A 40-Year-Old Woman Who Noticed a Medication Error

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**DR AUDET:** Ms K is a 40-year-old woman who found an error with her prescribed medications. She was diagnosed with HIV infection in 1996 and has taken several different drug regimens. Despite the complexity of her drug program, Ms K has been able to manage it well. She has taken an active role in understanding the benefits of her medications and has not had major adverse effects.

Ms K had asked that refills for her prescriptions be called in to her pharmacy. When the time came to take her newly filled prescriptions, she noted that 2 of the drugs were unfamiliar to her, and that 2 of her HIV drugs were missing.

Ms K immediately called her primary care physician, Dr T, to report this fact and have the error rectified. She was concerned about continuing her planned HIV regimen without interruption. The error was confirmed. Stelazine (trifluoperazine) and ranitidine had been dispensed to her instead of stavudine and lamivudine.

The correct prescriptions were then called in to the pharmacy. Fortunately, Ms K was able to continue her drug regimen uninterrupted and did not experience any harm from this event.

Over the past 4 years Ms K has done remarkably well. She recently married and changed her career direction. She does not smoke or abuse alcohol or illicit drugs. Her medications include lamivudine, 150 mg twice daily; stavudine, 40 mg twice daily; efavirenz, 600 mg at bedtime; abacavir, 300 mg twice daily; pentamidine, 300 mg monthly via nebulizer; ethambutol, 1000 mg/d; and clarithromycin, 500 mg twice daily.

**MS K: HER VIEWS**

I have a regular medication regimen, a big one, because I’m HIV-positive. So I rely on my medications and have to get prescriptions every month. I picked up the medication. I didn’t look in the bag for about a week. When I opened the bag, I had 2 completely wrong medications. One was an ulcer medication and one was a tranquilizer, but they were supposed to be antiretroviral medications.

It was very frustrating because I count on these people to do it right and count on having the right medicines. The aggravation of having to go through that process again is like contacting City Hall. I think that you have to be an informed consumer of the medical system. I didn’t lose confidence in the system—I always thought it was poorly run. I go to the hospital because the doctors are very good, but the system is very poor. If I ran a business the way the hospital is run, I would be out of business. The hospital is like a mill—it’s depersonalized. The error was just indicative of my feeling about the process—it reinforced that no one is watching the store.

As much as I go to the same pharmacy every month and buy the same medications, I remain very anonymous. I was wondering, how many people spend $15000 a year at that pharmacy? Those are the customers who should be treated pretty well. But, to them, you’re just another packet of pantyhose.

The disturbing part of the whole thing for me is, what if I didn’t know better not to take those medications—suppose it was the first time I ever got them—and I took them. Luckily, I’m an informed consumer of my medications. But for someone who is not, it could have been disastrous.

**DR T: HER VIEWS**

There’s no question in my mind that this case was a near miss. In the vast majority of cases, it would have been a grave error had an intelligent, astute patient not caught it.

I was quite disturbed to see how completely unrelated the medication she received was to what had been prescribed. I mean, stavudine and Stelazine sound somewhat similar, but lamivudine and ranitidine are not that close. I checked her medical record to see what we had listed as having given
her. In fact, the practice assistant had called in the correct medications. I eventually spoke with the pharmacy manager, and he explained that they were very understaffed at the pharmacy and that he believed the prescription had been taken by a pharmacy technician, who had simply transcribed the wrong medications.

This error could have been tragic. It would have meant the discontinuation of 2 of 3 of Ms K’s antiretroviral drugs, leaving her taking only 1 drug. The virus might have rapidly developed resistance, which would have been devastating for her health.

However, I think these things happen all the time. This is a problem, and we are seeing only the tip of the iceberg—the really bad cases that come to light like this one. I hope that when we make changes in the system we’re also preventing the errors that we haven’t heard about. I’d like to ask Dr Bates if systems are available that can prevent this type of error.

**Systems Analysis of the Case**

This error would be classified as a nonintercepted potential adverse drug event (ADE). It is a potential ADE because, had the patient interrupted her antiretroviral therapy, the clinical consequences could have been serious. The virus could have developed resistance, or Ms K could have had serious adverse effects from taking a medication not intended to treat one of her conditions. It is classified as nonintercepted because it reached the patient: the system failed (although the patient detected the error before clinical consequences could occur).

Most systems are believed to include multiple “latent failures,” or suboptimal practices within the system; this case illustrates this idea. For an adverse event to occur, multiple latent failures have to line up.

**Today’s Medication Process**

The main stages of the medication process are prescribing, transcribing, dispensing, administering, and monitoring. In inpatients, an order is generally written in a chart and then flagged. Someone must notice the flag and transcribe the order. Often, one copy of the order is sent to the pharmacy, where it is reviewed by a pharmacist and then filled, and then the medication is sent to the unit, where the nurse administers it to the patient. Both nursing and pharmacy staff monitor the response of patients to their medications. In outpatients, a physician writes a prescription order and gives it to the patient. The patient takes it to a pharmacy of his/her choice, where it is filled. The pharmacist sometimes provides counseling. The patient carries out administration at home; physicians perform most monitoring.

Many things can go wrong in the medication process. In one large study in an inpatient setting, 49% of serious medication errors occurred at the prescribing stage, with 26% at administering, 14% at dispensing, and 11% at transcribing. In outpatients, few analogous data are available, although monitoring clearly plays a much larger role, as does administration. A major issue in counting outpatient errors relates to whether adherence is included; if it is, adherence (or outpatient administration) errors probably dwarf other types of errors in both frequency and consequences. Another key difference between the outpatient and inpatient processes is that the pharmacy is typically in a different site than the prescriber, and the degree of linkage (as in Ms K’s case) is markedly less.

**Epidemiology of Medication Errors**

Unfortunately, errors are ubiquitous, within medicine as well as outside it. However, most medication errors have little potential for harm. In one inpatient study, only 7 of 100 medication errors had the potential for harm, and 1 in 100 actually caused an injury. Another large inpatient study, the Adverse Drug Event Prevention study, found 6.5 ADEs for every 100 admissions, of which 28% were preventable.
a meta-analysis evaluating the frequency of adverse drug reactions (nonpreventable ADEs) found an incidence of serious reactions of 6.7%.9

Effect of Setting
While the most extensive data about ADEs and medication errors come from the inpatient setting, increasing data are available regarding the frequency of medication errors and ADEs outside the hospital.

In an outpatient study performed in Boston medical practices among 2858 patients, 2248 (79%) reported prescription drug use.9 Among this group, 18% self-reported drug complications, while 3% had documented ADEs on chart review. Clearly there is a wide discrepancy between these figures; the authors were unable to determine whether patients were not telling their clinicians about these problems, or clinicians were not noting them in the medical record. In addition, some of the problems patients attributed to their medications likely had other, unrelated causes, for example, diarrhea that was actually caused by gastroenteritis. However, these problems had major consequences for patients, and many sequelae could have been avoided. Among patients experiencing a drug complication, 48% sought medical attention, 49% experienced worry or discomfort, and 35% reported interference with their work, leisure, or activities of daily living. In 13% of documented ADEs, a known allergy or sensitivity was present and the ADE could have been prevented. In 35% of instances, the medication was not changed, and 20% had symptoms lasting longer than 3 months. Among these prolonged symptoms, the most frequent were gastrointestinal complaints, changes in mood, trouble sleeping, and muscle aches.7

Risk Factors for ADEs
Data about patient-level risk factors for ADEs are surprisingly sparse. There are many anecdotes regarding the importance of factors such as older age, renal and hepatic dysfunction, and taking multiple medications, but relatively few empirical data. Clearly, pharmacology dictates that medications must be used differently in these groups. However, in one study of inpatients none of these “risk factors” was independently associated with the presence of an ADE.9 This suggests that system-based prevention approaches, which decrease the probability of ADEs for all patients (and take into account patients’ uniqueness), may be most effective.

Causes of Errors
Among the many causes of errors, sound-alike names have loomed large, with some data suggesting that they account for a quarter of errors, at least in outpatients.9 Sometimes the possibility of confusion is obvious: for example, Prilosec originally was marketed as Losec, which could be confused with Lasix. Another example is cis-platinum and carbo-platinum, which have often been confused, and in addition to sounding alike came in similar packaging. When cis-platinum is given at a dose typical for carbo-platinum, renal failure or death predictably occurs. This happened a number of times in the United States until the package labeling of these agents was changed.10 Fortunately, the pharmaceutical industry recently has been more willing to consider strategies that should help prevent such errors. For example, many companies now voluntarily submit the names of new agents (both brand name and proprietary) to the Institute for Safe Medication Practices, which will provide a formal assessment of the risk of confusion associated with a new name. In addition, a computer program has been developed that allows an objective assessment of the probability of confusion.9

In Ms K’s case, the drugs did not sound all that similar, but were still confused. However, techniques exist to address this type of error. In aviation, it is routine to use “readback.” When an important message is given, the receiver repeats it to the initiator. Ultimately, though, it will be safest if prescriptions can be electronically sent directly to the site filling the prescription, reducing the number of handoffs in the process.

In terms of errors with antiretroviral drugs, Purdy et al11 identified antiretroviral prescribing errors in hospitalized patients over a 34-month period. During this interval the investigators found 108 clinically significant errors, for an overall rate of 5.8% among admitted patients. This rate increased from 2% of admissions in 1996 to 12% in 1998; this increase was likely caused by the growing complexity of therapy over this period. Most errors were related to confusion or lack of familiarity regarding appropriate frequency (30%) or dosage (26%), and familiarity may have been an issue in Ms K’s case.

Prevention Strategies
The traditional approach to preventing errors in medicine has been to expect individuals to function flawlessly, and then punish those who make errors.12 A much more effective approach is to target and design systems that minimize the likelihood of error.13,14

In the inpatient setting, a number of strategies have been demonstrated to be efficacious for reducing medication error frequency, and a number of others appear promising.15 In one study,14 implementation of computerized physician order entry reduced the serious medication error rate by 55%, although the effect on preventable ADEs was lower (17%). Another time series study compared paper ordering with computer ordering with increasing levels of sophistication and found an 81% reduction in the overall medication error rate.16 Data from these studies suggest that even simple systems in which physicians write orders electronically can substantially improve the overall medication error rate. On the other hand, simple systems had less impact on the number of preventable ADEs. To realize larger improvements in preventable ADE rates, more highly sophisticated decision support likely will be needed. However, in my experience, by far the largest cultural change (and most difficult step to accomplish) is making the process electronic rather than paper-based and getting physicians to use the system.
Even without complete computerized physician prescribing, computerized decision support can result in major improvement. For example, Evans et al. demonstrated that clinical decision support regarding antibiotic prescription in the intensive care unit can result in major improvements in a variety of outcomes, including the antibiotic-associated ADE rate, costs, and inpatient length of stay. Also, Raschke et al. used a commercial system to detect opportunities to prevent patient injury caused by ADEs at a rate of 64 per 1000 admissions. Nightingale et al. recently demonstrated that warnings about high drug doses in a renal unit were often heeded, and that users considered the system valuable.

A low-technology approach that can reduce errors involves having pharmacists participate in intensive care unit rounds. In a before-and-after study, this approach resulted in a 66% reduction in preventable ADEs at the drug ordering stage. Other approaches with substantial potential but fewer supporting data include bar-coding of medications and using automated drug delivery devices for both oral and intravenous medications.

In the outpatient setting, fewer data are available. However, the outpatient study discussed earlier suggested that electronic prescribing would be the highest yield strategy, with allergy detection, notification about drug-drug interactions, and checks for high-risk patients being especially important. In one study relating directly to HIV care, Safran et al. demonstrated that computerized guidelines for management of HIV infection, including recommendations regarding initiation and monitoring of therapy, substantially improved response time to reminders (median, 114 days for intervention vs >500 days for control, P<.001).

Schiff and Rucker have argued that the paper prescription pad is archaic, and that clinicians need to move rapidly to electronic prescribing. This may occur via use of outpatient electronic medical records, which are becoming widespread. For example, England’s National Health Service has set a target of 50% of its primary and community trusts to have electronic patient record systems by 2004. A number of companies are developing handheld devices that can be used to prescribe and provide formulary and other checks, and the resulting prescriptions can then be sent electronically to the appropriate location.

Pharmacists also have a vital role in medication error prevention, and historically they have provided the most important safety net for outpatients. Pharmacists can provide much-needed counseling to patients, resulting in improved diabetic control, for example. Unfortunately, Ms K’s experience with her pharmacist is more the norm than the exception. In most community pharmacies, the pharmacists rarely interact with patients; in one study only 4.3% of patients using a chain pharmacy and 2.7% using an independent pharmacy received counseling.

As noted earlier, adherence is an extraordinarily important issue in the outpatient setting. Studies demonstrate, for example, that excellent adherence with antiretroviral therapy results in better viral load levels. Inexpensive devices are now available that make tracking compliance much easier.

**Medication Errors and the Public**

The public is understandably concerned about error in medicine and medication errors in particular. The Institute of Medicine report suggested that medication errors result in more than 7000 deaths per year, and a Kaiser Family Foundation poll suggested that more than half of US residents “fairly” or “very closely” followed news about the Institute of Medicine report. The most recent Kaiser survey also suggests that 34% of the surveyed population was “very concerned” about an error occurring when filling a prescription at a pharmacy. Disclosing errors to patients can be painful. It also is problematic due to the current tort system. It may be useful to explain to patients the difference between adverse outcomes from appropriate treatment and error. When an error has occurred, it generally makes sense to apologize, and a recent Veterans Affairs report argues for extreme honesty in such situations. Follow-up with patients who have experienced an error or preventable adverse outcome is also critical; in many instances, what patients like Ms K really want is the assurance that what happened to them will be used to make the system safer.

Little in the way of scientific data is available regarding the consequences of errors to patients and families. But many heartbreaking stories, like that of Dorothy Brenia, illustrate the consequences of tragic errors to patients and families. Brenia died of an overdose of sodium nitroprusside after a nurse switched off a pump but failed to manually engage a clamp, resulting in free flow. This error is completely preventable with new pumps and was preventable even at the time with an inexpensive device. Brenia’s son, a pharmacist, has made it his mission to publicize the incident, although he had to fight to get the involved authorities to pay attention to him.

**Strategies to Reduce Error: The Refill System**

The case of Ms K highlights one very important step in the medication process—the prescription refill. When patients need refills, they have to notify the practice, often monthly, usually by telephone. However, it is often difficult for the patient to get through, which leads to delays in getting medications, not so important over the short-term for something like lipid-lowering but critical for HIV therapy. The patient talks to someone at the practice who may be a registered nurse but, in our cost-conscious era, often may be less skilled and have little medication-related knowledge. Then, the practice staff must call a pharmacy—another oral handoff and opportunity for error. This approach is fraught with potential delays.

An alternative process design might be for the patient to access an individualized medication list via the Internet, where he/she can get information about drugs, check for interactions, and request refills (FIGURE). These requests can be screened by the computer for errors or other issues (for example, long duration of a specific medication with no visit or follow-up data).

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and then routed to the appropriate staff with medication knowledge (often, but not necessarily, a registered nurse). The staff can then contact the physician electronically for approval of the refill and the prescription can be electronically sent directly to the pharmacy. The pharmacy could then communicate to the patient via e-mail when the prescriptions are ready, and also notify the practice that the drugs have been picked up. Automation of these handoffs could dramatically reduce the probability of errors, improve the convenience of the process, and even allow some assessment of adherence. This design requires that patients have access to the Internet, that providers use it, and that electronic transmission of prescriptions be legal (it is in 33 states) and private. While major concerns about privacy exist, patient use of this Internet-based approach is already happening at many medical centers, including Beth Israel Deaconess Medical Center.

Interim approaches also can have a major impact. Steps include guidelines for qualifications of individuals taking refill calls, protocol-driven processes requiring checking against the patient’s current profile (much easier to implement with a computerized medication list), and the “readback” approach for receiving prescriptions and sending them to the pharmacy. Finally, physicians need to become involved in improving the quality of all the systems used in their practices—not just the refill system, but the prescribing system and the laboratory and radiology follow-up systems. All clinicians should spend part of their time on quality, and everyone should contribute. Instead of sweeping defects under the rug, we should use them as “pearls,” or opportunities for improvement. In Ms K’s case, the practice did this, but the pharmacy did not. The “work-arounds” required by inferior systems—like the one that Ms K had to develop to get

Figure. Prescription Refill Process and New Prescription Process in an Outpatient Setting

A basic tenet of quality improvement is that it is helpful to reduce the number of steps in a process, especially handoffs. This figure displays the medication process for refills (A) and new prescriptions (B) in the ambulatory setting using the current routing approach and then with electronic prescribing. In both instances, electronic prescribing substantially simplifies the process. In addition, making the process electronic allows introduction of forcing functions (eg, a drug name, dose, route, and frequency must be specified for medications, or the person refilling the medication must check the prior medication list) and decision support (eg, checks for drug allergies and drug-drug interactions, among others).
her medications safely—are less efficient and satisfying for clinicians and patients than building better processes.

Conclusions
Several of Ms K’s comments are especially perceptive and painful. She has the sense now that “the hospital is a mill, no one is watching the store,” emphasizing the need for quality management. She feels that while the physicians, nurses, and health assistants are great, “the system” is very poor. She cannot count on her medications being ready when she goes to the pharmacy or that they will be the correct ones.

Ms K’s insights have important implications. Our health care system is under enormous financial stress, and despite the fact that most individuals working in medicine are highly committed, our results are suboptimal. Patients want systems that run well, and at the same time they want to be treated like people. Clinicians care deeply about patients but are struggling to meet these expectations. Perhaps the main reason is that far too little attention has been devoted to developing effective systems in the first place and to making refinements that might be necessary over time. Our systems are generally mediocre. Even the most devoted people cannot overcome bad systems. Medicine in general, and the medication process in particular, must be reengineered. For this to occur, those at the “sharp end,” in this instance physicians, nurses, health assistants, and pharmacists, need the support of those at the “dull end,” that is practice leaders and administrators. We would all like to work in systems that are friendly, reliable, and efficient, and that produce optimal outcomes. Attention to the bottom line to the exclusion of other domains such as safety will not take us there. Instead, we need to place safety and quality high on the priority list for health care.

QUESTIONS AND DISCUSSION

A Physician: Why do this patient’s prescriptions need to be refilled monthly? Perhaps if they were prescribed on a 6-month or yearly basis it would be done right.

Dr Bates: That’s an excellent point. I do not think that there is a good reason for monthly refills for most long-term drugs. Operationally, a major reason that it occurs this way is because insurance companies do not want to dispense large amounts of expensive drugs. However, it clearly would be safer if this patient could receive larger amounts.

A Physician: Mistakes are, as you say, an opportunity for improvement. Yet, for 2 reasons, people are afraid to talk about mistakes. One reason is local factors, where people are ashamed, embarrassed, or fear criticism by their peers, mentors, preceptors, or program directors. The second reason is that the legal system tends to promote disincentives so that one avoids telling a patient about a mistake. Indeed, if litigation occurs, a physician might regret telling the truth, even though from a human perspective it’s obviously the right thing to do. How do we effect change in both of those areas?

Dr Bates: That is challenging. A recent article called for honesty as the best policy. The authors suggested that clinicians may be better off being honest about a mistake, and that may improve care from a variety of perspectives. That paper came from experience with the VA, where malpractice is relatively less of a concern. The malpractice system has made people reluctant to admit mistakes and has been an enormous hindrance in this regard. It is critical that we talk about mistakes in our clinical practice situations and use them as opportunities to improve the way that we work. I think that what happened in terms of discussion about the error that Ms K reported is exemplary in that regard.

A Physician: In terms of making the business case to invest in system changes that are quite costly, how do you view the data on the cost of medical errors, and how can we make the case stronger?

Dr Bates: The business case for investing in the system is actually quite strong already. Order entry, for example, actually saves resources. A hospital would see returns on the investment within the first couple of years, and, in the long run, the return is very good. As new technologies are devised to make medical care safer, it will be critical to evaluate the costs and benefits. Historically this has not been done.

A Physician: Do you think it may be unrealistic to depend primarily on electronic solutions to this difficult problem?

Dr Bates: Electronic solutions are clearly not a panacea. Quality improvement techniques and approaches—such as examining a process, simplifying it, and reducing the number of steps and handoffs that occur—should also substantially improve the safety of our systems.

Funding/Support: Clinical Crossroads is made possible by a grant from the Robert Wood Johnson Foundation.

Acknowledgment: We thank the patient and her doctor for sharing their stories. Dr Bates thanks Josh Borus for assistance in preparing the manuscript.

REFERENCES

(Reprinted) JAMA, June 27, 2001—Vol 285, No. 24
A 26-Year-Old Woman With Shoulder Pain, 1 Year Later

In March 2000, Stephen S. Burkhart, MD, discussed a 26-year-old woman with severe chronic shoulder pain. Mrs B was a physical education teacher whose activities were limited by chronic left shoulder pain. She had tried physical therapy, nonsteroidal anti-inflammatory drugs, and cortisone injections without adequate relief. The pain started 4 years earlier in both shoulders without preceding injury, and diagnoses included subdeltoid bursitis, rotator cuff tendinitis, and impingement. The pain awakened her from sleep and interfered with basic activities such as brushing her hair and lifting her arm. A magnetic resonance image (MRI) showed a possible small tear in the rotator cuff. She wondered whether surgery would afford long-term relief and how difficult the recovery period would be.

Dr Burkhart discussed the prevalence and pathophysiology of shoulder pain, along with the correct history taking and physical examination for these patients. He described the roles of plain films, computed tomographic scans, and MRIs, as well as the roles of treatment modalities other than surgery. Dr Burkhart outlined the indications for arthroscopic intervention and shoulder replacement and illustrated the procedures. He diagnosed Mrs B with a refractory impingement syndrome and recommended arthroscopy with treatment based on the findings.

Mrs B, the Patient

The conference was really helpful to me in sorting out my options—I liked hearing the perspective from different doctors. I did go ahead and have the surgery, and even though I had general anesthesia, I was home in a day. The surgeon removed some bone, and cleaned up the joint. I did physical therapy intensively for 7 weeks, but I found it very difficult to continue physical therapy on my own after I stopped with the therapist. Though I still have the cracking sound, the range of motion is 85% to 90% improved and the pain is gone. My strength is good and I can do all the activities I need to do. My right shoulder is still bothering me, and I am considering surgery for that if it doesn’t come along.

Dr K, the Primary Physician

I saw Mrs B several months after her shoulder surgery and she was very pleased with the outcome.

Richard A. Parker, MD
Erin E. Hartman, MS

REFERENCE