EMR Precharting Efficiency in Internal Medicine: A Scoping Review

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ABSTRACT

PURPOSE: The act of precharting, or navigating the EMR to review a patient's recent vitals, labs, notes, and other results, is something that is required of every clinician prior to effective rounding on patients. The purpose of this scoping review is to review the extant literature on precharting.

METHODS: Scholarly data through OVID on Medscape and grey literature were systematically searched with extensive inclusion criteria including the terms "Pre-round" "precharting" as well as "student" "education" or "teach" adjacent to "EMR" or "electronic medical record" or "electronic health record" or "documentation." We collated this with "education, medical, undergraduate," or "Students/medical."

RESULTS: As of September 23, 2020, 241 scholarly articles were identified. No grey literature were identified. Inclusion criteria included full article access, English language, and covering the precharting topic. Seventeen articles met inclusion criteria and were included in the review. These articles included 1 direct observational study, 1 retrospective study, 2 qualitative studies, 5 EMR workshop trainings, 1 perspective piece, 1 curriculum analysis, and 6 articles based on survey measures. Of these articles, the majority were published recently, with 8 of the 17 published since 2018. Summary of the limited existing literature can be distilled into 3 findings: a need for timely EMR data extraction, the potential optimization of EMR workflow, and the benefit of time intensive EMR trainings.

CONCLUSIONS: This scoping review explored the existing scholarly and grey literature to summarize the review of precharting and education surrounding navigating the EMR for medical students as a means of exploring the topic to determine current practices and identify areas of potential improvement.

KEYWORDS: Medical education, precharting, prerounding, electronic medical record, workflow

As medical students progress from pre-clinical to clinical training, they become entrusted with increasing levels of responsibility for patient care. Knowledge and skill navigating the electronic medical record (EMR) is a critical foundation for the core competencies of patient care, systems-based practice, and interpersonal collaboration.[1] The ability to efficiently review electronically documented clinical data is essential for transitioning from a pre-entrustable to an entrustable learner. Specifically, the Association of American Medical College's (AAMC) entrustable professional activity (EPA) 1 (gather a history and perform a physical exam) and EPA 2 (prioritize a differential diagnosis following a clinical encounter) require that students effectively navigate the EMR to collect pertinent clinical data.[2] Surveys of medical student's attitudes regarding navigating the EMR support the central role this skill plays in their day-to-day work.[3]

Extensive discussion has ensued over the past decade surrounding the role of the medical student in contributing to medical documentation and even whether or not they should have access to the EMR. This is surprising given that 93% of clerkships require medical student use of the EMR, and medical student achievement of core competencies depend heavily on patient data extraction for both notes and presentations.[4] Less, however, has been devote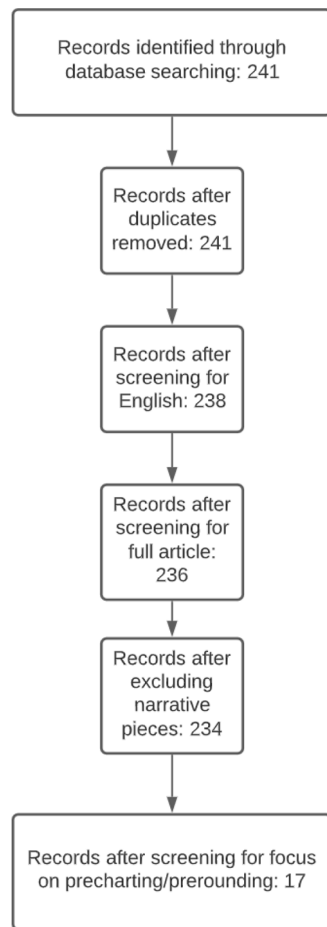d to the appropriate skills training for these new clinicians. The act of precharting, or navigating the EMR to review a patient's recent vitals, labs, imaging, notes, and other results, is something that is required of every clinician to ensure timely rounds and appropriate patient care.

Despite the critical importance of precharting, teaching this skill is often relegated to casual, on-the-job training by resident physicians or even other medical students.[5] The Alliance for Clinical Education recommends that medical schools develop required EMR related competencies for graduation, though do not provide guidelines on specific methodology or metrics.[6] The purpose of this paper is to review the extant literature on precharting and methods of enhancing this experience to provide a pedagogical framework for more efficient precharting by medical students.

Methods

In completing this scoping review, we developed search criteria through OVID on Medscape. These criteria included as the terms: "Pre-round" "precharting" as well as "student" "education" or "teach" adjacent to "EMR" or "electronic medical record" or "electronic health record" or "documentation." Additionally, we collated this with a search for "education, medical, undergraduate," or "students/medical."

Figure 1. Flow diagram of inclusion criteria.

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Records identified through
database searching: 241
        │
        ▼
Records after
duplicates
removed: 241
        │
        ▼
Records after
screening for
English: 238
        │
        ▼
Records after
screening for
full article:
236
        │
        ▼
Records after
excluding
narrative
pieces: 234
        │
        ▼
Records after screening for focus
on precharting/prerounding: 17
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Figure 1. Flow diagram of inclusion criteria.

To search for gray literature, a number of sources were identified and searched using "prechart" and "preround" including the "Grey Literature Report," the "Directory of Open Access Journals," "MedNar," and "Grey Matters". We also searched the top 10 medical schools according to US News and specifically searched these program websites for information regarding "prechart" or "preround." After the articles for inclusion were agreed upon, they were independently reviewed by the authors and data was extracted for reporting.

Results

On August 21st, 2020, there were 241 published articles from this combined search. There were no results found through the systematic gray literature search. Of these articles, 3 were excluded for not being published in English. Two were excluded because there was only access to the abstract and not the full data. Two were excluded for being narrative pieces without data and 217 articles were excluded as they were not about precharting. Exclusion criteria eliminated articles which focused on medical student access to the EMR or on chart documentation practices, neither of which were a primary goal of this scoping review. Additional reasons for exclusion included focusing on using the EMR during a patient encounter or focusing on note writing itself. Final inclusion criteria focused on EMR utilization for accessing daily patient information in preparation for clinical decision making. Figure 1 represents the flow diagram for inclusion criteria.

Seventeen articles were ultimately included in this analysis (Table 1). These articles included 1 direct observational study, 1 retrospective study, 2 qualitative studies, 5 EMR workshop and improvement trainings, 1 perspective piece, 1 curriculum analysis, and 6 articles based on survey measures. Of these articles, the majority have been published recently, with 8 of the 17 published since 2018 and all but 1 published since 2011.

Of the 17 articles included with relevance to precharting or EMR proficiency education, 3 main themes were identified (Figure 2). The first theme is the need for students to have adequate EMR proficiency for efficient data extraction: 7 articles touched on topics including the students' desire for EMR navigation training, the association of EMR efficiency with clinical rotation success, as well as the impact of low efficiency with high burnout symptoms due to larger amounts of screen time. Another theme among the reviewed articles was the analysis of trainee workflow practices for EMR data extraction. Two articles described in detail the timing and order of operations in practical EMR usage. These articles described both qualitative and quantitative results of training efforts as well as development of novel tools to teach EMR efficiency. Finally, 8 articles addressed training EMR users to improve efficiency, with comparisons between paper and electronic precharting.

Need for timely EMR data extraction

Medical students dedicate large amounts of time to accessing the EMR during clinical rotations, with screen time especially high during non-procedure-based rotations such as internal medicine.[4] One study analyzed medical student EMR usage over a one-year period and showed that medical students access the EMR for over 4 hours per day while at work and 35 minutes on average logging in from home.[7] Another study included EMR auditing of student actions as well as a survey of 45 medical students after a 4-week internal medicine rotation. Results showed that medical students spend approximately 40% of their work day on the EMR performing tasks such as chart review, placing orders, and documenting notes.[8] While accessing the EMR is essential to multiple core competencies and EPAs, excessive EMR screen time burden has been implicated as a driver of clinician burnout.[9] Moreover, despite high amounts of screen time logged by medical students, no correlation is seen between student EMR use and clinical grades.[4]

Overall, student use of EMR has increased over recent years with 99% of medical students utilizing the EMR in 2016 compared to just 96% that had in 2012, a statistically significant increase based on a survey of 27 788 medical students.[10] This is likely in the setting of the medical field adapting to EMRs becoming popular and then federally required for use. Given recent trends toward EMR usage and the time spent precharting, 1 study looked into efficiency of pre-templated paper

Efficiency	Students need to be efficient users of the EMR for clinical success.
	Efficiency EMR usage is a potential aid in reducing screen time and subsequent burnout.
Workflow	There is very limited data on how to become more efficient apart from a few trainings with time intensive results on EMR use, not specifically focused on pre-charting
	EMR precharting flow of interns and residents is mixed but appears to follow 4 core paths
Training	Trainings are useful and can improve efficiency
	Many of the trainings described were time intensive

Figure 2. Framework for major findings.

precharting versus electronic precharting as means of extracting relevant patient data.[5] This small study described how students modeled precharting practices based primarily on resident behavior with paper precharting requiring time consuming duplication of work from the EMR.

EMR data extraction workflow

When surveyed after completing training modules, 445 students who rotate at multiple sites with a single EMR reported that 2 of the most critical lessons to learn early on in the clinical year were navigating the results review and chart review in the EMR, thus highlighting the need for medical students to effectively navigate the EMR for precharting on patients.[11] Two studies which focused on trainee experiences, rather than that of medical students, explicitly discussed the process movement of EMR use for precharting on patients. One study describes a quality improvement initiative to improve rounding and handoffs through utilization of the EMR rather than paper rounding.[12] This project determined that unfamiliarity with full capabilities of the EMR was a limiting factor to workflow of precharting. These data were collected from surveys to improve standardizing EMR rounding and sign offs in a neonatal ICU by advanced practitioners over the course of 745 patient encounters. This project demonstrated that standardized EMR precharting was associated with increased trainee precharting efficiency.

The second study took a more microscopic approach and analyzed medical resident navigation patterns themselves in EMR workflow for precharting.[13] The authors discussed how clinicians are dissatisfied with EMRs because much of the screen time is spent attempting to retrieve charting information. As such, the authors conducted a live, direct observational study of clinicians precharting to document the flow patterns on the EMR. The authors found that on average, physicians spent about 3 minutes per patient and used 4 main screens

which accounted for 50% of the precharting time. These screens were results review, summary/overview, flowsheet, and chart review. The navigation pathways between these screens were highly variable, yet individual physicians were internally consistent in their EMR navigation strategies.

Trainings in EMR are beneficial, but time-intensive

Desire for EMR trainings is notable in a survey which showed that two-thirds of medical students would have preferred a more formal EMR workshop compared to informal teaching from residents. Students considered familiarity with the EMR as important to their clinical success including effective data gathering, documentation, and order entry.[14] Another survey described how medical students participate in informal EMR training, but "a formal orientation on how to use the EMR system would have been useful on the first day" and that including this training during an orientation would be beneficial.[15] This survey asked students after family and community medicine rotations to indicate whether or not they performed specific EMR tasks as well as providing free responses to open-ended survey questions. While some suggestions centered around access to computers or orders, there were multiple comments on the practicing of EMR skills in general.

The handful of training studies included sought to address this pedagogical deficit, with mixed results. Trainings developed utilizing case studies or simulated exercises that required students to navigate the EMR to discover and enter patient information was deemed 1 possible solution to increasing comfort with EMR usage.[14] Another study demonstrated that students were hesitant to believe the trainings would have lasting impacts and that after a two-day training they still did not feel confident in their EMR usage.[16] While overall opinion on the usefulness of EMR training increased after their training, only 27% ultimately felt confident navigating the system.

Table 1. Scoping review articles included.

TITLE	JOURNAL	YEAR	AUTHOR	STUDY METHODS
Electronic health record skills workshop for medical students.	*MedEd Portal*	2019	Zavodnick et al	Training
Navigating through electronic health records: survey study on medical students' perspectives in general and with regard to a specific training.	*Journal of Medical Internet Research*	2019	Herrmann-Werner et al	Training
Medical student use of electronic and paper health records during inpatient clinical clerkships: results of a National Longitudinal Study.	*Academic Medicine*	2018	Foster et al	Survey
Electronic health record use in internal medicine clerkships and sub-internships for medical students graduating from 2012 to 2016.	*American Journal of Obstetrics & Gynecology*	2020	Wallach et al	Survey
Medical student appraisal: electronic resources for inpatient pre-rounding.	*Applied Clinical Informatics*	2013	Sampognaro et al	Survey
Medical students and the electronic health record: "an epic use of time."	*American Journal of Medicine*	2014	Chi et al	Survey
Self-perceptions of readiness to use electronic health records among medical students: survey study.	*Journal of Medical Internet Research*	2020	Lander et al	Survey
Predictors of student use of an electronic record.	*The Clinical Teacher*	2019	Huang et al	Survey
How are medical students using the electronic health record (EHR)? An analysis of EHR use on an inpatient medicine rotation.	*PLoS One*	2019	Chi et al	Retrospective analysis
Improving efficiency using electronic medical record rounding report & sign-out report.	*Journal of Pediatric Health Care*	2005	Casey et al	Training
Commentary: the RIME/EMR scheme: an educational approach to clinical documentation in electronic medical records.	*Academic Medicine*	2011	Stephens et al	Perspective
Collaborating for competency—a model for single electronic health record onboarding for medical students rotating among separate health systems.	*Applied Clinical Informatics*	2018	Pereira et al	Training
Analyzing EHR navigation patterns and digital workflows among physicians during ICU pre-rounds.	*Health Information Management*	2020	Coleman et al	Observational study
Pharmacy students' perspectives on the initial implementation of a teaching electronic medical record: results from a mixed-methods assessment.	*BMC Medical Education*	2020	Vlashyn et al	Survey
Simulated electronic health record (Sim-EHR) curriculum: teaching EHR skills and use of the EHR for disease management and prevention.	*Academic Medicine*	2014	Milano et al	Curriculum description
A pilot study: a teaching electronic medical record for educating and assessing residents in the care of patients.	*Medical Education Online*	2018	Smith et al	Training
A novel approach to supporting relationship-centered care through electronic health record ergonomic training in preclerkship medical education.	*Academic Medicine*	2014	Silverman et al	Training

A bi-institutional survey of medical student self-perception for EMR readiness that looked into an experiential EMR training synthesized the findings into 3 core EMR-based competencies, one of which is looking up information.[17] Understanding how medical students are utilizing the EMR can give insight into how to make this experience more efficient and instill positive habits. One mixed-method study comprised of focus groups and surveys reported that overall, virtual EMR trainings were favorable with half of participants agreeing that teaching sessions on the EMR enhanced learning.[18] A simulation EMR training course on a platform identical to the EMR system used at the facility was modestly beneficial in helping students use the EMR; however, the course was time intensive and took place over many weeks and thus required significant resources.[19] Another training program used a case study on severe sepsis as a method of teaching the EMR, which was well received by the students and was mostly limited by the in-person format.[20] An additional study revealed that second year medical students who had multiple EMR trainings found a compounding improvement in EMR navigational skills and that at least 3 training sessions were needed to have significant improvement.[3] These results provided evidence that EMR training enabled students to engage with patients more effectively by better addressing patient concerns through effectively integrating the EMR into patient encounters and was subsequently supported by student self-assessments and faculty assessments.

Discussion

As medical students will arrive to rounds expected to know about their patients, it is curious that more has not been written about training students to easily navigate the EMR to systematically and efficiently prechart. There is an overall dearth of literature regarding precharting and the methods to do so efficiently, in contrast to the extant literature available on the ties between burnout and EMR use or the role of medical students in EMR documentation. Moreover, the dearth of gray literature on the topic is remarkable given the current practices of informal teaching of EMR precharting skills. The lack of evidence-based teaching methods may explain the minimal formal training offered for medical students on EMR precharting. As a result, EMR training of medical students is left to informal and unstructured sessions led by senior medical students or residents. Nevertheless, precharting is an essential competency for medical students and this scoping review describes the limited extant literature on the topic.

Given the skills needed to use the EMR effectively and efficiently are first learned during the clinical years of medical school, it would be optimal to provide options for standardization of this learning experience to instill strong learned habits. While much of the current EMR training is informal, medical students report a desire for a more formalized training of EMR use. Given the only extant literature on EMR workflow is that of trainees, this provides a critical insight into the role of how

medical students are currently instructed on precharting activities during offhanded resident free time, a precious commodity. As trainings have demonstrated success, it is even more surprising that no published data exists describing their incorporation into medical school curricula. Building efficient precharting habits would be potentially beneficial to reduce overall time spent accessing the EMR. This would be beneficial in allowing students and physicians to spend more time with patients and reduction of EMR usage could reduce burnout.

Review of the extant training literature suggests a need for multiple iterations of trainings to improve precharting efficiency and comfort. While the training suggested is time-intensive, the results suggest that having sufficient training leads to a decrease in time required to prechart. Furthermore, as there is limited data on training approaches to EMR precharting, individual programs may implement various pedagogic methodologies to accomplish this goal based on program resources and culture. This is further supported by the EMR workflow studies which demonstrate the patterns of EMR navigation that have the potential to be optimized to improve efficiency. Similar to the systematic approach that medical students are taught in how to approach reading an EKG or a chest x-ray, a similar structured methodology can be utilized to teach time-efficient but thorough precharting.

The results from this scoping review can be employed by medical schools and by early career physicians to further establish the precharting process to become more effective and efficient. This study is limited by the fact it is a scoping review and undertook a broad and exploratory search of the literature without a formalized appraisal. The authors view this limitation as a strength, however, as this is the first study to summarize the existing literature regarding precharting in the EMR. This scoping review explored the existing scholarly and grey literature to summarize the review of precharting in addition to education surrounding navigating the EMR for medical students as a means to determine current practices and identify areas of potential improvement.

Author Contributions

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