to curriculum design. Specifically, this competency-related theory highlights intrinsic motivation and autonomous self-regulated learning as positively associated with academic performance and well-being. These qualities are useful to foster in support of efforts toward successful and effective adoption of EHR within practice.

Health professions educators are further challenged to engage millennial learners with the proposed “5 R’s” to guide curriculum design for EHR use for developing ACGME core competencies. “Skill acquisition, Leach has written, is a developmental process, and “although insights may occur suddenly, competence develops over time, nurtured by reflection on experiences.” Maximizing learning through facilitated reflection on practice relies on self and other (faculty) as “reflective coaches.” Facilitated reflection has been previously described as valuable for learning outcomes in graduate medical education and for engaging in physicians’ narratives on experience (as described above). Reflective learning and practice can thus serve as a foundational competency for EHR training in UME, bridging theory to practice. Providing our learners with such training in UME may then help facilitate “leveraging the EMR for the optimal educational experience” within graduate medical education as benefits of EMR use for developing ACGME core competencies are realized.

In general, foundational guiding principles of curriculum design for EHR training in UME focused on empowering PRC care in the computerized setting can include the following for an integrated approach:

- Kern and colleagues’ six-step curriculum design framework (problem identification and needs assessment; targeted needs assessment; goals and objectives; educational strategies; implementation; evaluation and feedback).
- Reflective learning and practice,
- Spiral longitudinal developmental curriculum,
- Narrative medicine, and
- Adapting pedagogy to needs of millennial learners.

Curriculum Example

At Alpert Medical School of Brown University (AMS), we undertook iterative, systematic development of a longitudinal UME EHR curriculum innovation within a series of clinical “Doctoring” courses at our institution. We drew from relevant conceptual frameworks of reflective practice and narrative medicine to complement our application of Kern and colleagues’ curriculum development framework for a more integrated approach. We offer the following overview of our resulting curriculum innovation as a concrete example of bridging theory to practice in UME EHR training.

“Doctoring” is a required longitudinal, four-year, six-course, non-specialty-specific program designed to teach knowledge, skills, attitudes, and behaviors of the competent, ethical, and humane physician. The six courses combine instruction and assessment in medical interviewing, physical examination, cultural competency, medical ethics, and professional development, using an educational paradigm that models interdisciplinary teaching and collaboration. A targeted needs assessment (April, 2012) led us to implement, within the inaugural third-year clinical skills clerkship, an initial training session in EHR use to formally introduce the computer into the physician–patient relationship. This addition built on the foundation of PRC medical interviewing and physical diagnosis skill proficiencies developed within the first two years of the Doctoring program. For further development of students’ EHR skills, a second “advanced” EHR training module occurs late within the final Doctoring
course at AMS, a fourth-year internship preparation elective.

Within the third-year learning module, students view a didactic PowerPoint presentation entitled “Effective Communication with Electronic Medical Records” prior to experiential learning within a standardized patient encounter that is directly observed by faculty. The goal of this exercise is to facilitate reflection-before-action (RBA)9,10 within the EHR training module design, prompting students to reflect on potential positive and negative influences of EHR use on physician–patient communication. The pedagogic value of simulated patient encounters and associated opportunity for feedback in a safe setting has been described.11,12 RBA within our paradigm includes a narrative medicine component using selected reflective readings assigned at various time points on the developmental trajectory in the EHR curriculum to optimize effective accommodation of concepts.13–16 We facilitate reflection-on-action (ROA)17 with feedback from a coteaching faculty team of a physician and social/behavioral science (SBS) specialist, who directly observe students’ EHR use and communication skills. We facilitate reflection-for-action by asking students to identify learning needs for preserving PRC behaviors while using the EHR. We use these processes to support self-directed learning.

We facilitated desired behaviors for empowering PRC interviewing skills during EHR use by constructing user-friendly, behavior-focused “introductory” and “advanced” grids drawn from existing literature18,19 and adapted for UME (see Appendix 1). These structured frameworks or “behavior grids” guide clinical practice exercises by concretizing desired behaviors and are made available to both third- and fourth-year students in electronic syllabi for review prior to session participation to enable RBA. They are also used for multisource feedback for students, including (1) reflective self-assessment, given the potential benefit of making specific criteria available to guide self-directed reflective learning,20 and (2) feedback within practice sessions from multidisciplinary faculty and standardized patients.

The behavior grid is also used by learners, clinical faculty, and real patients within additional mentor–role modeling opportunities of third-year clinical clerkships to scaffold the learning process. These opportunities include students actively observing experienced clinical mentors using EHRs and, subsequently, mentors observing third-year students using an EHR during a real patient encounter. Given reported substantial negative effects of EHR implementation on medical student educators, including decreased enthusiasm for teaching,21 we next plan to provide faculty development for clerkship directors around the structure and purpose of this longitudinal curriculum innovation. The grid design incorporates four identified domains in which examination room computing can affect physician–patient communication: (1) visit organization, (2) verbal and nonverbal behavior, (3) computer navigation and ultimately mastery; and (4) spatial organization of the examination room.22 Behaviors within the grid linked to curriculum objectives focus on:

- Patient participation for chart building,
- Information sharing and shared decision making,
- Patient education, including extracting from the medical record as well as educational materials to reinforce discussion,23 and
- Sending information to the interprofessional team in order to assure continuity of care and foster a feeling that medical students are part of a health care team with patient information a “shared asset” as they comanage patients.81(p3)

An expanded behavior grid introduced in the fourth-year internship preparation course is geared toward increasing students’ appreciation for potential added value of integrated computer use within the clinical encounter for “information mastery,”24 engaging patients with their health care narrative, and fostering effective and empathic communication and care.25 An “advanced skills” EHR module may serve as a clinical review with potential for diminishing likelihood of “distraction error,” such as the inability to focus on the EHR while interacting with a patient, which has been noted as a potential contributor to fourth-year students’ overlooking important information available to them within the EHR.16 Furthermore, inclusion of such a module within increasingly prevalent “transition course” curricula may help facilitate students’ transition to residency.84

Next Steps

Learning to conduct patient care well with EHR technology support in real time has been described as a complex process that should begin during medical school.27 Bridging theory to practice requires purposeful design of EHR curricula for supporting the development of core competencies of PRC communication skills, reflective practice, and professionalism. We have offered a curriculum innovation at our institution as an example of integrating components of longitudinal design, applied learning, critical reflection-in-practice, and humanities-based learning (narrative medicine) for impacting knowledge, behavior, and attitudes and transforming practice.88 We have planned rigorous analyses of survey construction and validation practices, though at introductory stages of a much-needed curriculum, achieving the desired educational impact may take precedence over accessing validity and reliability data over the long term. Such interests are indicative of the need for further scholarly work in this domain. We hope that planned robust formative and summative evaluations of our described innovation as well as such assessments of other emerging EHR curricula89 for competency evolution will help guide significant steps forward for HCIT pedagogy.

Narrative reflection and medical education in ethics and humanities aims to promote humanistic skills and professional conduct,86 precisely those skills that are potentially threatened by adding a computer into the patient–provider dynamic. We thus encourage consideration of more integrated curriculum approaches for EHR training and other core competencies in UME. Given the centrality of physicians’ stories within narrative medicine for fostering empathic rather than detached engagement,49 inclusion of first-person physicians’ reflective narratives about physician–patient communication and EHR use may be enriching. Such narratives can serve as reflective triggers, helping to enhance depth and breadth of reflection on experiential learning86 and professional identity development.50,89 Future research on effective methods for fostering reflective practice “in action”90 may shed
light on such practice supporting an ongoing “self-audit” mechanism for maintenance of patient- and relationship-centered skills, thus promoting a more enlightened biopsychosocial approach to patient care.

Further research on best practices for formally educating students on the use of EHRs as a powerful tool for patient care is needed. In line with the value of assessment for learning, measurable outcomes of physician–patient–computer communication skills training to avoid the “Dr. Computer” persona, teaching maintenance of narrative-based open-ended dialogue within EHR use, and facilitating EHR-narrative-based open-ended dialogue both at our institution and at others.

Another potential area of investigation related to but outside of practice exercises includes application of reflective practice for recognizing ethical considerations within EHR use. These may include forms of “clinical plagiarism” (i.e., cutting and pasting history of present illness and medical history information from other treating clinicians’ EHR notes prior to seeing the patient) and inadequate history taking while relying on erroneous information, potentially leading to diagnostic and care errors. In addition, future research efforts may help elucidate optimal methods of EHR use as a teaching tool for medical students.

In general, effective triangulation of physician–patient–computer may be optimized with implementation of medical education curricula that systematically incorporate use of EHR health technology, PRC communication skills, and reflective practice competencies. We conclude with a recent publication title as a salient theme for medical education and practice in this domain:

Patient-centered care and electronic health records: It's still about the relationship.

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Other disclosures: None reported.

Ethical approval: Not applicable.

References:
21. Robbins JA, Bertakis KD, Helms LJ, Azari R, Callahan CM. Behavioral instruction are promising. The preparation of technologically literate physicians of curricular evaluations of outcomes of curricular innovations that include both preclinical exercise didactic overview and concrete behavioral instruction are promising both at our institution and at others.
32. American Academy of Communication in Health Care. EHRICH Workshop. The Art of Communication and the
Appendix 1

**Grid for Electronic Health Record (EHR) Training in Undergraduate Medical Education, Warren Alpert Medical School of Brown University**

**Prep for visit (outside exam room): Pre-scan last visit and problem list.**

<table>
<thead>
<tr>
<th>Skills</th>
<th>Student self-assessment</th>
<th>Faculty assessment</th>
<th>Standardized patient assessment</th>
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</thead>
<tbody>
<tr>
<td><strong>Introductory (Years 3 and 4)</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Position patient, provider(s), and computer for optimizing interaction</td>
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<tr>
<td>Introduce computer while logging in</td>
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<tr>
<td>Start with patient’s concerns</td>
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<tr>
<td>Verbalize shift to the computer</td>
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<tr>
<td>Attend to/record pertinent narrative elements</td>
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<tr>
<td>Provider nonverbal (eye gaze and body positioning): Look at patient, position self-facing patient with eye contact, hands off keyboard and mouse (especially when sensitive discussion)</td>
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<tr>
<td>Patient nonverbal: Attend to nonverbal cues from patient</td>
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</tbody>
</table>

**Advanced (Year 4)**

<table>
<thead>
<tr>
<th>Skills</th>
<th>Student self-assessment</th>
<th>Faculty assessment</th>
<th>Standardized patient assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage patient's participation in building the chart (e.g., tell patient what you are doing as you’re doing it; point to screen to highlight data)</td>
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<tr>
<td>Maintain rapport while entering data</td>
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<tr>
<td>Utilize info from chart and/or patient education materials for shared decision making and/or to reinforce discussion</td>
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<tr>
<td>Send note to interprofessional team</td>
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