Essential Characteristics of an Electronic Prescription Writer*

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Healthcare practitioners have a professional mandate to prescribe the most appropriate and disease-specific medication in a safe and efficacious manner. Each year, however, this task becomes more complex. The number of new medications increases exponentially every year, with new entries for each class and new classes for each disease. Each drug has its unique indications, contraindications, cross-reactivity, complications, and costs. Increasingly, drug-drug interactions present a major problem, reportedly occurring in 12–22 percent of prescribed medications.1

Providers no longer can rely on memory for necessary details about familiar medications. They must prescribe in the context of all the medications that a patient takes, including those prescribed by other physicians in the community. In addition to indications, contraindications, and potential side effects, they must be aware of drug-drug, drug-age, and drug-allergy interactions, and cognizant of which medications are covered by the patient's insurance. The cost of managing the plethora of often-modified, insurance-specific formularies is rapidly driving up the cost of care.

Several studies have shown that applying computing technology to prescription writing significantly reduces the cost of medications while increasing the adherence to specific protocols.2, 3 Computerized prescription writing can provide tremendous benefits to both the healthcare provider and the patient.4 Despite the obvious benefits, the use of computerized prescription writers is not widespread.

My healthcare community, which includes 135 physician offices, is implementing an electronic prescription writer. The prescription writer is part of a project to automate the flow of clinical data between physicians and their affiliated healthcare partners. The first stage of the project involved managing the flow of incoming clinical data (such as laboratory results, radiology results, and transcriptions). The data was digitized and delivered to physicians’ “inboxes,” and tools were provided to manage those messages. The second stage of the

*For examples of electronic prescriptions, please see pages 60–61.
project automates the management of outgoing messages, including authorizations, laboratory orders, and prescriptions. Lessons learned during this effort provide insight into specific issues that must be addressed by the architects of automated prescription systems for healthcare providers.

A variety of papers and articles have addressed the design issues faced when implementing physician automation in a single economic entity. This paper addresses the myriad issues that must be considered when designing a prescription writing system to meet the needs of physicians in multiple economic entities linked only by a common community of patients.

**Cross-Community Implementation**

The typical patient sees a primary care physician and several specialists each year. An effective electronic prescription writer must track all drugs prescribed by all physicians in the community, and must perform duplication and interaction checking based on all drugs prescribed for that patient by multiple providers. The prescription writer must provide adequate security (for example, to assure that physicians do not have access to drug information for patients they are not managing). Finally, each prescription must be linked to a unique patient identifier so that data can be appropriately transmitted across the system.

Our healthcare community created a “master patient index” (MPI) that identifies each patient and provides up-to-date patient demographics, health plan, co-pay, and eligibility information. It also has the capability to carry key clinical information, including prescribed medications and allergies. The MPI database entries are automatically generated and maintained from data included in incoming clinical messages (such as laboratory results), and from outgoing messages (such as laboratory orders and prescriptions). The database is replicated across the community and allows for rapid demographic look-up and unique identification of clinical data (including prescriptions), and checking for duplicate and interacting medications.

Although we implemented a wide area network across the entire community to maintain the patient index and to distribute clinical messages, healthcare communities today can take advantage of the Internet and Web browser technology, thereby avoiding the high costs associated with the development of a community-wide network. Using the Internet and Web browser technology, physicians and their staffs can easily access the tools necessary to facilitate writing prescriptions. This includes linkages to expert databases, patient demographic data, and medication history. Using an e-mail metaphor familiar to physicians and their staff, prescriptions can be generated and delivered to the appropriate pharmacy.

Web technology entails two special considerations: security and speed. The federal government, via the Health Care Financing Administration (HCFA), is currently setting standards for the Web-based delivery of clinical data. With encryption and appropriate authentication or identification, the
security of Web transmittal of clinical prescription data should not present a problem.

Each day the average primary care physician writes ten to twenty prescriptions and processes a similar number of refills. Prescription writing generally occurs at the end of a patient encounter and must be done very rapidly. Because of this, response time is critical in any point-of-service system. Since the speed of a browser-based prescription writer is dependent on the data transfer bandwidth and the speed of the loading of pages, the prescription writer must be designed with an eye to rapid loading and transfer of data, even if this requires compromising the quality of graphics. In addition, physicians are very sensitive to the number of mouse clicks and amount of text entry required to complete a task. The physician must be able to quickly choose the appropriate drug and create the “Sig” (directions for use).

Effortless, Intelligent Medication Choice

We found that physicians generally wish to choose a medication by name but appreciate the ability to find medications by diagnosis and cost. Often, physicians remember only the brand name, yet wish to prescribe the generic alternative when available. Sometimes they do not know if the drug name is brand or generic, so they must be able to choose drugs from one master list. Spelling is also often a problem; physicians may remember only the first several letters of a drug name. Finally, physicians need guidance regarding the specific strengths available for a medication.

For new medications, physicians often remember that a new drug is available in a specific class or for a specific diagnosis but do not remember the name. Presenting the physician with drugs sorted by FDA-approved diagnoses solves this problem.

In short, choosing a medication should require minimal data entry and not be dependent on knowledge of the drug’s exact name or whether it is a generic or brand name. Once the medication is chosen, the physician should be presented with available strengths and guided to the appropriate directions for use.

Formulary Linkage

Managed care has introduced a new dimension to prescribing a medication—selecting one that is covered by the patient’s insurance. Because formulary management directly impacts patient satisfaction and office efficiency, it is of increasing concern to clinicians. Healthcare providers now spend more money on medications than they do for primary medical care. This is an issue of significant economic importance.

Unfortunately, there is no single formulary of medications to use for a specific diagnosis. Instead, the physician usually has several possible choices,
with costs related to the insurance carrier's contracted rates. The appropriate drug choice thus depends on the patient's insurance and that company's current contracts—a rapidly moving target. Providers should be warned when they prescribe a drug not on the patient's insurance plan and should be presented with a list of alternative, plan-approved choices in the same drug class. Providing this information at the time the prescription is written saves physicians, patients, and pharmacies significant effort in changing nonformulary drugs to appropriate alternatives.

Physicians tend to prescribe a subset of medications repeatedly. In addition, they usually prescribe the same number of tablets with the same directions and number of refills. The electronic prescription writer should allow rapid completion of the prescription form for each physician's frequently prescribed drugs.

**Expert Database Linkage**

The complexity of prescription writing requires that clinicians have rapid access to expert knowledge. The prescription writer should automatically check for drug duplications and interactions as prescriptions are written. Duplicate checking includes checking for the same drug as well as for similar drugs in the same class. We have found that physicians wish to be warned but do not want that process to interfere with the completion of the prescription. Often they are aware of the potential problem and do not want more details. When interested, however, the physician would like the complete detail of the potential interaction, including scientific reference.

Prescription writers linked to expert databases such as MediSpan allow such checking. Expert drug databases can also provide physicians with specific prescribing details, including the usual dosage, route of administration, relationship to food, contraindications, and potential reactions. Average wholesale price data is useful for choosing among otherwise equivalent drugs. Providing physicians with details of drug cost leads to cost-related improvement in prescribing patterns.3

**Directions for Use and Patient Education**

The ideal prescription writer provides defaults for appropriate usage directions. These defaults can come from the physician's personal list for frequently prescribed drugs or from an expert database, and can easily be changed. The directions for use should drive other automation within the prescription process. For example, the prescription writer can use the dose, strength, units prescribed, number of refills, and the directions for use to calculate the date that the drug would normally require renewal. This date can drive other processes, including the renewal process and the tracking of patient compliance.
Finally, drug databases can provide drug-specific patient education in multiple languages. This includes information about proper usage of the drug, contraindications, warnings, and precautions, and can be printed before the patient leaves the office.

Renewal Process

Our work-flow analysis showed that the refill process is one of the most cumbersome and expensive processes in a primary care physician's office. A typical primary care physician may receive 20 or more requests for refills each day. These requests come from patients and pharmacies via phone, fax, and mail. For each request, the office staff must obtain the chart, check and update the medication list, confirm the dose, and present the data to the physician for approval. Once approved, the staff must update the chart and transmit the refill approval to the patient or pharmacy by fax, phone, or mail. In a paper-based system, it is cumbersome to determine if the drug is being refilled too soon and impossible to determine if it is not being refilled soon enough. Medication lists often become outdated or contain incorrect information regarding dose or directions for use. For critical drugs such as Coumadin, this can lead to significant risk to the patient.

An automated prescription process must allow the staff to enter renewal requests for approval by the physician. By choosing a drug from the prescribed list, a staff member should be able to initiate a renewal with a single key stroke or click of a mouse. The original dose, quantity, refills, and directions for use should be carried forward to a new prescription with the date modified. This preliminary renewal request can then be deposited in the physician's electronic inbox for approval.

If the system can calculate the expected renewal date based on the dose, strength, quantity, refills, and directions for use, the staff and physician can quickly determine if the refill is occurring too soon or if there is evidence of noncompliance. If the dates of the patient's last visit and laboratory tests are also available, refill checking can be even more comprehensive.

Provider Workgroups

Provider groups often centralize the process of prescription management and refills. An automated prescription writer must function in the context of a group of healthcare providers and staff who work together to manage this complex task.

Provider workgroups may simply be call groups or may comprise all the clinicians in an economic entity. Thus, the prescription process must take into account the fact that providers often act clinically on behalf of each other. One clinician may write a prescription for another clinician's patient or may refill medications on behalf of a colleague who is out of town. Whereas
prescriptions must be signed by the generating providers, the regularly treating providers must have information about all drugs prescribed for their patients. It is the regular provider who takes responsibility for the ongoing management of the patient’s medication.

Because staff members generally work with multiple providers, the refill process must allow staff to generate prescriptions with direction to a specific provider for approval. An automated prescription writer should allow only physicians or, where legal, midlevel providers to complete (sign) prescriptions; however, normal work flow mandates that prescriptions be prepared by the office staff.

**Linking All Players**

In an ideal world, physicians, pharmacies, and patients would all be electronically linked. Whereas pharmacies often have automated systems to track drugs and refills, clinicians typically must deal with multiple pharmacies with dissimilar systems. In recent years, online pharmacies have been proliferating on the Web, yet no simple technology exists to link these services to provider or patient.

An automated prescription writer should have the ability to link to a variety of other computer systems. Refill requests from the pharmacy should be delivered electronically to the responsible provider. Even the patient could be brought into the loop with standard e-mail and Web tools. However, electronic prescriptions must also easily interface with the world of paper, fax, and e-mail. Incorporating prescription writing into a standard communication infrastructure allows for maximum functionality now, with a growth path for the future. Electronic prescriptions can easily be converted to fax and paper, thereby meeting the general needs of the current work environment.

**Implementation Process**

The critical success factor for any new system is that it can be adopted in a gradual, nondisruptive manner. In our healthcare community, we found that it is best, wherever possible, to introduce automation first with office staff. Once time savings are demonstrated, providers can gradually adapt to the new process. Automating the time-consuming and expensive refill process first provides the most obvious gain for the effort. A few key staff can be trained to enter refill requests from pharmacies and patients into the system. The physicians can approve or reject these requests online in a process that requires minimal adjustment from current procedures.

Once the system has been primed with most of the drugs for each of the patients, clinicians can gradually move toward an online prescription writing practice. Providing automated alerts for drug duplications, interactions, and formulary noncompliance will encourage clinicians to use the system.
Conclusions

Prescription writing is one of the most complex tasks performed by physicians, demanding detailed knowledge of both the patient's care and drug usage. Treatment protocols are increasingly complex, and providers are responsible for assuring that medications are prescribed appropriately and without adverse interactions.

Several factors are coming together that will move physicians to more automated systems. First, the complexity of medical care is increasing, making it difficult for physicians to maintain the knowledge base necessary to provide quality care to their patients. Second, as computers have become more common and less expensive, clinicians have begun to use them in their day-to-day work. A recent Gartner Group survey found that 78 percent of physicians use the Internet. Finally, Internet and e-mail technologies are increasingly sophisticated, and complex management tools can be built within this familiar environment to assist in the delivery of healthcare.

Systems that give physicians immediate and direct feedback during the prescription process are most effective in changing behavior and improving quality. Using tools built on communication platforms, professionals can work together across a community to care for patients. Combining systems that generate prescriptions, track medications, provide communication between providers, and link to expert databases allows providers and their staffs to automate this process in the context of their usual workflow.

References


About the Author

Robert Keet, MD, FACP, has practiced internal medicine in Santa Cruz, California for more than twenty years. Dr. Keet consults with Axolotl Corporation, assisting in the effort to provide Internet-enabled clinical automation tools.
Elysium Prescription

To: Longs Drug Store - 1700 Mission St @ 457-2561 @ LFS
Physician of Record: Dr. Scott

Physician Details:
Patient: AGUILAR, WILLIAM A

Warning:
Tagamet
(Cimetidine HCl Soln 300 MG/5ML)

SIG: 5MLBID
Start: 03/15/99
Refills: 0

Elysium Drug Interactions
Onset: Rapid  Severity: Moderate

Effects: The pharmacologic effects of Inderal LA may be increased. Reduced pulse rate, sinus bradycardia and hypotension may occur.

Mechanism: Complicated. (See discussion.)
Management: Dosage reduction of Inderal LA may be needed during concurrent administration of Tagamet. Monitor clinical status and adjust the dosage of Inderal LA accordingly. Ranitidine, nizatidine, and famotidine are potential alternatives for cimetidine. Atenolol, penbutolol, and nadolol are potential alternatives for beta-blockers.

Directions for Use: 1 TEASPOONFUL TWICE DAILY
Warning: Duplicates Interactions Age

Rx

Inderal
(Propranolol HCl Tab 40 MG)

SIG: TID
Quantity
Refills 0

Start: 3/23/98

Directions for Use: 1 TABLET 3 TIMES DAILY

Additional Instructions: Medication to be taken with meals

Pharmacy: Select Pharmacy

Physician of Record: Select Physician

Ongoing Prescription: 

Do Not Substitute: 

Do Not Label: 

Do Not Save in CPh: 

Select and Save Save Cancel

Patient Data Patient Education