Medication Safety

Chapter FastFACTS

1. **A two-step process can ensure medication reconciliation.**
2. **Electronic prescribing may be the best tool to prevent and reduce errors.**
3. **It's costly—but critical—for physicians to have EMRs.**
4. **Electronic databases make it easier than ever to check drug interactions.**
5. **Online tools can help you set up best practices for medication safety in your practice.**

Given the alarmingly high incidence of medication errors, how hard is it to ensure medication safety for your patients? As it turns out, it may be easier than you might imagine, given today's tools: electronic prescribing (e-prescribing); medication reconciliation, especially at transfer points; and —despite the costs and hassle—EMRs.

Besides streamlining the entire process, e-prescribing eliminates written errors and prevents misinterpretation. Medication reconciliation helps prevent interactions and other errors, a measure that is especially important in treating high-risk patients such as the elderly or those who are on six or more medications, Dr. Letourneau says.

Thoughtful use of electronic databases can also improve safety, even in such a mundane task as reporting errors. A Johns Hopkins Children's Center study showed that when physicians, nurses, and other hospital staff voluntarily reported medication

For the treatment of hypertension

BYSTOLIC.

Significant blood pressure reductions with a low incidence of side effects.[1-3]

Bystolic®
(nebivolol) tablets
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Important Safety Information

Patients being treated with BYSTOLIC should be advised against abrupt discontinuation of therapy. Severe exacerbation of angina and the occurrence of myocardial infarction and ventricular arrhythmias have been reported following the abrupt cessation of therapy with beta blockers. When discontinuation is planned, the dosage should be reduced gradually over a 1- to 2-week period and the patient carefully monitored.

BYSTOLIC is contraindicated in severe bradycardia, heart block greater than first degree, cardiogenic shock, decompensated cardiac failure, sick sinus syndrome (unless a permanent pacemaker is in place), severe hepatic impairment (Child-Pugh >B), and in patients who are hypersensitive to any component of this product.

BYSTOLIC should be used with caution in patients with peripheral vascular disease, thyrotoxicosis, in patients treated concomitantly with beta blockers and calcium channel blockers of the verapamil and diltiazem type (ECG and blood pressure should be monitored), severe renal impairment, and any degree of hepatic impairment or in patients undergoing major surgery. In patients who have compensated congestive heart failure, BYSTOLIC should be administered cautiously. If heart failure worsens, discontinuation of BYSTOLIC should be considered. Caution should also be used in diabetic patients as beta blockers may mask some of the manifestations of hypoglycemia, particularly tachycardia.

Use caution when BYSTOLIC is co-administered with CYP2D6 inhibitors (quinidine, propafenone, fluoxetine, paroxetine, etc). When BYSTOLIC is administered with fluoxetine, significant increases in d-nebivolol may be observed (ie, an 8-fold increase in AUC).

In general, patients with bronchospastic disease should not receive beta blockers.

BYSTOLIC should not be combined with other beta blockers.

The most common adverse events with BYSTOLIC versus placebo (approximately ≥1% and greater than placebo) were headache, fatigue, dizziness, diarrhea, nausea, insomnia, chest pain, bradycardia, dyspnea, rash, and peripheral edema.

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Please see brief summary of Prescribing Information on adjacent page.

References: 1. BYSTOLIC [package insert]. St. Louis, Mo: Forest Pharmaceuticals, Inc.; 2008. **2.** Data on file. Forest Laboratories, Inc. **3.** Saunders E, Smith WB, DeSalvo KB, Sullivan WA. The efficacy and tolerability of nebivolol in hypertensive African American patients. *J Clin Hypertens.* 2007;9:866-875.

 44-1014950 01/09

Bystolic®
(nebivolol) tablets
2.5 mg, 5 mg, 10 mg and 20 mg

Rx Only

Brief Summary: For complete details please see full Prescribing Information for BYSTOLIC.

INDICATIONS AND USAGE
BYSTOLIC is indicated for the treatment of hypertension. BYSTOLIC may be used alone or in combination with other antihypertensive agents.

CONTRAINDICATIONS
BYSTOLIC is contraindicated in patients with severe bradycardia, heart block greater than first degree, cardiogenic shock, decompensated cardiac failure, sick sinus syndrome (unless a permanent pacemaker is in place), or severe hepatic impairment (Child-Pugh >B), and in patients who are hypersensitive to any component of this product.

WARNINGS
Abrupt Cessation of Therapy
Patients with coronary artery disease treated with BYSTOLIC should be advised against abrupt discontinuation of therapy. Severe exacerbation of angina and the occurrence of myocardial infarction and ventricular arrhythmias have been reported in patients with coronary artery disease following the abrupt discontinuation of therapy with β-blockers. Myocardial infarction and ventricular arrhythmias may occur with or without preceding exacerbation of the angina pectoris. Even patients without overt coronary artery disease should be cautioned against interruption or abrupt discontinuation of therapy. As with other β-blockers, when discontinuation of BYSTOLIC is planned, patients should be carefully observed and advised to minimize physical activity. BYSTOLIC should be tapered over 1 to 2 weeks when possible. If the angina worsens or acute coronary insufficiency develops, it is recommended that BYSTOLIC be promptly reinstituted, at least temporarily.

Cardiac Failure
Sympathetic stimulation is a vital component supporting circulatory function in the setting of congestive heart failure, and β-blockade may result in further depression of myocardial contractility and precipitate more severe failure. In patients who have compensated congestive heart failure, BYSTOLIC should be administered cautiously. If heart failure worsens, discontinuation of BYSTOLIC should be considered.

Angina and Acute Myocardial Infarction
BYSTOLIC was not studied in patients with angina pectoris or who had a recent MI.

Bronchospastic Diseases
In general, patients with bronchospastic diseases should not receive β-blockers.

Anesthesia and Major Surgery
If BYSTOLIC is to be continued perioperatively, patients should be closely monitored when anesthetic agents which depress myocardial function, such as ether, cyclopropane, and trichloroethylene, are used. If β-blocking therapy is withdrawn prior to major surgery, the impaired ability of the heart to respond to reflex adrenergic stimuli may augment the risks of general anesthesia and surgical procedures.

The β-blocking effects of BYSTOLIC can be reversed by β-agonists, e.g., dobutamine or isoproterenol. However, such patients may be subject to protracted severe hypotension. Additionally, difficulty in restarting and maintaining the heartbeat has been reported with β-blockers.

Diabetes and Hypoglycemia
β-blockers may mask some of the manifestations of hypoglycemia, particularly tachycardia. Nonselective β-blockers may potentiate insulin-induced hypoglycemia and delay recovery of serum glucose levels. It is not known whether nebivolol has these effects. Patients subject to spontaneous hypoglycemia, or diabetic patients receiving insulin or oral hypoglycemic agents, should be advised about these possibilities and nebivolol should be used with caution.

Thyrotoxicosis
β-blockers may mask clinical signs of hyperthyroidism, such as tachycardia. Abrupt withdrawal of β-blockers may be followed by an exacerbation of the symptoms of hyperthyroidism or may precipitate a thyroid storm.

Peripheral Vascular Disease
β-blockers can precipitate or aggravate symptoms of arterial insufficiency in patients with peripheral vascular disease. Caution should be exercised in these patients.

Non-dihydropyridine Calcium Channel Blockers
Because of significant negative inotropic and chronotropic effects in patients treated with β-blockers and calcium channel blockers of the verapamil and diltiazem type, caution should be used in patients treated concomitantly with these agents and ECG and blood pressure should be monitored.

PRECAUTIONS
Use with CYP2D6 Inhibitors
Nebivolol exposure increases with inhibition of CYP2D6 (see **Drug Interactions**). The dose of BYSTOLIC may need to be reduced.

Impaired Renal Function
BYSTOLIC should be used with caution in patients with severe renal impairment because of decreased renal clearance. BYSTOLIC has not been studied in patients receiving dialysis.

Impaired Hepatic Function
BYSTOLIC should be used with caution in patients with moderate hepatic impairment because of decreased metabolism. Since BYSTOLIC has not been studied in patients with severe hepatic impairment, BYSTOLIC is contraindicated in this population (see **CLINICAL PHARMACOLOGY, Special Populations** and **DOSAGE AND ADMINISTRATION**).

Risk of Anaphylactic Reactions
While taking β-blockers, patients with a history of severe anaphylactic reactions to a variety of allergens may be more reactive to repeated challenge either accidental, diagnostic, or therapeutic. Such patients may be unresponsive to the usual doses of epinephrine used to treat allergic reactions.

In patients with known or suspected pheochromocytoma, an α-blocker should be initiated prior to the use of any β-blocker.

Information for Patients
Patients should be advised to take BYSTOLIC regularly and continuously, as directed. BYSTOLIC can be taken with or without food. If a dose is missed, the patient should take the next scheduled dose only (without doubling it). Patients should not interrupt or discontinue BYSTOLIC without consulting the physician.

Patients should know how they react to this medicine before they operate automobiles, use machinery, or engage in other tasks requiring alertness.

Patients should be advised to consult a physician if any difficulty in breathing occurs, or if they develop signs or symptoms of worsening congestive heart failure such as weight gain or increasing shortness of breath, or excessive bradycardia.

Patients subject to spontaneous hypoglycemia, or diabetic patients receiving insulin or oral hypoglycemic agents, should be cautioned that β-blockers may mask some of the manifestations of hypoglycemia, particularly tachycardia. Nebivolol should be used with caution in these patients.

Drug Interactions
BYSTOLIC should be used with care when myocardial depressants or inhibitors of AV conduction, such as certain calcium antagonists (particularly of the phenylalkylamine [verapamil] and benzothiazepine [diltiazem] classes), or antiarrhythmic agents, such as disopyramide, are used concurrently. Both digitalis glycosides and β-blockers slow atrioventricular conduction and decrease heart rate. Concomitant use can increase the risk of bradycardia.

BYSTOLIC should not be combined with other β-blockers. Patients receiving catecholamine-depleting drugs, such as reserpine or guanethidine, should be closely monitored, because the added β-blocking action of BYSTOLIC may produce excessive reduction of sympathetic activity. In patients who are receiving BYSTOLIC and clonidine, BYSTOLIC should be discontinued for several days before the gradual tapering of clonidine.

CYP2D6 Inhibitors: Use caution when BYSTOLIC is co-administered with CYP2D6 inhibitors (quinidine, propafenone, fluoxetine, paroxetine, etc.) (see **CLINICAL PHARMACOLOGY, Drug Interactions**).

Carcinogenesis, Mutagenesis, Impairment of Fertility
In a two-year study of nebivolol in mice, a statistically significant increase in the incidence of testicular Leydig cell hyperplasia and adenomas was observed at 40 mg/kg/day (5 times the maximally recommended human dose of 40 mg on a mg/m^2 basis). Similar findings were not reported in mice administered doses equal to approximately 0.3 or 1.2 times the maximum recommended human dose. No evidence of a tumorigenic effect was observed in a 24-month study in Wistar rats receiving doses of nebivolol 2.5, 10 and 40 mg/kg/day (equivalent to 0.6, 2.4, and 10 times the maximally recommended human dose). Co-administration of dihydrotestosterone reduced blood LH levels and prevented the Leydig cell hyperplasia, consistent with an indirect LH-mediated effect of nebivolol in mice and not thought to be clinically relevant in man.

A randomized, double-blind, placebo- and active-controlled, parallel-group study in healthy male volunteers was conducted to determine the effects of nebivolol on adrenal function, luteinizing hormone, and testosterone levels. This study demonstrated that 6 weeks of daily dosing with 10 mg of nebivolol had no significant effect on ACTH-stimulated mean serum cortisol $AUC_{0\text{-}120\ min}$, serum LH, or serum total testosterone.

Effects on spermatogenesis were seen in male rats and mice at ≥40 mg/kg/day (10 and 5 times the MRHD, respectively). For rats the effects on spermatogenesis were not reversed and may have worsened during a four-week recovery period. The effects of nebivolol on sperm in mice, however, were partially reversible.

Mutagenesis: Nebivolol was not genotoxic when tested in a battery of assays (Ames, *in vitro* mouse lymphoma $TK^{+/-}$, *in vitro* human peripheral lymphocyte chromosome aberration, *in vivo* Drosophila melanogaster sex-linked recessive lethal, and *in vivo* mouse bone marrow micronucleus tests).

Pregnancy: Teratogenic Effects. Pregnancy Category C:
Decreased pup body weights occurred at 1.25 and 2.5 mg/kg in rats, when exposed during the perinatal period (late gestation, parturition and lactation). At 5 mg/kg and higher doses (1.2 times the MRHD), prolonged gestation, dystocia and reduced maternal care were produced with corresponding increases in late fetal deaths and stillbirths and decreased birth weight, live litter size and pup survival. Insufficient numbers of pups survived at 5 mg/kg to evaluate the offspring for reproductive performance.

In studies in which pregnant rats were given nebivolol during organogenesis, reduced fetal body weights were observed at maternally toxic doses of 20 and 40 mg/kg/day (5 and 10 times the MRHD), and small reversible delays in sternal and thoracic ossification associated with the reduced fetal body weights and a small increase in resorption occurred at 40 mg/kg/day (10 times the MRHD). No adverse effects on embryo-fetal viability, sex, weight or morphology were observed in studies in which nebivolol was given to pregnant rabbits at doses as high as 20 mg/kg/day (10 times the MRHD).

Labor and Delivery

Nebivolol caused prolonged gestation and dystocia at doses ≥5 mg/kg in rats (1.2 times the MRHD). These effects were associated with increased fetal deaths and stillborn pups, and decreased birth weight, live litter size and pup survival rate, events that occurred only when nebivolol was given during the perinatal period (late gestation, parturition and lactation).

No studies of nebivolol were conducted in pregnant women. BYSTOLIC should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

Nursing Mothers

Studies in rats have shown that nebivolol or its metabolites cross the placental barrier and are excreted in breast milk. It is not known whether this drug is excreted in human milk.

Because of the potential for β-blockers to produce serious adverse reactions in nursing infants, especially bradycardia, BYSTOLIC is not recommended during nursing.

Geriatric Use

Of the 2800 patients in the U.S.-sponsored placebo-controlled clinical hypertension studies, 478 patients were 65 years of age or older. No overall differences in efficacy or in the incidence of adverse events were observed between older and younger patients.

Pediatric Use

Safety and effectiveness in pediatric patients have not been established. Pediatric studies in ages newborn to 18 years old have not been conducted because of incomplete characterization of developmental toxicity and possible adverse effects on long-term fertility (see **Carcinogenesis, Mutagenesis, and Impairment of Fertility**).

ADVERSE REACTIONS

The data described below reflect worldwide clinical trial exposure to BYSTOLIC in 6545 patients, including 5038 patients treated for hypertension and the remaining 1507 subjects treated for other cardiovascular diseases. Doses ranged from 0.5 mg to 40 mg. Patients received BYSTOLIC for up to 24 months, with over 1900 patients treated for at least 6 months, and approximately 1300 patients for more than one year. In placebo-controlled clinical trials comparing BYSTOLIC with placebo, discontinuation of therapy due to adverse events was reported in 2.8% of patients treated with nebivolol and 2.2% of patients given placebo. The most common adverse events that led to discontinuation of BYSTOLIC were headache (0.4%), nausea (0.2%) and bradycardia (0.2%).

Adverse Reactions in Controlled Trials

Table 1 lists treatment-emergent signs and symptoms that were reported in three 12-week, placebo-controlled monotherapy trials involving 1597 hypertensive patients treated with either 5 mg, 10 mg or 20-40 mg of BYSTOLIC and 205 patients given placebo and for which the rate of occurrence was at least 1% of patients treated with nebivolol and greater than the rate for those treated with placebo in at least one dose group.

Table 1. Treatment-Emergent Adverse Events with an Incidence (over 6 weeks) ≥1% in BYSTOLIC-Treated Patients and at a Higher Frequency than Placebo-Treated Patients

	Placebo (n = 205) (%)	Nebivolol 5 mg (n = 459) (%)	Nebivolol 10 mg (n = 461) (%)	Nebivolol 20-40 mg (n = 677) (%)
Headache	6	9	6	7
Fatigue	1	2	2	5
Dizziness	2	2	3	4
Diarrhea	2	2	2	3
Nausea	0	1	3	2
Insomnia	0	1	1	1
Chest pain	0	0	1	1
Bradycardia	0	0	0	1
Dyspnea	0	0	1	1
Rash	0	0	1	1
Peripheral edema	0	1	1	1

Other Adverse Events Observed During Worldwide Clinical Trials

Listed below are other reported adverse events with an incidence of at least 1% in the more than 5300 patients treated with BYSTOLIC in controlled or open-label trials, whether or not attributed to treatment, except for those already appearing in **Table 1**, terms too general to be informative, minor symptoms, or events unlikely to be attributable to drug because they are common in the population. These adverse events were in most cases observed at a similar frequency in placebo-treated patients in the controlled studies.

Body as a Whole: asthenia.

Gastrointestinal System Disorders: abdominal pain

Metabolic and Nutritional Disorders: hypercholesterolemia and hyperuricemia

Nervous System Disorders: paraesthesia

Laboratory

In controlled monotherapy trials, BYSTOLIC was associated with an increase in BUN, uric acid, triglycerides and a decrease in HDL cholesterol and platelet count.

Events Identified from Spontaneous Reports of BYSTOLIC Received Worldwide

The following adverse events have been identified from spontaneous reports of BYSTOLIC received worldwide and have not been listed elsewhere. These adverse events have been chosen for inclusion due to a combination of seriousness, frequency of reporting or potential causal connection to BYSTOLIC. Events common in the population have generally been omitted. Because these events were reported voluntarily from a population of uncertain size, it is not possible to estimate their frequency or establish a causal relationship to BYSTOLIC exposure: abnormal hepatic function (including increased AST, ALT and bilirubin), acute pulmonary edema, acute renal failure, atrioventricular block (both second- and third-degree), bronchospasm, erectile dysfunction, hypersensitivity (including urticaria, allergic vasculitis and rare reports of angioedema), myocardial infarction, pruritus, psoriasis, Raynaud's phenomenon, peripheral ischemia/claudication, somnolence, syncope, thrombocytopenia, various rashes and skin disorders, vertigo, and vomiting.

OVERDOSAGE

In clinical trials and worldwide postmarketing experience there were reports of BYSTOLIC overdose. The most common signs and symptoms associated with BYSTOLIC overdosage are bradycardia and hypotension. Other important adverse events reported with BYSTOLIC overdose include cardiac failure, dizziness, hypoglycemia, fatigue and vomiting. Other adverse events associated with β-blocker overdose include bronchospasm and heart block.

The largest known ingestion of BYSTOLIC worldwide involved a patient who ingested up to 500 mg of BYSTOLIC along with several 100 mg tablets of acetylsalicylic acid in a suicide attempt. The patient experienced hyperhidrosis, pallor, depressed level of consciousness, hypokinesia, hypotension, sinus bradycardia, hypoglycemia, hypokalemia, respiratory failure and vomiting. The patient recovered.

Due to extensive drug binding to plasma proteins, hemodialysis is not expected to enhance nebivolol clearance.

If overdose occurs, BYSTOLIC should be stopped and general supportive and specific symptomatic treatment should be provided. Based on expected pharmacologic actions and recommendations for other β-blockers, the following general measures should be considered when clinically warranted:

Bradycardia: Administer IV atropine. If the response is inadequate, isoproterenol or another agent with positive chronotropic properties may be given cautiously. Under some circumstances, transthoracic or transvenous pacemaker placement may be necessary.

Hypotension: Administer IV fluids and vasopressors. Intravenous glucagon may be useful.

Heart Block (second or third degree): Patients should be carefully monitored and treated with isoproterenol infusion. Under some circumstances, transthoracic or transvenous pacemaker placement may be necessary.

Congestive Heart Failure: Initiate therapy with digitalis glycoside and diuretics. In certain cases, consideration should be given to the use of inotropic and vasodilating agents.

Bronchospasm: Administer bronchodilator therapy such as a short-acting inhaled β_2-agonist and/or aminophylline.

Hypoglycemia: Administer IV glucose. Repeated doses of IV glucose or possibly glucagon may be required.

In the event of intoxication where there are symptoms of shock, treatment must be continued for a sufficiently long period consistent with the 12-19 hour effective half-life of BYSTOLIC. Supportive measures should continue until clinical stability is achieved.

Call the National Poison Control Center (800-222-1222) for the most current information on β-blocker overdose treatment.

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errors and logged those reports into the computer database, errors decreased.

The existing problems are serious enough to merit taking the time to examine your own practice and pinpoint areas for improvement. Consider the following:

- In 2006, patients reported 1.5 million preventable adverse drug events (ADEs), according to a 2006 IOM report.
- According to an IHI 2007 report, hospital ADEs were estimated at approximately 400,000, and the additional cost at $3.5 billion.
- Giving patients the wrong drug or the wrong dose accounted for 88% of medicine errors, according to a study by the Massachusetts College of Pharmacy and Allied Health Sciences.

Medication Reconciliation

The process of medication reconciliation is a two-step update to keep your practice current on what medicines a patient is taking. For example, if you haven't seen Mr. Smith for a year, he may have been prescribed new medications by his ophthalmologist, dentist, mental health care provider, or others, or he may have stopped taking a drug. In addition, Mr. Smith may be taking nutritional supplements that could affect his prescriptions and his overall health. All these changes need to be logged into his record.

The first step is for you, a medical assistant, or other staff member to compile a list of the patient's medications. The list should, of course, be as current as possible and should include each medication's name, dosage, and how (and how often) it is taken. The second step is for that staff member to compare, update, and reconcile the patient's medication list with any other lists of his or her medications, such as the one from a hospital or walk-in clinic where the patient has been treated.

It's critical for your practice to take this step since a given medication list is not always updated and reconciled at each step, or transition point, as the patient moves through the healthcare system. In fact, this reconciliation has been named one of the Joint Commission's National Patient Safety Goals (see "Know the National Patient Safety Goals," opposite).

The serious need for medication reconciliation cannot be

Know the National Patient Safety Goals

Medication reconciliation is one of the National Patient Safety Goals established by the Joint Commission, an independent, not-for-profit organization that accredits and certifies more than 16,000 healthcare organizations and programs in the United States.

It has outlined goals for the following areas:

- Ambulatory healthcare
- Behavioral healthcare
- Critical access hospitals
- Disease-specific care
- Home care
- Laboratory
- Long-term care and Medicare/Medicaid certification-based long-term care
- Office-based surgery

For more information, go to *http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals.*

overstressed. "Experience from hundreds of organizations has shown that poor communication of medical information at transition points is responsible for as many as 50% of all medication errors and up to 20% of adverse drug events in the hospital," according to *Medication Reconciliation Review* by Luther Midelfort of the Mayo Health System, published on the IHI Website. (See *http://www.ihi.org/ IHI/Topics/PatientSafety/ MedicationSystems/Tools/Medication+Reconciliation+Review.htm*.)

E-Prescribing

No less important for safety is the growing trend toward e-prescribing. "Hands down, the number-one best practice—the one thing that's going to reduce errors the most in outpatient practice" is e-prescribing, according to Dr. Bagley. This way of prescribing is easy to implement and provides major benefits. (See "Five Ways E-Prescribing Helps Patient Safety, p. 33.)

Most obviously, e-prescribing eliminates the problems associated with a handwritten prescription: struggles to decipher a

scrawled prescription, which can lead to the wrong drug or dosage being given; efforts to figure out whether a scribbled word is intended to be Celexa or Celebrex or something else entirely; and the even greater loss of legibility that occurs when a prescription is faxed to a pharmacy.

Most e-prescribing programs enable you to select from a list of medications that have already been loaded into the program, Dr. Bagley says. In his Albany, N.Y., internal medicine practice, only the pharmacist can add a drug to the e-prescribing module. That policy helps maintain quality control, he says.

E-prescribing programs make it harder to introduce quantity errors by narrowing your options. "If a medicine is available only in 20 milligrams, there's no way to select 200 milligrams" by mistake, Dr. Bagley explains. That means, for example, that there's no risk of writing "20.0 mg" with a faint decimal that is overlooked, resulting in the misread "200 mg." That sort of error is common in written prescriptions, Dr. Bagley says, but the "whole problem goes away with electronic prescribing."

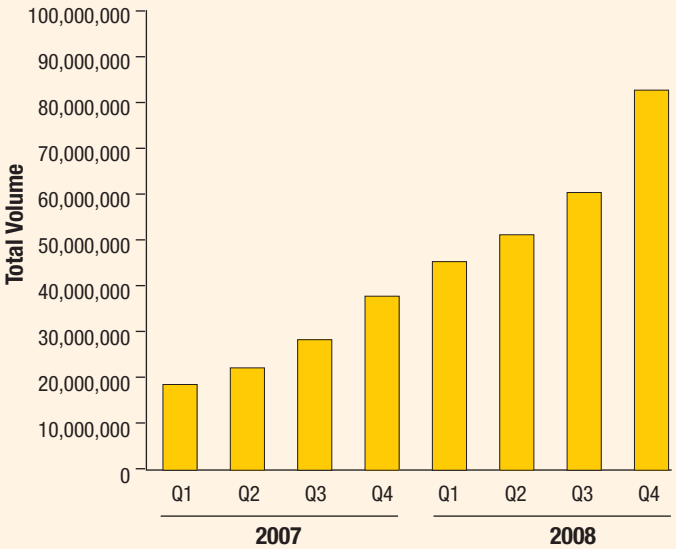
Physicians can also use e-prescribing tools to check for medication allergies in all patients and for interactions, especially in elderly patients who may be taking a long list of medications. That complicated cross-referencing check "is something you just can't do in your head, period—I don't care who you are," Dr. Bagley says.

More and more physicians are taking notice, as evidenced by the fact that e-prescribing message volume doubled between 2007 and 2008 to over 240 million, according to Surescripts. "Electronic Prescription Messages Sent," opposite, shows the rate at which electronic prescription messages sent by physician practices, pharmacies, payers, and patients increased between

Five Ways E-Prescribing Improves Patient Safety

- Eliminates handwriting legibility problems
- Prevents dosage errors
- Prevents drug-drug interactions
- Can flag medication allergies
- Is easy to implement

Electronic Prescription Messages Sent*



*Total e-prescribing message volume includes all messages related to the following prescribing services:

- Prescription benefit—both requests and responses
- Prescription history—both requests and responses
- Prescription routing—new prescriptions, prescription renewal requests, and responses

In order for payers, physician practices, pharmacies, and patients to gain the full benefit of e-prescribing, all services must be fully available and in use.

Source: Surescripts and The 2008 National Progress Report on E-Prescribing, http://www.surescripts.com/e-prescribing-statistics.html.

2006 and 2008. Those messages were made in prescribing or renewing prescriptions, checking prescription history, and checking prescription benefits.

Dr. Bagley suggests that, even if you are not ready to shift to a complete EMR system, you would be wise to choose an e-prescribing system that may be folded seamlessly into an EMR once

you make that change. "Eventually, the electronic prescribing would be integrated with the clinical charts so dosages would be checked against weight or kidney function or age," Dr. Bagley says.

It's important to understand how e-prescribing can pay off. In a study that was first presented at the First National Ambulatory Primary Care Research and Education Conference on Patient Safety in Chicago and published in 2005, physician reviewers found that advanced computerized prescribing with decision

To combat what Dr. Bagley calls [e-prescribing] "alert fatigue," he says physicians can adjust the hardware to include only alerts that reflect their practice's particular needs.

support (such as drug-dose and drug-frequency checking) could have prevented 138 of 143 (97%) prescribing ADEs and 59 of 62 (95%) potential ADEs. The majority of ADEs could have been prevented by a system that required complete prescriptions and provided mandatory default dose and frequency lists. A study published in the *Journal of General Internal Medicine* in 2005 found that 11% (103) of handwritten sites had prescribing errors versus 4.3% (40) of computerized sites. (For more study results see "Medication Prescribing Errors Preventable With Advanced Computerized Prescribing," pp. 36-37.)

Despite its advantages, some physicians complain that their e-prescribing tools flag too many alerts that they consider trivial, merely academic, or clinically unimportant. To combat what Dr. Bagley calls "alert fatigue," whereby physicians ignore warnings that they expect to be unimportant, he says physicians can adjust the hardware to include only alerts that reflect their practice's particular needs.

EMRs

When it comes to information technology to enhance patient care, healthcare is still playing catch-up compared with other industries, says Bruce Taffel, MD, vice president and chief medical officer for Shared Health, a Chattanooga, Tenn., company that provides health information exchange services, clinical

decision support, and electronic applications and tools for physicians and other providers.

While many physicians balk at the costs and hassle associated with EMRs, medicine has become so complex and is so laden with fast-changing information that trying to practice without this new technology puts physicians at a great disadvantage, Dr. Taffel says. The information a single physician or practice has about a particular patient is only a fragment of the total information that exists in the healthcare system about that patient.

"The average Medicare patient can see anywhere from seven to 14 doctors in a year," according to Dr. Taffel. Each of those doctors may use a different lab, imaging clinic, etc. As a result, that patient's health information gets scattered across all those practices and their various support facilities. The good news is that information technology and health information exchange have been designed to answer that emerging issue, Dr. Taffel says. The patient-centered medical home concept—in which each patient has a relationship with a personal physician who coordinates his care—will help resolve the issue by consolidating a patient's medical information in one place. (For more about the medical home, see the May/June 2009 *Doctor's Digest* issue: Primary Care and the Medical Home, *http://www.doctorsdigest.net/issue/0503.php*.) EMRs will help medical homes manage patient records effectively.

EMRs also will address the problem of incompatible medications for patients who go to more than one pharmacy with their prescriptions, says Laxmaiah Manchikanti, MD, CEO of the American Society of Interventional Pain Physicians (*www.asipp.org*). "One time I found a patient who was on amitriptyline with three different brand names," Dr. Manchikanti says, adding that EMRs prevent such conflicts and eliminate those problems.

Medication Prescribing Errors Preventable With

	Prescribing Errors (% of Total)	Prescribing Errors in Handwritten Sites (% of Total)
Total	143	103
Preventable with advanced computerized prescribing (overall)	138 (97)	102 (99)
Requiring complete prescriptions	49 (34)	38 (37)
Default dose list	36 (25)	33 (32)
Default frequency list	25 (17)	13 (13)
Drug-interaction checking	4 (3)	0
Other	24 (17)	18 (17)

*ADE: adverse drug event.

Checking Drug Interactions

Electronic drug databases can help physicians check potential drug interactions quickly and easily. Some are available as applications to be installed on mobile phones or mobile computing devices such as BlackBerry or Palm pocket PCs; some offer both online and mobile resources. Here are a few to consider:

www.pdr.net

In addition to the multi-drug interaction checker, this online home of the Physicians' Desk Reference includes the PDR online, MEDLINE, and Stedman's Medical Dictionary, study abstracts, specialty-focused resource centers, patient education materials, a personal digital assistant (PDA), a portable pocket computer download for clinical decision support, CME, and other resources.

Access is free to members who register online and who are U.S.-based MDs, DOs, dentists, optometrists, nurse practitioners, and physician assistants "in full-time patient practice" and to medical students, residents, and "other select prescribing allied health professionals."

Advanced Computerized Prescribing

Prescribing Errors in Basic Computerized Sites (% of Total)	Potential ADEs* (% of Total)	Potential ADEs* in Handwritten Sites (% of Total)	Prescribing ADEs in Basic Computerized Sites (% of Total)
40	62	38	24
36 (90)	59 (95)	38 (100)	21 (88)
11 (28)	16 (26)	10 (26)	6 (25)
3 (7)	10 (16)	9 (24)	1 (4)
12 (30)	18 (29)	11 (29)	7 (29)
4 (10)	3 (5)	0	3 (12)
6 (15)	12 (19)	8 (21)	4 (17)

Source: Reprinted with permission from Ghandi et al, Journal of General Internal Medicine, *2005.*

A companion site, *www.PDRhealth.com*, the "Physicians' Desktop Reference," provides information for patients including such topics as prescription and over-the-counter drugs, herbal supplements, diseases and conditions, and many other useful resources.

www.medscape.com

In addition to all its other medical information and resources, Medscape provides a drug interaction checker (*www. medscape.com/druginfo/druginterchecker*) that physicians can use to check for drug-drug interactions in a regime of two or more drugs. Enter up to 20 drugs at once and the program will identify interactions, if any; rate their potential severity; explain the mechanism of action and clinical effects; provide information on patient management; and list supporting references.

For example, if a physician is asked by a 75-year-old female patient who is taking lisinopril, atorvastatin (Lipitor), and alendronate (Fosamax), whether low-dose aspirin therapy might be added to her regimen, the Medscape checker would flag the severity level 3 "Moderate Interaction" between her ACE inhibitor (lisinopril) and aspirin. The clinical effects section would explain that concurrent aspirin may decrease the ACE inhibitors' antihypertensive effects, and the patient management section would advise: "Assess the risk to the patient and take action as needed;" 12 references are cited. Click the "Print this for your patient" option to provide the patient with a copy of the results.

■ *www.drugs.com*

This drug information online site provides a quick and simple drug interaction checker (*www.drugs.com/drug_interactions.php*) and offers other checkers and resources such as A to Z Drug List, Drugs by Condition, Drug Side Effects, Pill Identifier, Drug Image Search, Phonetic Search, and Medicare Part D Selector, as well as news and articles such as FDA Drug Alert, New Drug Approvals, New Drug Applications, and Clinical Trial Results.

To check a drug, type the name (generic or brand) into the search box; then choose from the resulting list, in alphabetical order, of drugs known to interact with the searched drug; then click the drug to be compared. For example, when a check of potential interactions between the fluoroquinolone drug moxifloxacin (Avelox) and the corticosteroid Medrol Dosepak (methylprednisolone) is made, a red alert for "Major Drug-Drug Interaction" appears and provides data on potential problems along with information on monitoring and managing the patient.

■ *www.epocrates.com*

This mobile reference device operates on PDA and mobile communications devices such as iPhone, BlackBerry, Palm, Windows Mobile, and Windows Smartphone. Epocrates provides instant access to disease, diagnostic, drug, and health plan formulary information at the point of care.

What works best for one physician may not be ideal for

another, or may not suit the devices in that physician's practice. Jacob Wood, MD, who practices family medicine at Green Clinic in Ruston, La., finds that Epocrates works best for him. Its multi-check function helps him easily prevent adverse reac-

"I have used the multi-drug checking function [on Epocrates]," Dr. Wood says, "[and] drugs come up with potential interactions that may or may not have been clinically significant; but I've decided to just steer away from those."

tions or drug interactions. First he enters all the medications his patient is currently taking. Then he adds one or more medications that he is considering prescribing for this patient. With the push of a button, the program compares those medications with each other. The results show not only potential drug interactions, but also other potential problems.

"I have used the multi-drug checking function," Dr. Wood says, "[and] drugs come up with potential interactions that may or may not have been clinically significant; but I've decided to just steer away from those. And I've had some where there were interactions that I did not foresee and that absolutely changed my course."

Because Epocrates also includes over-the-counter medicines (listed by their ingredients rather than brand name) and herbal remedies and supplements, those medications, too, can be checked for potential interactions. If a patient on anticoagulant therapy asks if it's okay to take ginkgo biloba to improve his memory, for example, Dr. Wood would reply, "Let me check before you do that." Then he'd look up "ginkgo" in the herbal section and cross-check it against the patient's prescribed anticoagulant therapy.

Physicians shouldn't worry that looking up information in front of their patients will cause patients to doubt their expertise or lose trust in their physician. "I've had just the opposite reac-

tion," Dr. Wood says. "I think that trust only goes up when they see a physician is being careful," especially when he checks the reference right in front of them and shows them where he's getting the information.

Do You Overprescribe?

Another safety issue—one that you may be uncomfortable considering—is overprescribing. Confronted by demanding patients, some physicians may prescribe medications they wouldn't otherwise. This is one of the safety issues that physicians can correct by adopting best practices, Prof. Furrow says.

While it's often easier to go ahead and write a prescription, physicians need to take the time to investigate the patient's condition and coordinate care before reaching for the prescription pad. "In some settings, like nursing homes," he says, "the primary care doctor goes whipping through, seeing patients, [and] may prescribe something to deal with a heart problem. Then the cardiologist may come through and prescribe [something else]. I've seen this happen—the patient ends up with a double or triple dose [of a drug] and has kidney failure."

Physicians can also increase patient safety by notifying the FDA when they see a problem with a drug. "Most of these drugs are studied, but they are not studied in 100,000 people," Prof. Furrow says. "When they are out there in the marketplace, you [may] start spotting things" that didn't show up in the trials.

Online Tools

If you're ready to set up best practices for medication safety in your practice and want some guidance, check out Creighton Health Services Research Program's online tool, "Medication Safety Best Practices Guide for Ambulatory Care Use." This free tool lets you inventory your safety practices, identify areas for improvement, and establish an action plan to implement the improvements. The guide includes sections on medication use process (chart, therapeutic decision, prescribing, etc.); office environment; error management; workplace conditions; safety education; safety perceptions; and references. (To download this tool, go to *http://www.psnet.ahrq.gov/resource.aspx?resourceID=3259*. For additional patient safety network toolkits, FAQs,

information, and resources, go to *www.psnet.ahrq.gov*.)

For examples of medication reconciliation tools, go to the Website of the Massachusetts Coalition for the Prevention of Medical Errors (*http://www.macoalition.org/*). There you'll find medication lists that can facilitate medication reconciliation in ambulatory care, acute care (including inpatient acute care), and other settings. The site also has other useful information about medical errors, reporting requirements, best practices, and patient safety. There's a downloadable form that patients and physicians can use for medication reconciliation called Med List (*http://www.macoalition.org/initiatives.shtml#3*).This template covers a range of important medical information, such as the patient's medical conditions, vaccinations, health insurance plans, over-the-counter medications (listed by category such as allergy relief, antacids, laxatives, and sleeping pills) and herbal/dietary supplements such as St. John's wort, diet pills, vitamins, and minerals.

The "discontinued medications/products" section prompts patients to recall and list any medication, food, or environment that caused a reaction, side effects, intolerance, or allergy. They're also asked to describe the reaction, its symptoms, and severity, and to note the month and year in which the reaction occurred.

Instructions at the bottom of the sheet advise patients to review and update their now-completed medication list whenever they see their primary care physician or any specialists and after any hospitalization.

Other medication reconciliation tools are available at *www.ihi.org* (type "med list" in the search box and browse through the 120 results to find one that matches your needs) and from the Institute for Safe Medication Practices (*www.ismp.org*).