

THE IMPACT OF ELECTRONIC HEALTH RECORDS ON PRIMARY CARE WORKFLOW
IN THE POST-IMPLEMENTATION ERA: A SYSTEMATIC LITERATURE REVIEW

By

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ABSTRACT

Background

The electronic health record (EHR) is now an integral part of the majority of primary care practices, particularly after passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act. Many studies have been published looking at use of the EHR with respect to quality of care, safety and cost. Many studies have focused on the challenges surrounding EHR implementations. A key factor in successful practice of primary care, particularly evident in experienced EHR users, is the impact of the EHR on the workflow.

Objective

This study will provide a systematic review of recent literature examining the impact of the EHR on the workflow of primary care practitioners who are at least six months beyond initiation of EHR implementation.

Materials and methods

Searches of CINAHL, Clinical Evidence, the Cochrane Library and Medline were performed, seeking articles published between January 2003 and January 2013. 21 studies ultimately met inclusion criteria. Studies were reviewed and organized using a framework of a provider task list, to identify common themes.

Results and discussion

Using a modified version of the Wetterneck task list, 5 articles discussed workflow of entering room/gathering and reviewing patient information; 6 articles discussed documenting patient information; 4 articles discussed performing duties including exams and recommending/discussing treatments; 10 articles discussed ordering and communicating; and 2 articles discussed providing instructions, wrapping-up and leaving the room. Common themes including benefits and barriers to efficient care were elucidated, and directions for further work were explored for EHR vendors, researchers, and leaders implementing or optimizing an EHR.

INTRODUCTION AND BACKGROUND

Prior to passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act, enacted as part of the American Recovery and Reinvestment Act (ARRA) of 2009, electronic health record (EHR) adoption was notably low. A survey released in 2008 reported 4% of providers having an extensive, fully functional electronic-records system, and 13% having a basic system.¹ Since HITECH and its meaningful use incentives, adoption has increased significantly. As of 2011, 55% of providers have adopted an EHR system.² Among solo practitioners, 29% have adopted EHR systems, with a proportional increase in adoption compared to practice size (60% of 2 provider practices, 62% of 3-10 provider practices, and 86% of practices with 11 or more providers). Among primary care groups, 58% report having adopted an EHR, and 77% of those adopters report having a meaningful use certified system. Many practices are now several years past their initial EHR deployment, and a body of literature is emerging describing the

experiences of these 'seasoned' practices. In this growing post-implementation era, the focus is shifting from why providers are not using EHRs, to whether or not providers are satisfied with their EHRs and getting the most out of them.

Small primary care practices make up the majority of provider practices in the U.S.³ Primary care practices tend to have a complex workflow, due to the wide variety of patients and diagnoses that are accommodated in these types of practices. This complexity is a major consideration when making the decision to implement an EHR. As providers progress from the implementation phase to the 'comfort' phase of EHR usage, changes are ideally made to existing workflow patterns to take advantage of benefits of the EHR. In some cases however, workarounds are created to help staff get through the day, and these can become the norm and even be taught among staff members. Many providers share a notion that as their use of the EHR evolves, their practice must evolve, which means matching workflow to that inherent with efficient use of the EHR.

Of existing studies, it has been noted that how provider satisfaction with the EHR changes over time is relatively unknown.⁴ Many published studies conducted evaluations within three months of implementing new technology, including some evaluations taking place with the first week of the initial go-live event. As has been noted, "health care delivery is a dynamic process that utilizes congruous interactions among different healthcare providers, each of whom is dependent on the other in terms of skills, knowledge, expertise, and physical assistance".⁵ More literature is needed in looking at the experiences of providers who have been using an EHR past the implementation phase.

The way each practice carries out their workflow is unique. Although some tasks and processes match, there is typically little uniformity. Regional variations exist based on particular protocols adopted by laboratories and insurance carriers in that region.⁶ Differences in protocols necessitated by insurance carriers can range from verifying patient information over the telephone, to using a machine to swipe the patient's insurance card for purposes of obtaining prior authorizations. The workflow of each practice is also individualized for each patient based on the complaint or disease that the patient seeks care for. The primary care provider is typically the initial stop when a new condition arises, and each condition typically has a unique protocol. The primary care visit can lead to referrals for other providers. In some cases, patients are referred from nursing homes, or present after emergency room visits or hospitalizations. Differences mandated by insurance, Medicaid or Medicare also impact workflow. Thus, many different patterns may emerge based on the nuances of each encounter, which makes consistency and reproducibility challenging.

Much of the literature has discussed EHR use as it relates to improvements in quality of care,^{7,8,9} safety,^{10,11,12} and cost.^{13,14} Additionally, many studies have looked at overall staff satisfaction across a wide range of disciplines.^{15,16} A significant factor in the satisfaction of EHR use among providers and office staff is the impact that the

daily use of the system has on workflow. How the use of an EHR has affected staff workflow and the efficiency of patient care delivery is a field of study that has not received a significant amount of attention, and will be the focus of this literature review.

METHODS

Literature search methodology

Searches of CINAHL, Clinical Evidence, the Cochrane Library and Medline were performed. Articles were limited to publications in English. A date range of publication from January 2003 to January 2013 was imposed. With significant changes in technology and culture surrounding EHRs, these were felt to likely be the most relevant. Keywords searched were 'electronic health record' or 'electronic medical record' or 'EHR' or 'EMR' combined with 'workflow' or 'efficiency'. The initial search yielded 742 articles, and after abstract review 135 articles were chosen for full text review.

Study Selection

Articles were excluded which were not published in English, or were published prior to January 2003. I excluded articles that did not focus on primary care providers in outpatient settings, as the key workflow being examined is that inherent in a busy ambulatory clinic. Many studies and literature reviews have examined the myriad of challenges surrounding EHR implementation. My focus was examination of the "post-implementation" phase of EHR use, thus articles where the entire study was conducted within 6 months of EHR implementation were excluded. Articles were excluded if they did not specifically include examination or discussion of workflow. Editorials, comments and letters were excluded. Qualitative and quantitative articles were included, and results had to be available. 11 articles were excluded because full-text could not be retrieved. In all, 21 articles from 17 data sets were ultimately included in this review. One article from 2001, referenced in a 2011 systematic literature review, was included as it lent to the discussion in a meaningful way. One systematic review of time studies was also included.

Identification of Framework

As a framework for our workflow evaluation, I have used the task list during an in depth examination of primary care provider workflow.¹⁷ One of the main goals of this study was to provide a tool to better determine how health information technology is integrated into clinical workflows. The focus was placed on patient-provider face-to-face visit workflow, which makes it an ideal structure for our review of workflow-related literature. Observational data from two studies was combined to generate the list. The list includes 12 major tasks and 189 subtasks, for a total of 191 possible tasks. I chose to focus on the major tasks for the purpose of this study:

- Enter room
- Gather information from patient

- Review patient information
- Document patient information
- Perform duties
- Recommend/discuss treatment options
- Look-up information
- Order
- Communicate
- Print/give patient advise/instructions
- Appointment wrap-up
- Leave room

The intention of the authors was to create a tool to better analyze provider workflow as changes are introduced to the mechanism of patient care, as often encountered through the implementation of an EHR. They note that workflows brought about by change that are unforeseen, awkward, and/or ineffective will result in an increase in provider workload and detrimental care to patients.

To facilitate organization of the studies chosen for this literature review, I consolidated the major events into 5 unique events:

- Enter room, gather and review patient information
- Document patient information
- Perform duties (including exams), recommend/discuss treatments
- Order and communicate
- Provide instructions, wrap-up, leave room

These categories serve as a filter for the available studies to best analyze the issues emerging in the post-implementation period. Several studies explored multiple events based on the chosen framework, and are included multiple times in the appropriate sections.

DATA ANALYSIS

Enter room, gather and review patient information

The elements forming the beginning of the patient encounter were not found to be a significant focus of studies meeting criteria. The studies that did explore this area focused on availability of data, and in some cases the changing roles of team members responsible for these task elements. Five qualitative studies are included.

A qualitative study of seven primary care practices in the northeastern U.S. with an EHR in place between 1-10 years found that one of the key sources of reduced work burden for check-in and patient rooming tasks involved availability of the chart.¹⁸ Many practice staff members praised their EHR for essentially eliminating the tasks of retrieving, filing, and searching for paper charts, all of which were time-consuming. Staff members were able to track the arrival of patients, and find key

information such as demographics, problems lists, medication lists, previous visit notes, vital signs, immunization records, laboratory results, and other test results. Prior to use of EHR this would have taken considerable time to find in the paper chart. Availability of the EHR during the patient rooming process served as a cognitive tool for clinical support staff to ensure appropriate information was elicited from patients. In contrast, clinicians reported that tasks involved in chronic disease management and review of preventive care recommendations were not well supported by the EHR, and as a result were more time consuming. One explanation was that data could not be displayed in ways that supported point of care needs, such as immunization data, screening test and lab information, medications, referrals, and even vital signs. To locate and review each item required that the clinician click through a series of screens that could not be opened simultaneously. In addition, alerts and prompts were either not used or found distracting rather than helpful. Two practices were notable exceptions to this issue. In one, the lead provider chose his EHR because it had a summary panel that provided alerts when specific care was needed. After spending time customizing the alerts, he reported his chronic and preventive care was more thorough and efficient. Another practice paid an outside vendor to extract data from the practice EHR and provide it in a summary sheet for each patient to prompt needed care by staff members. Clinicians at both of these practices reported less frustration with this aspect of using the EHR.

A study of primary care providers in Norway conducted through focus groups, observations, and mailed questionnaires found that although time was saved using the EHR in comparison to processes that were previously carried out on paper, many clerical tasks were now performed directly by providers.¹⁹ EHR made access to information easy, but reviewing the information in an efficient manner was harder. The presentation of information was a significant issue. Difficulties encountered included the absence of organized notes and results sorted chronologically or by condition, the lack of reminder or checklist availability during follow-up of chronic conditions, and missing functionality promoting efficient electronic communication among providers.²⁰ Despite these findings, and the additional finding of fifteen percent of staff reporting a hardware or software issues on a weekly or daily basis, the providers definitively stated that using the EHR was worth the time and energy involved.

A qualitative review of 6 primary care practices in Virginia examined EHR use and provider and staff perceptions through a series of on-site visits and telephone interviews.²¹ The majority of the practices identified several significant benefits of using an EHR. Documentation was felt to be better organized, more accessible, and created with higher accuracy. Having medical history and detailed patient complaint information now available before and during encounters, patient data was no longer felt to be buried in the chart. Other benefits included practice changes in the dynamic of care. One practice developed a team-based model, utilizing nurses in the collection and data entry of the majority of patient information directly into the EHR. One practitioner managed a scribe who did the

data entry during and proceeding patient encounters. Other practices created new roles or changed responsibilities of team members in the entry and retrieval of data.

A cognitive task analysis was performed through semi-structured interviews of 25 primary care providers in Israel who had ten or more years of clinical and EHR experience.²² Providers related that workflow tasks inherent with the diagnosis, decision making and treatment of severe or complex medical issues were associated with the highest cognitive loads. Providers felt that use of their EHR reduced these cognitive loads. Providers expressed contentment with the EHR, particularly with regards to the organization, comprehensiveness, and readability of data. This made the review of patient histories and results of tests easier. Reduction of the cognitive load was thus attributed to a minimization of the requirements of recalling information from memory, as well as the need to decipher difficult-to-read handwriting.

Document patient information

Several of the studies included an in-depth exploration of the effect of EHR use on documentation of the clinical encounter. This task is estimated to take up to one-third of providers' time.²³ Understanding how staff document in an EHR is critical. Beyond providing a narrative of patient progress, and forming the legal repository of the care plan, documentation has other functions, including facilitating communication, providing clinical decision support, and allowing for measurement of quality of care.²⁴ Included are four qualitative studies, one quantitative study, and one mixed methodology study.

A quantitative study looked at the notes of 1008 providers practicing within an integrated delivery network in Massachusetts, who had been using an EHR an average of 4 years.²⁴ Methods used to create notes included dictation, free text entry, and entry via structured templates. 63% of providers used mainly one method for documentation, while 21% strictly used one method, and the other 16% used more than one method. Far more specialists than PCPs used dictation only ($p < 0.001$) or mostly dictation ($P < 0.001$), and significantly more PCPs used only templates ($p < 0.001$) or mostly templates ($p < 0.001$). Providers who had been using the EHR longer were more inclined to predominately dictate than use a template (OR 1.13, CI (1.03, 1.25)). Users with less EHR experience were more likely to use templates than a free-form method (OR 0.86, CI (0.77, 0.95)). Most providers were pleased with the EHR documentation functionality independent of their typical method of documentation.

In their qualitative analysis, Howard et al. found that use of an EHR reduced staff work burdens by allowing simultaneous chart accessibility.¹⁸ This was recognized as one of the highest impacting functions, as it meant that support staff could perform their work without the need of the clinician to complete their work, as was the case with the paper chart. Several documentation related burdens dealt with issues of infrastructure inadequacy. Examples included a lack of needed user licenses, a lack of computers or absence of computers in key areas, and the

combination of several non-integrated programs with specific functions rather than a single integrated EHR. These infrastructure challenges forced double documentation of data, or in some cases the need to cut and paste data from one program into another. Providers noted having to complete documentation during their personal time due to limited access. In all but one practice, providers noted that charting in the EHR took more time than charting on paper, which accounted for longer work hours, requiring work to be done at home. Reasons included poor design of interfaces, difficulty in proper selection of diagnosis codes during the encounter, and no longer being able to use shorthand note taking that was commonplace when documenting in the paper chart. Interruptions in cognitive processes added to charting difficulty, as the flow of the patient-provider conversation was altered due to patterns forced by required sequences of work within the EHR. Additional burdens included the ability of staff to type quickly, and deficiencies in basic computing skills. An exception to this rule was seen in one practice, attributed to the lead provider of the group investing time and effort into investigating the existing workflow pattern and the current roles of staff members. Alterations in work roles to support the EHR processes were made, particularly the role of the medical assistant. As a result of these changes, the documentation burden on providers was reduced, and more time was allotted to direct patient-provider interactions.

A systematic review of time efficiency studies was conducted, focusing on the efficiency of providers and nurses using the EHR.²⁵ Study results indicated an increased likelihood that nurses would save time documenting patient information via an EHR compared to providers. Among the explanations provided were the ability of nurses to use standardized care plans and templates for their documentation. Providers typically do not use these standardized forms and instead create clinical notes in unique ways based on the specific situation. Additionally, it was noted that while providers and nurses both incorporate retrieval and viewing of data into their work processes, for providers it is much more directly related to providers' process of documentation.

In a study exploring the views of 19 primary care providers across southwest Ontario, Canada through semi-structured interviews, it was found that participants in the same role used the EHR in different ways.²⁶ A wide variance was seen between providers in terms of what was documented, where the documentation was performed, how often documentation was required, and the proficiency levels of the providers with respect to computing. Participants had at least 2 years of EHR experience, and were cognizant of the variability of EHR data. Increasing consistency in the usage of the EHR was thought to require additional leadership, prompting the continued presence of a system super-user or team champion. An additional study using this same group further elucidated that the main factors in proficient use of the EHR were the complexity of the system, and the possession of computer skills.²⁷ Users noted continuing struggles with the intricacy of the system and were noted to be lacking in essential computer proficiencies such as typing.

An analysis was performed of electronic survey responses of 225 primary care providers in Massachusetts, considered to be advanced users of their EHR.²⁸ Providers described the frequency of numerous tasks performed during patient encounters. Common tasks included performing medication reconciliation through manipulation of the listed medications, and completion of some part of the encounter note. Additional tasks included review or update of allergies, family and social histories, and immunizations. With respect to documentation, 46% of respondents related that on occasion during a patient encounter, paper was used for note taking. Several barriers to using the EHR to document throughout the encounter were identified. The most identified barriers were reduced patient eye contact (62% of respondents), taking too much time during the encounter (52%), system speed or latency issues (49%), inadequate typing ability (32%), perceived rudeness of computer use during the patient encounter (31%), and the inability to produce longer narrative documentation (28%).

Perform duties (includes exam), recommend/discuss treatments

This was not a commonly explored area of the literature. Five qualitative studies that met inclusion criteria explored these elements of workflow. Four discussed the difficulty in incorporating the exam into the EHR workflow, and one discussed workflow surrounding clinical reminders, a common system used in the recommendation of treatment to patients.

Goetz Goldberg et al. in their qualitative study of 6 primary care practices in Virginia found that one of the unintended consequences of EHR adoption is time away from patient care.²¹ A number of providers in the study expressed frustration with the substantial time requirement needed to enter data into the EHR, as well as the clerical nature of this work. Providers also shared the concerns of patients with regards to the entry of EHR data during patient exams being very impersonal. In some practices this led to dissatisfaction of using the EHR, and resistance to using advanced functionality of the system required to fulfill the requirements of meaningful use.

Two series of qualitative interviews of 24 primary care practitioners in Rhode Island explored use of the computer in the exam room.²⁹ The second series of interviews was conducted 8 months post-implementation, and compared to the first occurring prior to EHR implementation. During the post-implementation phase, providers noted that although they had anticipated negative effects of the use of the EHR in the exam room during a patient-provider interaction, that this was in fact not the case. This was particularly true for those caring for patients who were already established with the practice. Providers reported that they were able to effectively maintain eye contact through repositioning the workstation in a way that promoted patient engagement.

In the Shachak et al. qualitative study of 25 primary care providers in Israel, the authors found that 92% of study participants felt EHR use interfered with patient communication.²² Data gathered through observation found that the typical screen

gaze time of providers comprised 25-55% of the total encounter time. Providers did note several factors in their use of the EHR that they felt enabled communication. Advanced computer skills including blind typing, use of templates, and using embedded keyboard shortcuts created more time for direct communication. One provider created a template consisting of a completed exam for each of her typical physical examinations. Using the keyboard, a shortcut was used prior to the exam to insert the data, and after completion of the exam she would change the data to reflect the appropriate exam findings. Another provider expressed concern for patient safety using this technique, leading her to use free-text typing over use of the templates.

In a study of experiences with an EHR system, semi-structured interviews of 72 VA personnel across three networks were conducted.³⁰ Thirty-four of the subjects worked in the primary care setting. One of the most significant barriers to use of the EHR, particularly the clinical reminders functionality, was time. Providers addressed the concern that processing reminders required too many 'point and clicks', particularly in the context of a 20-minute encounter, which was the average time interval in which to see a patient. The number of reminders and the presentation of inappropriate reminders were also concerns. A typical work-around in dealing with this issue was to ignore all of the reminders, which led to breakdown in communication and several providers receiving negative feedback on their reviews of preventive care measures for their panels.

Order and communicate

This was a common area explored in many studies. Staff members felt these two elements were crucial in their clinical workflow, and that the EHR had significant impact on their efficiency for performing these tasks. Ten qualitative studies are included in the discussion of this task.

Through two questionnaires (one for providers and one for nurses), usability of a CPOE system in use for over a decade at an academic medical center in the Netherlands was examined.³¹ Survey topics included usability, system intuitiveness, workflow efficiency, user satisfaction and perceived changes in medication safety. 57 usability issues were identified, 35% of which were labeled as severe. Overall providers had a positive impression on the system in terms of effect of workflow, ease of use, efficiency, and safe prescribing of medications. Nurses were also positive in respect to effects of workflow, ease of use, and efficiency, but were least positive when asked about medication safety. Specifically looking at workflow, study results indicated high satisfaction levels among nurses and providers. 10% of providers indicated the system created difficulty in coordinating care with other clinicians, evidenced by misunderstanding of remarks made by the provider, or having to duplicate order entry when patients were transferred to another department. The authors conclude that CPOE systems altered existing communication pathways between nurses and providers, and created an illusion of effective communication where providers are led to believe that because

information is entered into the system, it will be delivered to the correct staff member who will respond to the task accordingly.

In contrast, Denomme et al. found in their study of 19 primary care providers in southwest Ontario that the use of the EHR common messaging system was viewed as facilitating team communication, with integration and normalization into the team's everyday work.²⁶ The messaging system also enhanced efficiency and consistency. The strength of the EHR messaging system for office effectiveness and productivity was also noted. Investigating the same group, Terry and Brown et al. noted that a significant issue creating a barrier for efficient use of the system was the absence of results coming directly into the system electronically, particularly laboratory results.²⁷

In the Howard et al. study of seven community-based practices in the northeastern U.S.,¹⁸ staff members noted that the ability to communicate with providers through the course of the day by using the electronic messaging functionality in their EHR was impressively convenient and efficient. In one, all staff members would continually check their EHR inbox, since providers were able to answer their questions as well as forward information, tasks, and requests to them in between patient encounters. The EHR allowed facilitation of better communication between staff and patients. With charts being easily accessible, questions could be answered immediately and callbacks minimized. Several order results and communication barriers were identified. Increased work for staff members was noted due to limitations in connectivity to outside health care entities. Hospital reports, letters of consultations, nursing home correspondence, and other diagnostic test results were delivered to the practice via mail or fax. Inconsistent transmission of laboratory result data from reference laboratories was commonplace, and several practices took the step of crosschecking all data coming into the EHR with data delivered on paper. Because some but not all laboratories returned results electronically, practices had to maintain both electronic and paper processes and providers often had to look in multiple places to determine whether or not lab results had been received. For those providers who had the ability to access laboratory results as structured data, they reported a positive effect on their workload; it allowed clinicians to view patient trends over time in one glance, thereby eliminating the need to flip through the chart. In addition to the burden of reviewing laboratory tests, the ordering of tests also placed a new burden of work on providers. Orders were placed in the EHR but then were also communicated to staff members responsible for placing the order into a separate system accessed by the outside reference laboratory. Several practices had a single computer dedicated to the outside lab were located in such a way as to make it impossible for labs to be verbally ordered and entered by staff. With respect to electronic prescribing, some clinicians found it reduced workload, while others found it burdensome. This variation was associated with whether or not a practice had a stand-alone e-prescribing program, or a program integrated into their EHR. For the practices that used the integrated program, prescribing was quicker and easier, and these clinicians also appreciated the information from the e-prescribing module

automatically populating the medication list in the patient's chart, and that a log of the patient's history with the medication was created in the process.

Interviews and observations of 13 small practices in the Baltimore and New York evaluated the workflow of EHR systems across different functions.⁶ The experience of primary care providers was contrasted with that of specialty providers. Primary care practices reported the major source of interruptions in workflow came from dealing with outside care participants including the referral laboratory, emergency rooms and hospitals, specialty practices, and payors. The computer did not lend efficiency to any of these interactions, which still required paper processed to effectively completed. A different experience was noted in the specialty offices, which operated by obtaining referrals from primary care providers. The typical workflow involved the primary care practice clearing the patient for insurance eligibility, and sending the pertinent documentation along with the referral, significantly lessening the burden of obtaining required information, which for the specialty practices corresponded to a substantial reduction in the time spent interacting with external entities.

Regarding medication orders, a qualitative case study involving observations and semi-structured interviews of 19 ambulatory medicine providers in New York specifically looked at this element.³² The study occurred one year after switching to a new, commercial EHR. Providers stated the EHR did not improve efficiency or ease the workflow inherent in writing prescriptions. The majority noted an increase in the amount of time needed to properly order and refill prescriptions with the new system, attributed to additional mouse clicks and the number of steps required to carry-out most functions. Through analysis of observational data, it was found that even tough task completion required a significant number of mouse clicks, in general providers could accomplish this task in under a minute. As difficulties arose, providers switched to alternate workflows including the use of paper to fill medications. Notwithstanding the perception of spending more time to accomplish tasks, providers placed importance on several features of the system that they felt improved efficiency. Providers saw uniform system access across multiple locations as a significant advantage, and felt the ability to create customized preference lists improved the time spent prescribing medications. Particularly timesaving, when working properly, was the ability to transmit prescriptions electronically. Another observation was a group of providers who chose to not send their prescriptions electronically. These providers cited the fact that many pharmacies were just starting to allow electronic prescribing, and thus awaited the ability to fully use this functionality once pharmacies would consistently allow it.

Two separate qualitative studies of seven primary care providers in Massachusetts combining task analysis and ethnographic observation investigated the usability of the group's EHR.³³ Data analysis specifically examined a results management component of the system that assisted providers reviewing laboratory results and following up with them appropriately. The majority of participants used the system during specific blocks of time they set-aside during the workweek, typically 30-60

minutes. This was typically the only block of time they had to complete acknowledgement of test results and send letters to patients with results and follow-up instructions. Additionally, some providers tried to complete this work while seeing patients and performing other duties. Providers usually had between 10-40 records to review, although the number was as high as 100. Focusing on usability, the study revealed many negative aspects of the system. Often access to other components of the system was required, such as the notes, medications, and patient summary sections. This made it difficult to maintain system context. Users commonly requested access to these components from within the results management system. Some users opened multiple sessions of the system in different browsers to provide this functionality, but this allowed for errors created if different patients were pulled up in each session accidentally.

A qualitative study investigated the experiences of a referral system for uninsured or underinsured patients among primary care practitioners in a San Francisco university-affiliated medical center via a web-based questionnaire.³⁴ The study revealed that for a significant number of providers, the time spent submitting an electronic referral was much greater than for others, and the amount of time spent on the submission correlated with an overall reduced satisfaction in care. Several reasons given for the increased amount of time required included an inadequate number of computer workstations, complicated procedures involving multiple steps required to access the referral system in a secure manner, and frequent system terminations in the middle of the session. Despite these findings, the providers did not report reduced affinity for the electronic referral system, leading the authors to conclude that the most significant aspect of the barriers were structural in origin.

A study involving semi-structured interviews of 16 VA healthcare workers in three primary care clinics and nine specialty clinics focused on the consult management process.³⁵ Among 12 of 16 staff members, authors discovered 17 incidents where the EHR was used in a manner not intended or designed. Many of the workarounds involved paper, such as staff printing the consults and the specialist providing handwritten feedback on the printed page, such as triage instructions. Alternate methods of work created documentation inconsistencies, or resulted in a staff member placing a non-verified order into the system for the provider as a surrogate, bypassing clinical decision support and other functionality prompting safe ordering. Other workarounds included cut-and-paste of information from the EHR to an email, and consults placed entirely outside of the EHR consult system. These affected the ability to effectively track the consult and its progress. Communication was also affected. 72 cases across 14 of 16 participants were observed to include a breakdown between primary care provider, specialist, ancillary staff, and patients.

A qualitative study among 44 providers at two geographically dispersed VA medical centers was conducted to understand the benefits and challenges to safe and effective management of abnormal test results delivered via EHR notifications.³⁶ In analyzing the data, the most commonly noted barrier to effective management of the test results was the amount of notifications delivered to providers. Notifications

included test results as well as other types automatically generated through consult processing and other tasks. The number of notifications made it difficult to process those results that needed more immediate action, affecting the ability to respond appropriately in a timely manner. Nearly all providers agreed that the robust patient care demands made the efficient processing of notifications very difficult. Among the most common suggestions were improved system functionality promoting better visualization, organization, and tracking of notifications.

Provide instructions, wrap-up, leave room

The final tasks involved in the clinical encounter received little attention in the studies included. Just two qualitative studies explored the impact on 'wrap-up' discussions, including incorporation of patient education, as part of the studied workflow.

An older (2001) case-control study conducted among six ambulatory internal medicine providers (238 encounters) in Illinois found that the three providers using an EHR checked and clarified information ($p < 0.01$), encouraged patient questions ($p < 0.005$), and ensured completeness of the encounter ($P < 0.005$) more often than the three using a paper record.³⁷ More time was spent with patients presenting initially to the practice among the providers using the EHR (an average of 35.2 minutes vs. 25.6 minutes; $p < .05$).

Doyle et al. in their qualitative study of 24 family medicine providers 8 months after EHR implementation found the most important skills that mitigated the negative impact of the EHR on communication were reading aloud while typing, maintaining eye contact, use of body language to show attention and empathy, use of humor to reduce tension, and stopping computer use to turn to the patient when conveying important information or discussing sensitive issues.²⁹ They also reported that not only had the expected benefits been realized, but also the benefits had been exceeded in many cases, in particular with regards to the educational resources available through the EHR. Providers asserted that use of the computer with the patient present in the room facilitated shared decision-making and collaborative creation of treatment plans with patients. The technology allowed them to print the treatment plan and give a paper copy to the patient. Providers reported sharing more information from the chart with their patients for educational purposes than they had done previously and increased ability to get patients to contribute to their care planning.

DISCUSSION

Overarching challenges of 'experienced' EHR users

As primary care providers and practice staff evolve through the use of EHR technology, unique issues can be explored that are more difficult to elucidate during the implementation period. Efficient EHR use has been shown to be facilitated by increased confidence in using computers, as well as the perceptions of providers

regarding the benefits of the EHR in patient care.²⁷ Assessing and increasing the computer skills of users, striving towards consistent data entry and EHR use, and creating intuitive procedures to deal with challenges such as outside document capture and information technology issues can all facilitate optimal use of the EHR.

Attempts have been made to create a conceptual model that captures the many facets of EHR use on clinical care workflows.⁴ Research suggests that the effect of EHR use on patient matters such as safety, communication and confidentiality, while a common point of discussion and a source of attention in the media, are in actuality less impactful for providers. Instead, the processing of patients, tasks involved with administrative activities, and encounter documentation are felt to be most important. This hierarchy speaks to how providers are conceptualizing EHRs. Providers essentially view the EHR in terms of functionality to improve the workflow of clinical care, similar to the effect of order entry systems. Hence, providers presently conceptualize EHRs as an evolution of order entry systems rather than as new technology, potentially resulting in less than optimal use of the EHR. This is consistent with other research showing that despite practicing in an environment with experienced primary care providers who feel their practice is improved through use of an EHR, the full functionality of the system is not utilized.³⁸ Many of these providers have noted training, including the initial training during implementation, and continued support in the post-implementation phase, to be inadequate.

As noted in a quantitative analysis of 6 high-functioning practices, those sites identified as having “great” implementation practices all emphasized the importance of optimization of their systems.³⁹ Focusing on gradual improvement helped the excelling practice sites ensure success of their implementations through consistent attention to the initial as well as the sustained use of the EHR in clinical practice. This was shown to be in contrast to the sites with less successful implementations, which did not plan for optimization as part of their implementation. Staff from these sites often reflected on changes that they would have made to their plan. The excelling sites used the optimization strategy to note how well providers were using the EHR, and dedicated resources and time to ensure that providers had successfully integrated EHR functionality into their workflow patterns. The lack of this integration has been shown to have a negative influence on care.⁴⁰ During the patient encounter, substandard forms of computer use have an adverse affect on the extent and substance of patient information, how much of the information is efficiently documented, and the quality and/or availability of the information in the EHR for patient care and research needs.

Changing roles and team building

Several practices in our review successfully altered or expanded the roles of staff members to handle the increased burden of work. Medical assistants were particularly tapped for a number of new duties, including panel management of chronic disease and preventative health tasks, which had previously been performed by clinicians.¹⁸ Through the use of intuitive protocols, tasks such as

completion of preventive care flow sheets, tracking of laboratory results, answering of patient requests, management of disease registries, communication with patients for appropriate follow-up, and in some cases performing elements of the documentation such as the initial histories at the beginning of a patient visit were able to be efficiently completed, freeing up significant time for providers to devote to direct patient interactions.

Many are cognizant that EHRs have been built to serve a more provider-centric model, but this model has proven insufficient to deal with the large burden of chronic illnesses and the challenges of providing preventive care to a growing elderly population. These new opportunities to shift work from providers to support staff represent a unique opportunity for practices to evolve. Altering workflow and increasing work roles to maximize the potential of staff members are key elements to promoting patient-centered care. Assigning clear EHR duties and responsibilities to each individual staff member ensures their contributions are maximized, team productivity and service levels remain high, and goals are attainable. In this model, continuous EHR teaching and training opportunities should accommodate a variety of needs, and use a range of methods, since each staff member's specific duties will differ based on their skill level and role on the team.

Lessons learned

The insight gained in examining the unique workflow issues of experienced EHR users in documenting their work provides several opportunities for further exploration. Allowing providers to choose from multiple techniques to perform documentation may promote a higher rate of provider satisfaction with regards to EHR documentation functionality. Additional studies need to pursue the correlation between quality and the preferred method of documentation. Comparisons in quality and use of decision support with the breadth of the provider documentation should also be explored, with a contrast of shorter notes to those with longer narratives. Emerging technologies in the field of documentation may change the perception that highly structured documentation is necessary for quality assessment and decision management support purposes. In real time, natural language processing tools can mine concepts from free text, so that it may be used to build coded data.²⁴ Providers may find this to be a successful alternative if it proves to be faster or promotes increased satisfaction. Advances in voice recognition software are likely another factor in this potential change.

With respect to order entry, several studies noted a large difference in satisfaction depending on whether lab and pharmacy (e-prescribing) systems were fully interfaced or stand-alone. At the heart of much of the dissatisfaction was the need to duplicate work in multiple places or multiple systems, and the lack of transparent resulting and communication. Consult entry and tracking was another common source of frustration. Health information exchanges have the potential to assist greatly with this element of workflow, and should remain an intense area of development given these findings.

Implementation considerations

As research focuses on providers who have been using systems for a longer amount of time, more lessons can be provided to those who are at the point of EHR implementation, to ensure identified workflow issues will not impact the success of their providers. Interactive assessments like a walk-through, creating a flow diagram, or performing role modeling can aid in keeping interference caused by the implementation to a minimum, with avoidance of excessive losses of productivity and erosion of provider support, both things that can derail a successful launch.⁴¹ Providers should be included in these exercises given the complexity and individuality of their workflows, irrespective of the additional unpredictability that patients bring. They should be encouraged to define and as appropriate change their workflow to best match the new functionality and new opportunities of support that the EHR will ideally bring.

Barriers exist. Without sufficient resources, practice owners often focus on minimizing the disruption to patient volume during the implementation phase. Also, recognizing the value of investing in redesign requires a systems-level orientation, not typical of either provider leaders or EHR vendors. As long as workflow assessment and redesign remains absent from or peripheral to EHR implementation, practices may need other forms of external help to aid them in accomplishing this. One cannot assume that just because a practice has been using an EHR system for many years, they are using it effectively or have implemented it optimally. HIT extension centers may be one possible avenue of support. Providing guidance towards meaningful use for existing users is as important a need as assisting new users with basic EHR implementation.¹⁸

Vendor considerations

Provider duties are often intricate and hard to predict, particularly in the primary care setting where a broad array of care takes place, and the needs for a wide range of data exist. As EHR programmers and vendors develop new systems and the next iteration of existing systems, the complex needs of the primary care clinician need to be thoroughly understood and considered. EHR development that focuses on documentation, population health and panel management of chronic conditions, placement orders and review of test results, and promotion of effective communication with entities outside the practice should all be seen as ways to decrease the negative aspects of EHR on provider workload.

Future research opportunities

Workflow has proved to be a key element of the healthcare experience. EHRs clearly need to incorporate intuitive interfaces to support this experience. Further qualitative research spanning multiple methodologies including observation, interviews, surveys and focus groups can help in improving the design and usability of EHRs through interaction with real users. The study of workflow and usability will likely intertwine.³³ Usability studies should continue to examine tasks required to carry out the goal of effective clinical care and emphasize those with significant

impact, in addition to identifying areas where the technology is lacking in needed functionality.

It would be fruitful to specifically study small practices where clinicians report that EHR use has decreased their work burden. Best practices could be identified that could help to inform a set of guidelines for workflow redesign in small practices using EHR. Such guidelines could be used in an intervention study in which practices, perhaps with the help of an external facilitator, assess current workflow and develop a tailored workflow for their particular practice to optimize EHR use. Ideally, such a process could be incorporated into the training model that vendors use in EHR implementations in small practices.¹⁸

In addition to the detailed tasks that are inherent within the context of a direct patient-provider interaction, task lists need to be developed that incorporate duties falling outside the typical visit context, such as disease management, preventative care assessment, and results reporting. As systems mature, technologies advance, and workflows change to take more advantage of increasing EHR functionality, more tasks will need to be elucidated. These will include work created through patient emails and other features of patient portals such as scheduling and medication refills, as well as work dealing with home technologies that will further link the patient to their care team within their medical home.

Study limitations

I chose to limit the articles considered English language articles published after January 1, 2003. The goal was to gather the most recent and relevant literature in this burgeoning field. I limited the scope of the study to outpatient primary care practices that have been using an EHR for more than 6 months. Exploring the experiences of these advanced EHR users was in part an effort to distinguishing the issues found in this group to those that are inherent in the initial stages of implementation, an area that has been well studied. Studies that did not include an examination or discussion of workflow were excluded, which may have limited the breadth of some of the studies given the multi-faceted nature of EHR use.

CONCLUSION

The workflow of primary care practitioners is as intricate and complex as many of the patients being cared for. Use of the EHR brings with it intended and unintended consequences. Using a task list to examine the impact of EHR on workflow in advanced users helps bring into focus many commonalities in terms of benefits and barriers towards optimal efficiency. These points provide lessons for other practices who are either embarking on EHR implementation, or are moving out of the implementation phase and into an optimization or maintenance phase. Vendors need to take advantage of these findings as they create and enhance their systems. Opportunities for further research and exploration abound.

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