

Adverse drug events (ADEs) are among the most common and preventable errors in medicine. E-Prescribing systems can help reduce the incidence of such errors in both inpatient and outpatient settingsⁱ. The Institute of Medicine (IOM) has identified electronic prescribing as a key core functionality of an electronic health record, and has placed a sense of urgency on encouraging provider adoption of this tool in the near future.ⁱⁱ In a 1998 report published in *JAMA*, the authors cite a statistic that less than 1% of prescriptions written in the US were electronic.ⁱⁱⁱ However, studies suggest adoption of e-prescribing systems is slowly increasing; in a survey conducted in Spring 2003 among a national random sample of physicians, 27% prescribe or order tests electronically.^{iv}

"Physicians should never again write a prescription. Given the explosion of scientific information and advances in computer technology, prescribing medications on a blank piece of paper will soon seem as antiquated as ordering tinctures of botanicals in Latin."
-Schiff G, Rucker D (1998)

What is E-Prescribing?

- Electronic Prescribing, or E-Prescribing refers to the use of computing devices to enter, modify, review, and output or communicate drug prescriptions and medication regimens for patients.^{v,vi}
- E-Prescribing is one component of Computerized Physician Order Entry (CPOE) systems, which provide decision support and enable providers to place computer-based orders for medication and tests.^{vii}

What are key functional capabilities of an E-Prescribing System?

E-Prescribing systems vary in their functional capabilities; however, those listed below are key functional capabilities of an E-prescribing system.

Medication Selection/ Decision Support Capabilities

- Diagnosis-based medication menus. Some systems may prompt a provider to enter a diagnosis, which then refines selection of medication. Some systems also have capabilities to store and provide information on previous diagnoses. To prevent inaccurate diagnoses, it has been recommended that systems should not require entry of diagnosis.^{viii}
- Evidence-based information on medication prescribing guidelines and therapeutic reviews to guide medication selection.^{ix}
- Drug interaction checking E-Prescribing systems often have the capability to screen for drug-drug, drug-allergy, drug-lab, and, drug-disease interactions.
- Formulary checking By checking against various insurer or Pharmacy Benefit Manager's (PBM) preferred medication lists, callbacks from the pharmacy can be avoided.
- Safety-alerts based on drug interaction and demographic information.
- Prescription Renewal. Refill and renewal requests can be filled. Some systems may send reminders, especially for regularly scheduled medications or have one-click renewal features.^x
- Dosage Calculation. The ability to specify frequency, duration, strength, and form of medication, as well as decision support capabilities that provide information on typical doses and frequencies for particular drugs.^{xi}

Patient Specific Information

- Current patient medication list. Maintain patient's complete and current medication list.
- Access to patient historical data including previous diagnoses, medication dispensing history.
- Patient identification. Some E-Prescribing systems ask a provider to select a patient's name from a menu. Some systems may display the patient name throughout each step of the prescription process, while others may not. Depending on the system, some may import patient information from an EHR, or support manual entry of patient information.

System Integration

- Connection with various information databases. Accurate safety alerts, maintenance of current medication lists, and patient monitoring activities are maximized when various information systems (EHR, pharmacy, practice management, etc.) are interconnected.

- Connection with Pharmacies and Pharmacy Benefit Managers (PBMs): One-way vs. Two-way communication. Not all pharmacies are equipped to receive orders electronically. In some situations, physicians can electronically send prescription orders to the pharmacy, where orders are printed and entered manually into pharmacy systems. Other times, prescriptions can be entered electronically and printed in the physician office, and then faxed to the pharmacy.^{xii} However, in these situations, “one way” communication limits the ability for future streamlined and automatic communication between the pharmacy and the provider. Two-way electronic communication between the physician office and the pharmacy and/or PBM maximizes opportunities for efficiency and quality improvement. Electronic prescribing networks such as **SureScripts** provides connections to pharmacies, and **RxHub** provides connections to PBMs^{xiii}.

Educational Capabilities

- Patient education. Some systems can create patient-specific education materials to support patient understanding and adherence to prescribed regimens. Additionally, the support and information provided by E-Prescribing systems can serve as a tool to support patient-provider communication.
- Provider feedback. By capturing information on prescribing patterns and patient history, some systems have the capability to offer information for providers to better understand their practice patterns, for example, commonly used medications and procedures.

E-Prescribing System: Key Functional Capabilities	
Medication Selection/ Decision Support Capabilities	<ul style="list-style-type: none"> • Diagnosis-based medication menus • Evidence-based information • Drug interaction checking • Formulary checking • Safety-alerts • Prescription Renewal • Dosage Calculation
Patient Specific Information Capabilities	<ul style="list-style-type: none"> • Current patient medication list • Access to patient historical data • Patient identification
System Integration Capabilities	<ul style="list-style-type: none"> • Connection with various databases • Connection with pharmacy and pharmacy benefit manager (PBM) systems: One-way vs. two-way communication
Educational Capabilities	<ul style="list-style-type: none"> • Patient education • Provider feedback

How is an E-Prescribing System utilized?

E-Prescribing systems can be utilized on a broad range of hardware options including handheld devices, desktop and laptop computers, tablets, and mobile phones with Internet access. Depending on provider workflow, certain hardware options may be more suitable than others.

Regardless of which hardware option is chosen, ordering and managing prescriptions in a clinical setting, using an E-Prescribing system generally involves several main steps:^{xiv}

- **Sign on.** To maintain security of the system, user sign on is required.
- **Identify patient.** The patient must be selected from the electronic system, but proper selection depends on accurate and updated information from EHR, practice management systems, and health insurance carrier databases.
- **Review current patient data.** The provider must review the patient’s current and past medication data, based on information from other providers and pharmacies.

- **Select medication.** A provider may either work with a patient's current medication, (i.e. change dose, refill prescription, discontinue medication) or choose a new medication either by selecting from a pre-determined list, or searching for specific drugs based on search results, warnings, and/or favorites.
- **Sign the prescription.** Sign one or more prescriptions, filled out either by the provider or other authorized staff.
- **Prescription transmission.** The prescription is sent to the pharmacy, either via fax or electronically.

There are varying levels of E-prescribing systems ranging from “standalone” to “integrated” systems.

- **“Standalone” applications** enable providers to order medication electronically. These systems are less sophisticated in their decision support capabilities since they include less patient information and are limited in the data available to support and inform physician decision-making. Standalone systems can be enhanced through the addition of additional supporting data, such as formulary information, patient allergy information, and current and previous medication history.
- **“Integrated” systems** include E-Prescribing applications as part of a more complex EHR. These systems include more information about a patient and are ideally connected to other systems including other practices, pharmacies, and PBMs. More sophisticated systems provide greater opportunity for improved efficiency, patient safety, and quality than standalone systems.^{xv}

What are the benefits of using an E-Prescribing system?

Improved patient safety

- One study stated that a primary care provider with 3,000 patients could expect 45-90 preventable adverse drug events (ADEs) per year among his or her patients, with more than half of these resulting from a prescribing error.^{xvi}

Cost savings to providers

- **Savings in drug expenditures.** In a cost-benefit analysis of an EHR system implementation in a primary care setting, the largest proportion of benefits (33%) accrued from savings in drug expenditure: prevention of adverse drug events and drug savings from alternatives to expensive medications, such as suggestions to generic alternatives.^{xvii}
- **Increased office efficiency: reduced callbacks from pharmacies.** Since prescriptions are legible, screened for interactions, and checked against formularies, physician office staff time is saved from reduced callbacks from pharmacies.^{xviii} Additionally, time is saved from reduction in chart pulls due to the information stored in e-prescribing systems.

Lessons Learned/Points to Consider in Implementing an E-Prescribing System

Before implementing an E-Prescribing system, consider the following ^{xix}:

- Implement an integrated E-Prescribing system. The more integrated an E-Prescribing system is with other electronic databases such as EHR, pharmacy, and PBM systems, the greater the benefit. While a standalone system may require smaller up-front costs, to maximize safety and quality, the ultimate goal should be integration with an EHR.
- Understand practice before choosing software and hardware. Prior to implementation, understand key practice characteristics, such as workflow, provider and staff support, and local pharmacy connectivity.
- Investigate local pharmacy's electronic communication capabilities.
- Identify appropriate implementation support, including vendors and peers who have employed similar systems.
- Ensure secure infrastructure. Network, software application, and hardware stability and reliability helps to ensure an adequate E-prescribing infrastructure.
- Additional time during start up for loading information. Loading patient information and integration with other systems such as formulary and practice management systems may take additional time and effort in the startup phase.

“Good implementation is critical to the success of any electronic prescribing project. The most intuitive software and cutting edge hardware will not stand on its own without a solid implementation plan...[P]roper implementation management is at least as important as, and perhaps more important than, good software design.”
-eHealth Initiative (2004)

-
- ⁱ McMullin S, Longeran T, Rynearson C, Doerr T, Veregge P, Scanlan. Impact of an evidence-based computerized decision support system on primary care prescription costs. *Ann Fam Med*. 2004; 2(5): 494-498. Available at: <http://www.annfammed.org/cgi/reprint/2/5/494>.
- ⁱⁱ Institute of Medicine (IOM). Key Capabilities of an Electronic Health Record System. Washington D.C: National Academies Press; 2003. Letter Report. Available at: <http://www.nap.edu/html/ehr/NI000427.pdf>.
- ⁱⁱⁱ Schiff G, Rucker R. Computerized prescribing: building the electronic infrastructure for better medication usage. *JAMA*. 1998; 279 (13): 1024-1029.
- ^{iv} Audet A, Doty M, Peugh J, Shamasdin J, Zapert K, Schoenbaum S. Information technologies: when will they make it into physicians black bags? *Medscape Gen Med* [serial online]. December 7, 2004; 6(4).
- ^v eHealth Initiative. Electronic prescribing: toward maximum value and rapid adoption. Washington DC: Electronic Prescribing Initiative; April 14, 2004. Available at: <http://ehr.medigent.com/assets/collaborate/2004/04/14/eHealth%20Initiative%20Electronic%20Prescribing%20Report%2004.14.04%20Full%20Report.pdf>
- ^{vi} Bell D, Cretin S, Marken R, Landman A. A conceptual framework for evaluating outpatient electronic prescribing systems based on their functional capabilities." *JAMIA*.. 2004; 11: 60- 70. Available at: <http://www.ncvhs.hhs.gov/040525p3.pdf>
- ^{vii} Bell D, Cretin S, Marken R, Landman A.
- ^{viii} Bell D et al. Recommendations for comparing electronic prescribing systems: results of an expert consensus process. *Health Aff*. 2004; Suppl Web Exclusives: W4-305-17. Available at: <http://content.healthaffairs.org/cgi/reprint/hlthaff.w4.305v1>.
- ^{ix} McMullin et al.
- ^x eHealth Initiative.
- ^{xi} eHealth Initiative.
- ^{xii} eHealth Initiative.
- ^{xiii} Lipton H, Miller R, Wimbush J. Electronic prescribing: ready for prime time? *J Healthc Inf Manag*. 2003; 17 (4): 72-9. Available at: <http://www.himss.org/content/files/jhim/17-4/lipton.pdf>
- ^{xiv} eHealth Initiative
- ^{xv} eHealth Initiative.
- ^{xvi} Bell D, Cretin S, Marken R, Landman A.
- ^{xvii} Wang S, Middleton B, Prosser et al. A cost-benefit analysis of electronic medical records in primary care. *American Journal of Medicine*. 2003: 114; 379-403. <http://www.brighamandwomens.org/gms/News/WangEMRCostBenefit.pdf> Accessed August 2, 2004.
- ^{xviii} Terry K. Expanding clinical connections: prescriptions. *Medical Economics*. October 2004;. Available at: <http://www.memag.com/memag/article/articleDetail.jsp?id=127292>.
- ^{xix} eHealth Initiative.