THE PHYSICIAN PERSPECTIVE

Life After Go-Live
Part 1: Paper in the Paperless Practice

Eric Rose, MD

This column is the first in a four-part series providing observations and insights from the author's experiences with ambulatory electronic medical record (EMR) implementation. It is intended to provide a glimpse "behind the veil" of an EMR-based care environment, with a particular focus on issues that have hitherto received little attention in the literature.

One morning recently, I was leaving the maternity ward of my local hospital. I had just delivered a healthy baby boy, mother and baby were doing fine, and it seemed I would make it to the office in time to see my first patient. Life was good.

As I rounded a corner, I met the nurse manager for the maternity unit. After we exchanged pleasantries, her eyes narrowed.

"You're the doc responsible for that computer system you've got over there, aren't you?"

"Well, yes, I'm involved..." I wasn't sure I liked where this was heading.

"You know, those prenatal records you send us, they're really hard to read. Our nurses hate them."

"Well, I know it's a different format than what they're used to. But all the information is there, you just have to read through it."

"All the other docs around here use the same paper forms for prenatal records, and it's been that way for 20 years! Our nurses are used to those forms. They know where everything is, and they can find a piece of information like that," she said snapping her fingers. "Why can't you just use those forms?"

"Well, it's complicated," I mumbled. "Let me look into it, I'll see what I can do to make our output easier to get through."

My insouciance ruffled but intact, I made my way to the office just a few minutes late. I was surprised to see my usually unflappable nurse looking harried.

"The transfer of information, usually on paper, has created one of the greatest challenges we have faced in our EMR implementation."

"Mr. Jones is your first patient. He's here for a follow-up from his consultation with the gastroenterologist you sent him to. It took me forever to find the consultation report, and the procedure report, and the report from the biopsy he had," she said. "We had received them, they were just in the scan pile," she said, referring to the queue of paper documents awaiting scanning into our EMR. "It's such a pain having all that paper to go through all the time. Why can't everyone use computers like we do and then we could all be connected?"

"Well, it's complicated," I muttered, as I took the paper reports from her and steered myself towards the coffeepot. I was going to need fortification.

In my organization, we like to refer to our medical offices as "paperless" practices. It's true that we keep no permanent patient records on paper — our EMR serves as a comprehensive record of providers' and nurses' notes, diagnostic studies, medications prescribed, and any other information generated in the course of patient care. However, our patients' care extends beyond our offices. They visit specialists outside our system; they receive care in hospital emergency departments or inpatient wards; they occasionally transfer care from other physicians to us and vice versa. All of this requires the transfer of information to and from our system, usually on paper, and has created one of the greatest challenges we have faced in our EMR implementation.

Incoming Documents Related to Past Care

When a patient establishes care with a new physician, it is common to arrange for a transfer of records from their previous physician. These records are nearly always delivered on paper, even if they originate from an EMR system. There are no standards that allow complete electronic transfer of a patient record between EMR systems from two different vendors, and even if the EMR systems are from the same vendor, such transfer is often impossible.

Our approach to the EMR has been to make it the sole repository of clinical information for our patients, so we have striven to avoid the accumulation of information on paper, even records of past care. When our providers receive records of past care from another physician, they read through it and if necessary type a summary of its contents in the EMR record for that patient. Any parts of the paper record that are felt to be important to incorporate fully into the

THE PHYSICIAN PERSPECTIVE

EMR (for instance, ECG tracings or information-rich laboratory reports) are scanned, and the scanned images are entered into the EMR record for that patient. Then the paper record is either returned to the patient or sent to an off-site secure storage facility.

This approach, of course, requires substantial "up front" work from the provider when the outside records are received. This is in contrast to the common approach in paper-based practices, which is to scan the outside records briefly to identify any critical issues that need attention, then to append it to the practice's own paper record for that patient, for future reference should circumstances require. This would be impossible in an EMR-based practice without either abandoning the goal of an all-electronic patient record or scanning the entirety of outside records received, a labor- and storage-intensive undertaking.

Incoming Documents Related to Ongoing Care

The volume of patient-related documents that continually flows into a primary care practice is truly astounding. In my own practice it usually exceeds 40 pages per day. There are reports of consultations with specialists, of visits to emergency departments, of diagnostic studies performed outside our system, and a host of other information.

Paper documents are also generated in the care process itself when providers complete forms for school physicals, workers' compensation claims, disability applications, etc. These need to be incorporated into the medical record for future retrieval if necessary.

In an EMR-based practice, incoming paper documents are generally electronically scanned and then destroyed, and the scanned image linked to the patient's EMR record. Most EMRs allow any patient-related data to be "tagged" with metadata that tells what type of information it contains. This metadata allows the EMR to display the patient record in different "sections," segregated according to data type, analogous to the sections of a paper patient record (e.g., sections for notes from patient visits, laboratory test results, imaging test results, specialty consultations, etc.). In order for a scanned document to be easily retrieved in the future, it needs to be tagged with appropriate metadata by the clerical staff who add it to the EMR. This requires not only knowledge of the EMR's data entry functions, but also knowledge sufficient to recognize what kind of information a patient-related document contains (e.g., being able to tell an MRI report from a chest x-ray report).

"One hopeful development is the growing use by hospitals and some large physician groups of web-based read-only systems for accessing patient information. Access to these systems is often given to referring physicians, allowing them to view transcribed notes and diagnostic test results."

This former task is not trivial. Incorporation of metadata-tagged information into an EMR often requires use of order entry or scheduling functions, which create a "placeholder" for the data. The EMR may not be designed with the need in mind of incorporating and tagging scanned images of paper documents; as a result, some convoluted "workarounds" can be necessary. Suppose, for instance, that our office receives a printed report on a cardiac stress test done on one of our patients. The clerical staff would need to bring up the patient's record in the EMR, check whether an order for "Cardiac Stress Test" for that patient exists and if not, go to the order-entry section, place an order for a "Cardiac Stress Test" for that patient, modify the default parameters of the order to indicate that the order is being placed for data-entry purposes only (so as not to generate a charge for our billing system or a task for our referral coordinator), scan the document, go to the result entry section of the EMR, and link the scanned image to the order just created.

One hopeful development in this area is the growing use by hospitals and some large physician groups of web-based read-only systems for accessing patient information. Access to these systems is often given to referring physicians, allowing them to view transcribed notes and diagnostic test results. Two of the three hospitals used by our physicians offer such systems. When we receive a paper report originating from one of these hospitals, we can retrieve the full text of the document from their web site, and enter it into our EMR by "cutting and pasting" instead of scanning the paper document. This does not reduce the complexity of the workflow described in the paragraph above, but it slightly reduces the time needed to enter the information (because scanning takes longer than cutting and pasting), vastly reduces the storage space needed for the document, and retains the ability to include the document in full-text searches of the patient record.

Outgoing Documents

In general, getting information out of an EMR is easier than getting it in, and this goes for information transfer on paper as well. However, challenges still exist. Our EMR allows us to print the patient record in a variety of ways, and the flexibility itself can be confusing to our staff. We have found it necessary to produce a written procedure manual on how to generate a "complete" printed version of the EMR record. Even when the

printed version of the EMR record is complete, however, the format is sometimes unfamiliar to those who read it, especially in specialty situations, as in the vignette above, where a particular paper-based format has become a de facto standard.

One particular irony with EMRs is the inability to transfer records from one EMR to another, even when they are from the same vendor. I have sometimes noted that we are sending a thick stack of printed patient records to an institution where I know they use the same EMR that we do.

Conclusions

The problem of how to handle paper patient-related documents in EMR-based practices will not go away. The growing trend towards vertical integration of healthcare, coupled with the increasing use of EMRs, may lessen the problem somewhat, since information can more often flow between various care domains electronically rather than on paper. However, even in highly integrated care systems, some care will always occur outside the system, generating documents (usually on paper) that will have to be incorporated into the patient's record. Several steps, however, may help reduce the burden this imposes:

- Healthcare organizations using EMRs should develop standard written procedures for incorporation of scanned images of paper documents into the EMR. This will maximize efficiency and produce consistency in the structure of data in the EMR
- Healthcare organizations should work towards electronic, rather than paper-based, communication of patient information to those outside the organization.
- EMR vendors should design efficient, simple functionalities for incorporating scanned images of patient documents, appropriately tagged with metadata.
- EMR vendors should work towards electronic transfer of patient records between two users of their software. This would require not only an electronic connection and appropriate security and privacy safeguards, but also a way to address differences in the structure of patient records arising from local users' configurations of the EMR.
- Government, standards-development agencies, and EMR vendors should work towards the eventual goal of electronic transfer of patient records between EMRs from different vendors.

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Richard Rydell
William F. Bria, M.D.

While computer use soars in almost every facet of today's culture, that's not routinely the case with clinicians. The growth of the daily use of information systems by clinicians while providing healthcare has been disappointing. What's the best way to get physicians on board with using a patient care information system?

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This book will be available on the HIMSS Web site, www.HIMSS.org, in March or call 312-664-4467.

Life After Go-Live
Part 1: 'So Good It's Bad' Information Management

Eric Rose, MD

This column is the second in a four-part series providing observations and insights from the author's experiences with ambulatory electronic medical record (EMR) implementation. It is intended to provide a glimpse "behind the veil" of an EMR-based care environment, with a particular focus on issues that have hitherto received little attention in the literature.

EMRs enable medical practices to manage information in ways that would be difficult or impossible with paper medical records. This holds immense promise to improve quality of care and prevent medical errors. However, since EMRs frequently produce new information that has to be dealt with, they can increase work for clinical personnel. This column will explore some examples of this phenomenon from the author's experience managing a comprehensive EMR in an ambulatory care environment.

'Results Overdue' Messages

Our EMR can generate alerts when a diagnostic test or clinical consultation is ordered but no results are entered into the system within a specified amount of time. This provides an important safeguard against results "falling through the cracks" and never reaching the ordering provider. Nevertheless, the volume of these alerts is quite high, and investigating them is a time-consuming task.

We have developed some approaches to mitigate this problem. One was to configure certain types of orders not to generate "results overdue" messages. This required an organizational consensus as to when it is safe not to follow up on the results of a diagnostic test or a request for a specialty consultation. As might be expected, the final list of such orders was quite limited, primarily consisting of specialty consultations for which we usually receive no written reports, such as referrals to a massage therapist.

Another solution was to take advantage of our EMR's capability to route "results overdue" messages to specific non-provider clinical staff based on the type of order in question. For instance, messages regarding lab test results go to our lab staff who, with their familiarity with laboratory procedures and processes, are able to handle these more efficiently than other clinical staff.

"Since EMRs frequently produce new information that has to be dealt with, they can increase work for clinical personnel."

'Open Telephone Message' Reports

Our EMR enables us to document contact by telephone with or regarding a patient. The document that's created must be designated "closed" by a user to indicate that the issues raised by the telephone contact have been resolved and no further action is needed. The telephone message might be left "open" for a time if, for instance, a staff member leaves a message for a patient and is awaiting a call back, or electronically sends the message to a provider for consultation. If a telephone message is not closed within a specified amount of time (three days as we have configured our system), it is automatically routed to the electronic "in-basket" of the provider in whose name it was created, with the label "open telephone message."

As with "results overdue" messages, "open telephone message" notification is an important failsafe mechanism in a busy medical practice. It helps to ensure that, if clinic personnel fail to act appropriately or the patient does not respond to our attempts to contact him or her, someone is reminded about the situation before too much time has elapsed.

Unfortunately, the "signal-to-noise ratio" of these reminders is low. Most of the "open telephone message" alerts are for telephone messages of which someone is diligently keeping track and which have been left open for more than three days with good reason (for instance, a patient has called to request the results of laboratory tests which haven't yet been received). This is usually easy to determine by reading through the message itself, but this takes time, and the alerts can pile up. If we were to lengthen the amount of time it takes for the messages to bounce back to the provider, we might improve the number of meaningful warnings, but we would increase the chance that those rare situations where appropriate follow-up has *not* occurred would not be caught soon enough.

Drug-Drug Interaction Warnings

Physician order-entry is a critical component of EMR functionality. It increases efficiency, improves documentation, and enables automated decision support to prevent medical errors and improve

quality of care. One of the most useful decision support features in our EMR is the drug-drug interaction warning system. This system uses a regularly updated third-party database to warn providers, as they are prescribing a medication, about ways in which it may interact with other medications the patient is taking.

There are literally tens of thousands of such interactions, far more than any provider could otherwise remember. Some are potentially serious, and there is little doubt that dangerous problems are averted by the drug-drug interaction alerts that our EMR provides. However, many of these interactions are minor and would never put the patient at any risk. Interrupting the provider's workflow with an alert for the more trivial interactions makes more work for the provider without any benefit for the patient.

Our EMR enables each user to adjust the "sensitivity" of the drug-drug interaction alerts to only present alerts for interactions of a certain level of potential seriousness. However, many of our providers have been hesitant to make that adjustment because they're concerned that a "minor" interaction might actually be clinically significant in certain contexts.

Cross-Coverage for Results Review

Like most EMRs, our system enables electronic review of results for referrals and diagnostic tests. When one provider is absent from the office (the "covered provider"), it is possible for him or her to designate another provider (the "covering provider") to be electronically "copied" on any results that come in during his or her absence. This functionality enables prompt action, when warranted, in response to abnormal results. However, it also duplicates the work of reviewing results, because the results are electronically routed to both the covered and the covering provider. In addition, if the results require action, the covered provider, when reviewing the results upon his or her return, has to review other sections of the patient record to confirm that appropriate action was taken.

The latest version of our software enables the covering provider, after reviewing a result, to delete it from the covered provider's electronic in-basket. This is analogous to the common custom, in paper-based medical practices, for the covering provider to review results on paper and then have them filed in the patient's paper chart, without the covered provider ever seeing them. But so far, our providers have expressed reservations about using that approach, indicating that they prefer to see all results on tests they've ordered even if another provider has reviewed them.

"Our EMR enables each user to adjust the 'sensitivity' of the drug-drug interaction alerts to only present alerts for interactions of a certain level of potential seriousness. However, many of our providers have been hesitant to make that adjustment because they're concerned that a 'minor' interaction might actually be clinically significant in certain contexts."

Conclusion

Paper-based systems are incapable of addressing certain information management tasks. Thus, when systems that automate information management (like EMRs) replace paper-based systems, new information management tasks, in which humans must play some role, become possible. The net effect can be an increase in work — information management that is "so good it's bad."

The solution, of course, is not to abandon these advanced features of EMRs. All the examples described above, despite the burden placed upon EMR users, confer some benefit to the care process. Our goal should be to pursue innovation in EMR design and implementation to minimize the burden without lessening the benefit. For instance, using one of the examples above, the difficulty with "open telephone message" alerts might be ameliorated by enabling users to override the default interval after which the message would "bounce back." In that way, for example, if they knew that a result about which a patient was calling would not be back for seven days, the message would bounce back after seven days, not three.

One curious phenomenon, which also deserves attention, is the hesitancy of providers to restrict in any way the information presented to them in the EMR. As mentioned above, we have seen this come into play with both the drug-drug interaction warnings and the duplication of results review during providers' absences. In both instances, providers seem hesitant to restrict this information stream, even when the information imposes a substantial burden with little benefit.

I believe that, over time, as EMR use becomes the norm, medical personnel will become more comfortable acknowledging that the potential information volume an EMR can provide is overwhelming and that some prioritization must occur in what types of information can be attended to.

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Life After Go-Live, Part 3: Struggling with Structure

Eric Rose, MD

This column is the third in a four-part series providing observations and insights from the author's experiences with ambulatory electronic medical record (EMR) implementation. It is intended to provide a glimpse "behind the veil" of an EMR-based care environment, with a particular focus on issues that have hitherto received little attention in the literature.

"Hey, computer guy!"

These words, which reached my ears on a recent Monday morning, were not spoken in the tone of joyful recognition with which one might, for instance, hail the hot dog guy at one's local ballpark. They were, in fact, more growled than spoken, in the baleful manner of a disappointed sports fan — or, as fate would have it, an overworked, if goodhearted, doctor. Discretion being the better part of valor, I valiantly started walking very fast in the other direction, but was soon overtaken.

"This darn computer system is driving me nuts," said my colleague. "I saw a patient with a migraine this morning, and did you know it won't let you just put down a diagnosis of 'migraine'? It makes you pick from all those cockamamie choices. The only one that fit the patient was 'migraine not otherwise specified without mention of intractability.' What kind of nonsense is that? How is someone supposed to make sense of a patient's problem list when it's filled with that kind of gobbledegook?"

"Oh, ah," I explained.

"And another thing," he continued. "The choices for diagnoses don't even make sense a lot of the time. You and I both know how asthma is divided into intermittent versus persistent forms, right? Why does that computer program make you choose between 'intrinsic asthma' and 'extrinsic asthma'? That's a totally archaic way of thinking about the disease! You should get that software company to fix those lists, or better yet, just let us type in the diagnosis. Why do we have to choose from a list, anyway?"

"Many of the advantages of EMRs over paper-based records derive from things the EMR can do with structured patient information."

"Well, the software company isn't really responsible for the list. It's the World Health Organization, and the National Center for Health Statistics, and as for choosing from a list…"

"Yeah, whatever. I gotta go. All this great technology has me running unbelievably late."

Patient information stored in an EMR is often described as being either "structured" or "unstructured." "Unstructured" information, of which plain narrative text is the most common example, lacks any standardization of format, and its meaning generally cannot be automatically "understood" by a computer system. "Structured" information consists of abbreviated representations of ideas (often numerical "codes," with accompanying text descriptors or "terms"), whose meaning is standardized, i.e., agreed upon by all users of the representation format ("coding system"). This standardization facilitates automatic processing of the information by a computer.

Most EMRs allow for entry of patient information in a combination of structured and unstructured formats. For instance, the record of a patient visit might include both a free-text narrative (unstructured) and a code indicating the final diagnosis for the visit (structured).

Many of the advantages of EMRs over paper-based records derive from things the EMR can do with structured patient information. These have been detailed extensively in the literature, and include the following:

- Prevention of medical errors by alerting users to patient conditions that require intervention — also known as clinical decision support (CDS)

- Powerful tools for viewing information in a patient's record (e.g., viewing numerical information graphically or viewing records of only those visits where a particular diagnosis was addressed)
- Generating data for billing processes as a by-product of clinical documentation
- Database reports across populations of patients for clinical, research, or administrative purposes

All of these benefits involve the output of information from an EMR. Getting structured information into the EMR, on the other hand, involves certain difficulties. This issue's column focuses on some of those difficulties, and how our organization has attempted to overcome them.

Taxonomic Issues

The coding systems underlying structured data entry in EMRs determine the choices from which the users must select information to enter. These lists of codes impose their own conceptual framework ("taxonomy") as to how the things they represent (symptoms, diagnoses, medical procedures, etc.) should be categorized. If this conflicts with the taxonomic framework with which the user is familiar, confusion and frustration can result.

The situation regarding asthma codes mentioned in the introduction illustrates this. The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) is a commonly used coding system for medical diagnoses. We use it in our EMR to represent diagnoses for specific patient encounters as well as to populate patients' "Problem Lists."

As my frustrated colleague pointed out, the categorization scheme for asthma-related diagnoses in ICD-9-CM is based on the underlying cause. In contrast, current medical opinion emphasizes degree of severity as the most salient characteristic for categorizing asthma. Although our EMR allows users to append free-text comments to a diagnosis (e.g., a statement as to the severity of a patient's asthma), this information cannot be effectively used by any automated processes in the EMR.

Semantic Issues

The information that physicians and other clinical personnel are trained to enter in their patient's records is full of subtlety and nuance, which even unrestricted prose is sometimes inadequate to capture. It is unsurprising, then, that the use of structured data poses challenges having to do with the meaning of the data itself ("semantics").

"Many standardized coding systems do not provide a built-in way to express uncertainty."

For example, many standardized coding systems do not provide a built-in way to express uncertainty. When one of our clinicians determines that a patient may have diabetes, it is possible to record a diagnosis of "diabetes" as structured information, but any statement as to the tentativeness of the diagnosis must be entered as free text. The EMR's CDS modules, consequently, will generate the same alerts and reminders as for confirmed diabetics, and the patient will appear on the automated reports of diabetic patients we periodically generate.

Sometimes, a coding system offers a term that is congruent with what a user wishes to express, but is so awkwardly worded that it undermines the clarity of the patient record. The headache-related term about which my colleague was complaining is one example (from ICD-9-CM). This problem is compounded when terms must be abbreviated due to string-length limitations imposed by the database structure. For example, in our system, ICD-9-CM code 491.21, "Chronic bronchitis, obstructive type, with acute exacerbation" is denoted by the term "Obstr Chr Bronchitis W Ac Exacerb" — hardly the most comprehensible of diagnoses.

Lexical Issues

Although most coding systems assign numerical identifiers to structured data terms, it is impractical for users to memorize these numbers. Therefore, entry of structured data must rely on some interaction between the user and the text-based terms in a coding system. When the list of choices is short, this can be achieved by having the user choose terms from a "menu"-type list. When the list of choices is long, however, that approach is impractical, and it is necessary to have the user type free text into and then choose from among the matches retrieved by the EMR.

This process often does not work perfectly, even if a term exists that matches the meaning the user has in mind. If the text typed in by the user differs in the precise words used, or in the word order, from the term the coding system uses ("lexical differences"), the EMR will be unable to match the two. For example, in our EMR we use the Current Procedural Terminology (CPT) coding system for storing information on patients' past surgical histories. Suppose a user wishes to record that a patient has had an incisional breast biopsy. The CPT term for that procedure is "biopsy of breast, incisional" (code #19101). If the user were to type in "breast biopsy," "incisional breast biopsy," or even "biopsy breast," there would be no match.

There are ways to mitigate the lexical issues in entering structured data. In many EMRs, it is possible to assign additional text strings to each code such that those text strings, when entered by a user of the EMR, will result in a match to that code. We have found this to be an immensely valuable tool and have put substantial effort into populating our coding system databases in this manner.

We have also found it valuable to train users in the "art" of text pattern-matching. This consists in typing in

just enough text to indicate what type of code one is searching for — with enough specificity to avoid generating an unwieldy number of matches, but without so much that minor lexical variation will prevent a match.

User Interface Issues

As mentioned above, when a structured datum is to be acquired and the allowable choices are few, it is possible to display them all as a "menu" and have the user select the appropriate item(s). One example of this common to many EMRs is the use of documentation "templates," which prompt the user for responses to a number of menus, each of which details some aspect of a patient encounter (e.g., duration of symptoms). These templates compose a visit note from those choices, but in many EMRs also store the choices as structured data.

The design of the user interface has a substantial impact on the usability of menu-driven structured data entry in an EMR. Ideally, the EMR should allow users to switch easily between structured and unstructured data-entry modes, so they can "opt out" of structured data entry when the choices before them do not meet their semantic needs. In addition, there should be minimal need to switch between keyboard and mouse in the data-entry process.

Conclusion

Much of the promise EMRs hold for improving health care hinge on structured information. The difficulties in acquiring data in structured format, however, are substantial.

Limitations in existing coding systems, such as the taxonomic issues discussed above, can undercut the value of collecting structured data in the first place. However, improvements in coding systems, particular the development of more flexible, multiaxial coding systems that can better adapt to changes in the conceptual constructs of medicine, can mitigate this.

"We have also found it valuable to train users in the "art" of text pattern-matching."

The lexical issues in entry of structured data are also largely surmountable. Several companies, and one large government project (the Unified Medical Language System Metathesaurus) have undertaken the task of comprehensive lexical indexing of the major clinical coding systems. It seems likely that the eventual standard approach for addressing lexical issues will involve dedicated, regularly updated products, which can be "plugged in" to an EMR for linking free text entered by users to standardized codes.

The semantic issues described above are probably inherent in the process of giving structure to data. There will undoubtedly always be a role for unstructured text in EMRs to convey the details for which no coding system less complex than language itself is sufficient. It is incumbent upon EMR developers and implementers to recognize which structured data fields should be supplementable with free text, and to ensure that such free text is displayed in the EMR along with the structured data.

Lastly, careful attention should be given to user interface issues in the entry of structured data. Appropriate interface design can substantially speed the data entry process, so that the advantages of structured data entry are realized with minimal burden on busy clinical personnel.

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Life After Go-Live
Part 4: Preventing Error with an EMR

Eric Rose, MD

This column is the last in a four-part series providing observations and insights from the author's experiences with ambulatory electronic medical record (EMR) implementation. It is intended to provide a glimpse "behind the veil" of an EMR-based care environment, with a particular focus on issues that have hitherto received little attention in the literature.

The Rationale for Decision Support

The causes of medical errors are many (and the subject of considerable controversy). Although poor judgment and lack of knowledge are popularly thought of as the main causes, it is clear from recent research that insufficient access to, or management of, information plays a substantial role.

Numerous studies have shown that physicians often fail to adhere to well-substantiated principles of good medical care (such as prescribing aspirin for patients after a heart attack or avoiding use of beta-blockers in patients with asthma), even though those same physicians are highly familiar with those principles. The nature of human cognition is such that physicians will rarely recall all the standards of care that might apply to a particular patient, especially in a time-limited encounter focused on a particular complaint.

Fortunately, where human brains fall short, computers excel. The automated cross-checking of patient information against formally expressed "rules," and the provision of feedback to the user of an EMR, is a rapidly developing area in medical informatics. It has been given the rather confusing name of "automated decision support" (DS).

DS tools within an EMR can take many forms. They vary in their degree of intrusiveness — from tools that the user must actively access without any prompting from the software, to "pop-up" style alerts that require some action on the part of the user before the user can return to what he or she was doing. DS tools may be contact-dependent, where the user will only see the alert when he or she accesses a patient's record, or contact-independent, where the alert is delivered to the provider (e.g., through a virtual "in basket") regardless of whether the patient's record is accessed. Many commercial EMRs offer DS tools at various levels of intrusiveness and in contact-dependent and contact-independent forms.

"It is important to select the rules on which DS tools will be based with great care, and to obtain organizational consensus before turning them on."

EMR vendors usually leave it to the client institution to program DS tools with the medical "rules" they feel appropriate. However, commercial databases are available for certain types of DS tools, such as databases that drive alerts for drug-drug interactions in EMRs that incorporate medication order entry.

The Challenges of Decision Support

In our organization, we have made extensive use of the DS tools within our EMR. We believe these to be valuable for ensuring high-quality care and preventing medical errors. However, we also find they pose certain challenges.

The most significant problem with DS tools we have encountered is that they add to the information that the provider must deal with (see also the spring issue's column, "So Good It's Bad" Information Management"). At best, this slows down the provider; at worst, it distracts him or her from the patient's immediate problem. Our providers have described a resulting phenomenon, which we term "pop-up fatigue," where, after receiving a number of alerts on a given patient or on a given day, providers simply stop paying attention to them.

Another difficulty with DS tools is the problem of false-positive alerts, i.e., alerts that appear but, for some reason, do not apply to a particular patient. This might occur, for instance, with an alert suggesting an intervention (like a vaccine), which the patient has received outside our organization. Our EMR allows users to record data on care delivered elsewhere in ways that can be "seen" by its DS components.

However, providers often elect to record such information in free text (e.g., typing in "Joe got a tetanus booster last July" into a visit note), rather than entering the information, in a structured format, into the appro-

priate section of the patient record. The result, of course, is a false-positive alert the next time the record is accessed. Other causes of false-positive alerts include a patient's prior informed refusal of a recommended intervention, clinical inappropriateness of a recommended intervention (e.g., routine cholesterol screening for a terminally ill patient), or any situation in which the logical rule driving the alert is not adequate to incorporate all the relevant aspects of the patient's situation.

The underlying rules driving DS tools require ongoing maintenance. As we implement more and more DS reminders and alerts, this work has grown substantially. One aspect of this involves maintaining the clinical appropriateness of the rules, so that they remain consistent with the most current evidence-based standards of care. In addition, any changes in the standardized terminology systems, which we use for the structured data on which these rules operate (e.g., ICD-9-CM and CPT), must be reviewed, so that pertinent new entries from these terminology systems are incorporated into the DS rules.

For instance, recent updates in CPT added new codes for certain types of hysterectomy procedures. Since we allow our users to make entries on patients' "surgical history" records using the most current CPT codes, and patients who have had a hysterectomy do not (in general) require pap smears, these new CPT codes had to be added to the list of codes that would prevent the pap smear alert from appearing.

The implementation of DS tools also requires careful attention to organizational politics. It is important to select the rules on which DS tools will be based with great care, and to obtain organizational consensus before turning them on. In our organization, we have used three criteria in this selection process:

- The rule is supported by an unassailable foundation of evidence
- The rule is intended to promote good clinical outcomes (rather than, for instance, cost considerations)
- There exists structured data in the EMR sufficient to support a high level of accuracy in performance of the DS tool (in particular, a low rate of false-positives)

We also take pains to inform our providers as to what patient data drives the application and what the underlying rules are, and to train them in how to interact with the DS tool, e.g., to order the recommended intervention. With this approach, we have seen a high degree of acceptance on the part of our providers.

What Lies Ahead

DS tools, as they exist in most commercial EMRs, are an evolving technology, and will likely grow in flexibility and usefulness. At present, they rarely go beyond a binary indicator (alert applies/does not apply) based on simple Boolean manipulation of structured patient data.

In some cases, linkage to the EMR's order-entry functionality enables the

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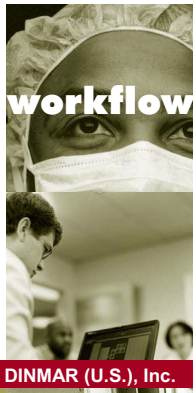

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provider to respond immediately to a DS alert by placing an order for the recommended intervention. Our EMR also enables some user-level customization, such as the ability for providers to adjust the drug-drug interaction warning system so that only warnings above a specified level of "seriousness" appear. A growing trend is for DS tools to be more "transparent," i.e., to display (or link to) the specific patient data that triggered the alert, the underlying rule, and/or extensive background information, along with the recommended action.

There are several ways that present DS functionality could be enhanced. For instance, broader user-level customization might be useful, e.g., allowing a provider to choose whether he or she receives a particular alert in a contact-dependent or contact-independent context.

In addition, DS tools should provide a simple way, when displaying an alert, for providers to specify that a particular alert does not apply to a particular patient, thus suppressing the alert (either temporarily or permanently, as warranted). There is also a need for DS tools to enable direct feedback from providers to system administrators if they feel an alert is not based on the best available evidence.

Another major advance in DS will hopefully occur with the emergence of systems for standardized representation of clinical practice guidelines. Such systems (GLIF, ProForma, Asbru, and others) have mushroomed in recent years. They offer the promise of DS tools that will base recommendations not on simple rules, but on an overarching plan of care that, among other subtleties, recognizes complex time relationships between events.

About the Author

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ARTICLE RESPONSE

A Cat's Perspective: Being a Vendor in a Selection Process

Mark Groper

An article in the Summer 2003 issue of JHIM regarding herding cats and vendor selection described the enormous complexities associated with selecting an EMR. I empathized with the healthcare organization's challenges; the current vendor had stopped supporting the installed EMR, clinical features were missing from the product, and more.

As the context of the article became clearer, I realized that the author's organization was my company's customer, the vendor in question was me, and the EMR product was mine.

Upon investigation, I was relieved to discover that while the article was published recently, it was written and focused on events that took place three years ago, before my company acquired Oacis, which was then owned and managed by another vendor. During that time, the customer was uncertain about the previous vendor's commitment to support and continue developing the product. For that and other reasons, the customer decided to evaluate other EMR products.

The customer has publicly indicated that the vendor reference was to the previous vendor of Oacis, that the capabilities of Oacis have been significantly enhanced by DINMAR, and that customer service has improved as well.

While I can certainly relate to the author's metaphor of "herding cats," it reinforced for me the significant challenges our industry faces. It also reminds me of the high costs vendors carry for the public relations and sales aspects of an EMR. These higher costs hurt the industry at large.

Although vendors can improve in many areas, we should avoid the tendency to oversell and should focus our message on what our products can realistically achieve. Our company's sales team possesses strong working knowledge of what clinicians and other HCO personnel really need, enabling them to focus on building long-term relationships as well as addressing important requirements, rather than focusing on "winning a deal."

For providers, increased emphasis on establishing a long-term partnership with their vendor will help reduce costs and improve outcomes. A common attribute of successful EMR implementations is that the buyer spent as much effort defining how they would work with the vendor as they did evaluating the product. The product itself is not always the solution.

HIMSS, as the industry's primary professional association, also can be a place where vendors and buyers collaborate on tangible methods to reduce excessively long and complicated RFP cycles, and the associated costs. For the well-being of our industry, we must come together and streamline the EMR selection process.

About the Author

Mr. Groper is the President and CEO of DINMAR, a leading North American healthcare IT solutions company. In November 2000, after DINMAR's successful five-year track record as a certified Oacis implementation partner, it acquired Oacis Healthcare Systems Inc., which included the Oacis EMR product suite.