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COMMENTARY

E-Prescribing: Clinical Implications for Patients with Diabetes

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Abstract

With the recent Center for Medicare and Medicaid Services and stimulus package incentives for health information technology, many clinicians are expected to adopt or enhance their use of e-prescribing systems. E-prescribing has nearly eradicated medication errors resulting from prescriber handwriting interpretations, yet several other patient-care and workflow benefits still remain a promise. As prescribers select or update their e-prescribing systems (whether stand-alone or integrated with electronic health records), close attention is needed to the e-prescribing application features and level of clinical decision support to avoid clinical blind spots, including incomplete or inaccurate patient medication lists, poor drop-down menu or screen design, and lack of clinically relevant and actionable drug interaction and drug allergy alerts. This article presents three case studies that highlight common e-prescribing problems involving diabetes patients.

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E-Prescribing Overview

E-prescribing has garnered increasing attention. First, the Center for Medicare and Medicaid Services (CMS) announced incentives to physicians who adopt and use this technology, and the 2009 American Recovery and Reinvestment Act has allocated $19 billion for health information technology (HIT). In addition, the National Committee for Quality Assurance includes e-prescribing in the measures for recognizing physician practices as medical homes.[1]

The CMS defines e-prescribing as "the transmission, using electronic media, of prescription or prescription-related information between a prescriber, dispenser, pharmacy benefit manager, or health plan, either directly or through an intermediary, including an e-prescribing network. E-prescribing includes, but is not limited to, two-way transmissions between the point of care and the dispenser." [2]

As of January 2009, the CMS offers prescribers incentives for Medicare patient e-prescriptions as a stimulus to improve e-prescribing adoption nationwide. Bonuses on Medicare payments from 2009–2010 are 2.0%, from 2011–2012 are 1.0%, and in 2013 is 0.5%. Starting in 2012, prescribers who do not use e-prescribing will have their Medicare payments reduced by 1.0% in 2012, 1.5% in 2013, and 2.0% in 2014 and beyond.[3]

Since 2000, most of the e-prescribing initiatives have involved state and federal governments, payers, application

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Abbreviations: (CMS) Center for Medicare and Medicaid Services, (EHR) electronic health records, (HCTZ) hydrochlorothiazide, (HIE) health information exchange, (HIT) health information technology

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vendors, and HIT consultants. Despite the national attention, adoption by prescribers has been minimal and slow. Surescripts reports that approximately 12% of office-based physicians use e-prescribing and are connected to 76% of community pharmacies; this activity generated 68 million e-prescriptions in 2008.[4]

Much of the e-prescribing activity since 2005 has focused on standards development and CMS pilot programs. Most early e-prescribing programs used stand-alone e-prescribing applications with minimal clinical decision support, out-of-date or incomplete patient medication histories, and poor patient-specific formulary information.[5] Current HIT applications are evolving from stand-alone e-prescribing platforms to those integrated with electronic health records (EHRs) and health information exchanges (HIEs) and have more complete patient-specific information that produces clinical decision support at the point of care.

E-prescribing has promised many patient safety and clinical care quality benefits.[4] However, many of the promised benefits are yet to be fully realized. While errors due to prescriber handwriting interpretations are essentially eradicated with e-prescribing, several other clinical quality and medication safety benefits still remain a promise. Medication lists in e-prescribing systems or EHRs are often incomplete due to discrepancies between actual medication use at home and medication lists in medical records or prescription claims history. These medication lists should be used only to start the conversation with a patient about their current medication use at home. The medication list needs to be reviewed and updated with each patient visit or communication. Studies report that 57–88% of medication entries in EHRs had at least one medication discrepancy between actual patient use and EHR medication lists.[6,7] E-prescribing drug interaction alerts often are overridden by prescribers due to lack of clinical relevance or workflow interruption.[8,9] Pharmacists have reported that 31.9% of pharmacist interventions on e-prescriptions are for missing information (e.g., patient administration instructions, quantity, dose, and dosage form) and that 17.7% of pharmacist interventions were for insufficient or excessive doses.[10] The promise of efficiency gains (especially saving time) for prescribers, patients, and pharmacists is often diminished with required phone calls to clarify discrepancies or correct errors prior to the medication being filled.

E-prescribing can enable a scenario where a list of the patient's medications are available through a regional HIE that can be accessed or updated by all the patient's clinicians, including primary care providers, specialists, pharmacists, emergency room and urgent care providers, hospitalists, and advanced practice nurses. With the development and use of HIEs, improved care management and coordination (as described in a medical home model[1]) could be realized. At the point of care, a provider would be aware of prescriptions ordered by other providers (including specialists), active and discontinued prescriptions, and prescriptions from recent hospitalizations or emergency department visits. Pharmacists would be able to view prescriptions that were filled at other pharmacies (e.g., when a patient is traveling or using multiple pharmacies) and may recognize medication discrepancies and medication reconciliations needed upon transitions in care (e.g., admission to/discharge from hospital or emergency department).

Clinical Information Gaps and Challenges with E-Prescribing

E-prescribing is about patients not just standards or paperwork. Even with the features and potential clinical benefits of e-prescribing, there remain several clinical information gaps and challenges with the technology. These limitations are "clinical blind spots"—lack of accurate or complete medication information or actionable clinical decision support. Some examples of clinical blind spots are as follows:

- Prescribing inaccuracies that lead to new errors introduced with poor e-prescribing software screen design or drop-down menus, e.g., selecting wrong drug with similar name (hydralazine/hydroxyzine), wrong medication abbreviations ("qd/qod"), wrong dose (1 mg/10 mg), or missing patient directions.

  When these inaccuracies occur, pharmacists need to contact the prescriber to clarify the intended medication order, and this often delays the prescription being filled. Thus the potential e-prescribing benefit of time savings for the patient, pharmacist, and prescriber is negated.

- Incomplete medication histories or profiles—no capture of a patient's use of over-the-counter meds, physician samples, herbals, or nutriceuticals that can cause drug interactions; lack of information regarding drug allergy or intolerances; discontinued medications or dosage changes are not updated on the patient's active medication list; and certain dosage forms not included (e.g., inhalers and injectables).

With an incomplete list of medications the patient is actually taking at home, the potential benefit of improved medication safety with e-prescribing cannot be realized.

- Lack of software flexibility to allow the prescriber to alter preprogrammed medication administration directions. This often requires a prescriber to add free-text directions that can seem conflicting. Similarly, the e-prescribing software may not be up-to-date with new dosage availabilities, again forcing the prescriber to resort to having to select a preprogrammed dosage strength and then enter the actual desired dosage strength in the free-text field.

  Both of these scenarios can lead to great confusion to patients and pharmacists and potentially compromise patient safety.

- Gaps in clinical decision support—lack of dosing calculators for pediatric or geriatric patients, lack of clinically relevant drug interaction/allergy alerts that can lead to overriding/alert fatigue, and lack of actionable interaction or adherence alerts.

  E-prescribing systems with weak or no clinical decision support systems compromise the potential benefit of improved patient safety and prescriber point-of-care efficiencies.

Diabetes patient cases illustrating common e-prescribing clinical blind spots are described in the next section.

E-Prescribing Challenges: Cases Involving Patients with Diabetes

JP is a 55-year-old female with a history of type 2 diabetes mellitus for 3 months. She is currently taking 1000 mg of metformin twice daily. Other medications include 25 mg of hydrochlorothiazide (HCTZ) daily and 2 sprays of Nasonex in each nostril daily. She also reports taking one tablet of calcium and vitamin D twice a day and fenugreek. Her self-monitored blood glucose readings are elevated, and her most recent hemoglobin A1c level is 7.8%. As a result, her physician starts glipizide 5 mg daily to be taken 30 minutes before breakfast. Two weeks later, the patient calls the physician's office with complaints of frequent hypoglycemia since starting glipizide. She denies skipped or delayed meals, changes in exercise frequency or intensity, or taking excess medications.

This case illustrates the importance of gathering a complete medication profile as a basis for checking potential drug interactions. Unfortunately, the medication profiles provided in some e-prescribing applications do not capture or include any nonprescription medications, herbals, or dietary supplements that the patient is using at home. E-prescribing software applications may not have the functionality to alert a prescriber for drug interactions between prescription medications, over-the-counter medications, herbal products, and dietary supplements as illustrated in this case between fenugreek and glipizide (i.e., potential for increased risk of hypoglycemia).[11] In addition, e-prescribing systems may not always include a complete, active medication history from multiple prescribers or patient use of multiple pharmacies (e.g., mail-order pharmacies, pharmacies offering discounts for generic medications, or pharmacies offering coupons for new/transferred prescriptions). All of these situations increase the potential for incomplete medication histories as well as missed drug interaction evaluations.

MR is a 62-year-old male with type 2 diabetes for 15 years. He is currently taking 20 units SQ of Novolin 70/30 in the morning and 10 units SQ in the evening 30 min before meals. He presents to his physician for follow-up, and a new prescription is issued via e-prescribing due to elevated self-monitored blood glucose readings. The patient also asked the physician to renew his lisinopril-HCTZ 20/25 mg one tablet once daily prescription, as the patient is out of refills for this medication. He goes to his pharmacy and picks up his prescriptions for 20 units SQ of Novolog Mix 70/30 in the morning and 15 units SQ in the evening 30 minutes before meals and one 20 mg tablet of lisinopril once daily.

This case illustrates a major e-prescribing challenge with the increased potential to select the wrong medication from a drop-down menu or list in the e-prescribing application. In this case, Novolog Mix 70/30 was selected in error instead of Novolin 70/30 because they are located adjacent to each other in the medication selection menu. Similarly, there is the potential to select the wrong dose or formulation for a medication, leading to subsequent supratherapeutic or subtherapeutic consequences as when the single-ingredient 20 mg lisinopril was selected erroneously instead of the intended combination lisinopril-HCTZ tablet. Although e-prescribing can minimize incorrect dispensing of medications due to illegible written prescriptions, prescribers must be cautious of the increased potential for selecting the wrong medication or dose within e-prescribing software medication lists and menus. If an unintended medication or dose is inadvertently selected and sent by e-prescribing to the pharmacy, the pharmacist may be aware of a wrong

medication or dose for a *refilled* prescription. However, for a *new* e-prescription, the pharmacist would not be as aware of an unintended medication order, and the patient may receive the unintended medication or dose.

KC is a 45-year-old female with type 2 diabetes and spinal stenosis who presents to the pharmacy to pick up her prescriptions for glipizide and oxycodone controlled-release (OxyContin). The pharmacist informs KC that he is awaiting a reply from her physician regarding clarification of the dosages. The prescriptions that were transmitted from the physician's office are as follows:

glipizide 10 mg po bid

dispense 60 tablets

additional directions: 1 qAM and ½ qPM

refill: 2

oxycodone HCl controlled-release 10 mg po q12h

dispense 60 tablets

additional directions: 15 mg po q12h

refill: 0

This example illustrates another potential for error created by e-prescribing that is not usually present with handwritten prescriptions: conflicting dosage and medication administration directions. KC's prescriber intended to have the patient take one 10 mg tablet of glipizide each morning and half a tablet each evening as well as one 15 mg tablet of OxyContin every 12 hours. However, for glipizide, the discrepancy between the prescription line and the special directions, as well as the prescribed tablet quantity (only 45 tablets would have been required) led to the need for clarification. The pharmacist also had to confirm with the prescriber whether the 10 or 15 mg tablets of OxyContin are to be dispensed. The physician intended for the patient to take the 15 mg tablets, but this is a new strength that had not yet been added to the e-prescribing software. Since the e-prescribing software did not allow the ability to alter a preprogrammed prescription or prescribe a dosage strength that is not already in the database, the physician had to resort to adding in special directions to bypass these problems, but with unintended consequences.

Summary

While e-prescribing has the potential for improved medication safety and workflow efficiencies, the lack of widespread adoption and integration with electronic medical records has limited its realized clinical benefits to date. As prescribers are incentivized to begin e-prescribing and select e-prescribing systems (whether stand-alone or integrated with EHRs), they need to closely examine the e-prescribing application features and functionality (including the level of clinical decision support) to avoid some of the clinical blind spots outlined in this article.

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