Medication Errors And Prevention Strategies
By Melissa Leedock, PharmD, BCPS

Upon successful completion of this article, the pharmacist should be able to:
1. Identify contributing factors to medication errors in the community pharmacy setting.
2. Identify types of environmental improvements that may reduce the rate of medication errors.
3. Discuss the roles of medication therapy management services, patient counseling, and health literacy in the reduction of medication errors.
4. Educate patients on their role in error prevention.
5. Identify resources available to pharmacists and patients regarding the identification and prevention of medication errors.

Medication errors, their causes, and prevention strategies are topics that are on the minds of pharmacists, patients, providers in the health care industry, and payers. In the past, much of the focus has been on errors that occur within the hospital setting. However, more recent media coverage has begun to take notice of medication errors that occur in the community pharmacy setting. Many pharmacists will remember a 2007 report on a major nightly news program that highlighted medication errors made in community pharmacies. This report described the case of a prescription for a young girl who was prescribed phenobarbital for seizures, and instead received a diabetes medication. Instead of relieving her seizures, the error caused those seizures to become worse. Another more recent error was reported nationally in early 2011 when a pregnant woman was mistakenly given a prescription for methotrexate meant for a patient with a similar name. The questions then become: What are the sources of medication errors and what can community pharmacies do to improve processes to prevent these errors? There are lessons to be learned from these errors, as there are in any error that occurs. It is also important to note that errors can happen during several steps of the prescribing and dispensing processes. Community pharmacists are involved not only in preventing errors during the dispensing process, but also in catching errors that may have occurred during the prescribing process. The objective of this article is to review available literature and recommendations on the subject of medication errors, so that pharmacists can effectively evaluate their own pharmacy setting and identify areas for improvement.

The subject of medication errors was highlighted in the report “To Err is Human: Building a Safer Health System” in 1999, and was again featured in “Preventing Medication Errors: Quality Chasm Series” in 2007. According to the latter report, it is estimated that at least 1.5 million preventable adverse drug events (ADEs) occur every year in the United States. In the Quality Chasm Series report, the Institute of Medicine (IOM) itself recognizes that there is scant data regarding the incidence of errors in the ambulatory care setting, of which community pharmacy is considered a sub-section. Of the few studies available regarding error rates in community pharmacies is a study by Camp and colleagues which reported the overall error rate among telephoned prescriptions in two community pharmacies to be 12.4 percent, causing additional workload for pharmacists needing to clarify these prescriptions. Of the types of errors recorded in this study, “wrong strength” occurred 2 percent of the time, “wrong directions” 1.6 percent, and “wrong medication” 1.4 percent. Other reports have described community pharmacy dispensing errors to be anywhere from 1.7 percent to 24 percent (Camp, Hailemeskel, & Rogers, 2003). Of note, in the 2003 “National observa-
tional study of prescription dispensing accuracy and safety in 50 pharmacies,” Flynn and colleagues found the rate of clinically significant errors to be 0.1 percent out of 4,481 prescriptions analyzed, while in “Accuracy of dispensing in a high-volume, hospital-based outpatient pharmacy” Kistner and associates found the rate of clinically significant errors to be 1.6 percent out of 9,846 prescriptions analyzed. If these studies represented true error rates for the average community pharmacy, then with an estimated 3.9 billion prescriptions filled in 2009, they would put the number of clinically significant errors at a minimum of 3.9 million per year. If the average community pharmacy dispenses 65,000 prescriptions in a year, it may document approximately two clinically significant errors per month.

There are a variety of types of errors that can occur when dispensing prescriptions in a community pharmacy. To prevent medication errors, we first need to know where and how they originate. Flynn and colleagues studied the accuracy of prescriptions dispensed in 50 pharmacies and found that the types of errors included wrong label instructions, wrong prescription label information, wrong quantity, wrong drug, omission, and wrong dosage form. The reasons these types of errors occur can vary. Provider handwriting may be confusing or illegible, drugs may look or sound alike, technicians may pull and count wrong medications, and if the patient has not been educated about the medication by the prescriber, it can become more difficult for the pharmacist to solve the puzzle.

J.J Case Study (Part 1)
J.J. is a 38-year-old black male who comes to your pharmacy to fill a prescription that he just received from his physician. His prescription is written for amiloride 10 mg daily, but his prescription vial awaiting pharmacist verification contains amlodipine 10 mg, even though the label on the vial is correct. Upon inspection you notice the mistake and alert the technician who filled the prescription. To get a better understanding of why this error occurred, you ask her what she thinks lead to the mistake. She then tells you that while she was attempting to retrieve the drug that she stopped to answer the ringing telephone. After helping the customer on the telephone she went back to her original task of retrieving the medication, however she did not bring the patient label with her to the shelf and instead pulled the drug from memory. What are the possible process improvements that can be made to keep this type of error from happening again?

The IOM lists several areas that, when addressed, may reduce the rate of medication errors. Specifically there are three areas that have supporting evidence in error reduction. A summary of these recommendations can be found in Table 1.

### Table 1. Recommendations That May Lead to Reduced Medication Errors

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Summary</th>
<th>Supporting Evidence</th>
</tr>
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<tbody>
<tr>
<td>Improved work environment</td>
<td>Increasing illumination from 45 foot-candles to 146 foot-candles was observed to significantly reduce error rates.</td>
<td>Buchanan et al, 1991</td>
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<tr>
<td></td>
<td>Prescriptions filled with one or more distractions or interruptions were found to have a higher error rate than baseline.</td>
<td>Flynn et al, 1999</td>
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<tr>
<td>Pharmaceutical case management</td>
<td>Patients who enrolled in PHARMACEUTICAL CASE MANAGEMENT were significantly less likely to be taking a medication with an inappropriate indication, wrong dose, or incorrect duration.</td>
<td>Chrischilles et al, 2004</td>
</tr>
<tr>
<td>Patient counseling</td>
<td>In an outpatient pharmacy, 89% of reported errors were caught during patient counseling.</td>
<td>Kuyper, 1993</td>
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new prescriptions only, as refill prescriptions were
filled at a satellite pharmacy. A total of 10,889
prescriptions were observed under three differ-
ent levels of illumination: 45 foot-candles, 102
foot-candles, and 146 foot-candles. It should be
noted that levels of illumination were randomly
assigned to each study day to achieve seven
days under each illumination level, although
those days were not consecutive. While the
overall error rate was 3.4 percent, there was a
statistically significant difference between the
lowest and highest levels of illumination. The
rate of errors observed under 45 foot-candles of
illumination, the standard baseline illumination
for that pharmacy, was 3.8 percent, while the
rate of errors observed under 146 foot-candles
of illumination was 2.6 percent. Based on these
findings, evaluating the illumination in the phar-
macy may be a part of a strategy to identify the
factors which contribute to errors in a community
pharmacy. Illumination can be measured by a lux
meter to optimize the workplace lighting.

Anyone who has worked in a community
pharmacy knows that distractions and interrup-
tions often become a standard part of the work
environment. Examples include ringing tele-
phones, questions from staff, patient counseling
needed, and overhead paging systems. It may
come as no surprise that limiting interruptions is
another strategy that may reduce medication er-
ror rates. In a study completed by Flynn and col-
leagues in 1999 to determine the impact of dis-
tractions and interruptions in an ambulatory care
pharmacy on error rates, 5,072 prescriptions
were analyzed with an overall error rate of 3.23
percent. The error rate for prescriptions filled
with one or more interruptions during the process was
6.65 percent and prescriptions filled with one or
more distractions was 6.55 percent. The most
common types of interruptions observed were
related to prescription processing questions by
the staff. It is thought that with better staff training
that this type of interruption would decrease,
and possibly reduce the number of errors made.
Other types of interruptions and distractions
observed included facility related, job related
(other than prescription processing), miscellaneous, and
unrelated to job. This study also looked at baseline mea-
surements of field independence, which is a measure of a
person’s susceptibility to distractions. As expected, phar-
macists with a higher score, indicating less susceptibility to
distractions, were indeed observed as having succumbed
to fewer distractions. A different study by Flynn and as-
sociates in 1996 looked at the effect of ambient noise,
as well as other types of noise and sound on medication
error rates. In this study, pharmacists were simultaneously
observed by a registered pharmacist and videotaped to
capture the timing of noise occurrences with regard to the
timing of when errors were made. Observations took place
over a period of 23 days for a total of 184 hours. The study
found that ambient noises were not shown to impact error
rate, and that the error rates increased up to the point of
a certain sound level and then decreased. Surprisingly,
uncontrollable noise was not found to have an impact on
errors. The authors proposed several possibilities for this
unexpected result. First, there is the possibility that uncon-
trollable sound and noise have an arousal effect, which
causes the worker to become more alert, even if he or she
is annoyed by the sound. A second explanation pertaining
to uncontrollable noise is that pharmacists may employ
a noise-induced stress coping mechanism, making them
less susceptible to being distracted by noises. An explana-
tion proposed for why it is that controllable sounds are not
observed to have an effect is because of their potential to
be controlled, which causes them not to be perceived as
annoying. Identifying sources of distraction in the typical
community pharmacy and developing a strategy for reduc-
ing them should be a part of efforts to reduce errors. Which
distractions can be reduced or eliminated when pharma-
cist, technician and ancillary staff cooperate?

Individual pharmacist workload is another area where
improvement can lead to a reduction in dispensing errors.
Kistner and colleagues studied the accuracy of prescrip-
tions dispensed in a high-volume outpatient pharmacy over
the course of 12 weekdays. A total of 9,846 prescriptions
were audited after verification and before dispensing to
patients. The total error rate was found to be 12.5 percent,
with 1.6 percent found to be potentially clinically significant
errors. This study made two important observations related
to the pharmacy work environment. The first is that there
was a significant difference between the number of errors
made and the number of prescriptions dispensed per hour.
There was also a significant difference between the number of errors made and the number of prescriptions dispensed per pharmacist per hour. In fact, the accuracy rate was 87.2 percent at 16–20 prescriptions per hour, and fell to 84.3 percent when the number of prescriptions checked by an individual pharmacist rose above 30 prescriptions per hour. These findings highlight the importance of managing individual pharmacist workload and appropriate staffing for prescription volume. Using reports from pharmacy management systems, the pharmacy staff can identify peak filling hours and determine if current staffing is sufficient to safely and accurately dispense prescriptions.

**MTM PHARMACEUTICAL CASE MANAGEMENT SERVICES**

In a position statement published by the American College of Clinical Pharmacy (ACCP) and approved by several organizations, including NCPA, medication therapy management (MTM) services are designed to optimize therapeutic outcomes for individual. One of the components in the definition of MTM services includes performing medication reviews with a goal of identifying and preventing medication-related problems, which includes adverse drug events. Multiple studies including the Asheville Project and studies involving Iowa Medicaid and a VA medical center in Philadelphia have shown that pharmacist involvement and intervention not only improved patient outcomes, but also reduced medication errors.

Chrischilles et al described an evaluation of the pharmaceutical case management services within Iowa Medicaid. The state of Iowa recognized pharmacists as providers and paid pharmacist-physician teams to deliver pharmaceutical case management to high risk populations in the community. This program allowed pharmacists to work collaboratively with physicians to implement a predetermined action plan without patients needing to make an extra visit to the physician. Pharmacists communicated with the physicians after each patient visit, making individual recommendations for each patient. Any accepted recommendation was considered to be an action plan. The state identified patients taking at least four long-term medications, including at least one medication for one out of 12 pre-specified disease states. Before pharmaceutical case management services were started, more than one half of eligible patients had at least one indicator of inappropriate medication use. Patients who enrolled in pharmaceutical case management services were shown to be significantly less likely to be taking a drug without an indication, or with an incorrect dose or duration. Looking at patients over the age of 65, those enrolled in pharmaceutical case management services showed significantly decreased use of high-risk medications than those not enrolled in the service.

**J.J. Case Study (Part 2)**

After correcting the prescription, your technician completes the transaction and asks J.J. if he has any questions for the pharmacist. He answers, “no” and leaves the pharmacy. One week later J.J.’s physician calls the pharmacy and tells you that J.J. is at the office for a re-check. J.J. brought his new prescription vial to his appointment, where the physician realized that he had mistakenly given J.J. a prescription for amiloride instead of amiodarone, the drug he actually needed. The physician is contacting you to cancel the amiloride prescription and call in the correct amiodarone prescription. Is there a way that this prescribing error could have been caught at the pharmacy?

**PATIENT COUNSELING**

In pharmacy school, most pharmacists are now taught about patient counseling in the form of the three prime questions for new prescriptions: First, what did your doctor tell you the use is for this medication? Next, how did your doctor tell you to take this medication? Third, what did your doctor tell you to expect from this medication? For refills, there are separate questions to be discussed while showing the patient the medication, referred to as the “show and tell” method. For what do you take this medication? How do you take it? What problems are you having with the medication? The aim of a study by Anthony Kuyper at the Indian Health Service was to look at how patient counseling can impact medication errors. The premise for the study was that the process of verifying prescriptions eventually becomes a habit for
many pharmacists. When there is an imbalance between habit and concentration, medication errors can occur. One way to counter this is through patient Counseling, which activates the mind with each unique encounter. The IHS study was a retroactive review of documented errors over an 18-month period in a pharmacy that fills approximately 100,000 prescriptions per year. During that period a total of 323 errors were reported, of which 286, or 89 percent, were caught and corrected during patient counseling.

The IOM has several recommendations when it comes to patient Counseling which expand on the prime questions mentioned previously. The first is to review the name and purpose of the medication. This will help identify dispensing and/or prescribing errors. It will also help identify if the physician is prescribing the medication for an off-label use, which may affect the expected dosing. The second recommendation is to discuss when and how to take the prescribed medications, which also serves to identify dispensing errors as well as patient confusion over the directions, such as scheduling three times daily versus every eight hours. Next is to discuss side effects and what to do if they occur. Patients will appreciate knowing which side effects are serious and which ones they can self treat. Discussing drug-drug, drug-food, and drug-disease interactions may help give patients an understanding of why certain medications are or are not prescribed, and can help them better understand their health conditions. The next step is to review the patient’s or surrogate’s role in achieving appropriate medication use and also review the role of the medication in the patient’s overall health. Patients want to know indicators of whether or not their medication is working, how the medication will help their condition, and how long they will need to take the medication. Patients should be encouraged to take responsibility in their health care and become active participants in the process.

TECHNOLOGY

As new technology develops, the interest in how that technology aids in the prevention of medication errors grows. Among the types of technology that may improve medication safety, computerized physician order entry (CPOE), clinical decision support systems (CDSSs), and electronic prescribing may be the most well known. CPOE provides standardized and legible orders while also providing several standard patient identifiers on the printed prescription including patient name, date of birth, and address. Additionally, patient allergy information will also commonly be included on the printed prescription, preventing another possible source of error. A CDSS can provide a wide range of services, including advice on drug doses, routes, and frequencies, and can perform drug-drug interaction checks, allergy checks, drug-laboratory value checks, reminders and even drug guidelines. Computerized physician order entry and clinical decision support systems do not necessarily need to come together, but often they are used together. A review conducted by Kaushal and colleagues looked at the effects of computerized physician order entry and clinical decision support systems on medication safety. In total there were 12 studies that met their inclusion criteria, with five studies that looked at CPOE combined with CDSSs. The results showed that CPOE with CDSSs reduced non-intercepted serious medication errors between 55 percent and 86 percent, with one study demonstrating an 81 percent decrease in medication errors.

Electronic prescribing, or e-prescribing, is a separate component whereby a patient’s prescription is sent electronically and directly to the patient’s pharmacy management system through a computer to computer transaction, completely bypassing the need for a printed prescription. CPOE is a pre-requisite for e-prescribing. An advantage of e-prescribing is that it generally needs little alteration on the part of the pharmacy because the information sent by the prescriber is translated into the patient’s profile and creates a new prescription. This can cut down on medication errors that result from transcription of a printed prescription into the pharmacy profile. Another advantage is that depending on the prescribing platform vendor, it may be possible for prescribers to see details of the patient’s prescription coverage. This allows prescribers to identify formulary options from the classes of medications they would like to prescribe, and ideally reduces calls from the pharmacy to the prescriber to change medications due to coverage issues. Of course, new technologies come with their own unique opportunities for errors. Warholak and Rupp
looked at the number and types of interventions made by community pharmacies on e-prescriptions. They relied on documentation of interventions made by pharmacists in 68 pharmacies, representing five chain organizations in five states. In total, 2,690 e-prescriptions were reviewed, with 102 prescriptions requiring intervention, representing 3.8 percent of e-prescriptions. The study pharmacists recorded 21 different categories of intervention, with the most commonly cited reasons being omitted information, insufficient dose, and excessive dose. To resolve these issues, the pharmacists documented needing to contact the prescriber 75 percent of the time. This obviously results in instances of more time and effort spent on a process that is supposed to streamline prescribing. In fact, the study pharmacists also documented the amount of time spent on each intervention, which averaged 6.07 minutes per intervention with a median of five minutes.

A different study by Rupp and Warholak evaluated the use and processing satisfaction of 276 pharmacies with the e-prescribing process, and used the results to formulate best practice recommendations. This survey was administered to all pharmacy staff in participating pharmacies. The authors found that in general, pharmacists had a more positive view of e-prescribing compared with technicians in the categories of safety, effectiveness, and efficiency while all staff reported being moderately satisfied with e-prescribing and the processing of the e-prescriptions. On a 6-point Likert scale, staff rated their satisfaction with the process between 4.42 and 4.66. A number of comments were also returned with the surveys. Positive comments included improved legibility and efficiency, while negative comments included prescribing errors and unreasonable expectations of patients arriving very soon after receipt of the prescription and expecting the prescription to be ready. In total the survey resulted in 11 best practice recommendations, with five recommendations being pertinent to the community pharmacy and six recommendations aimed at the physician side of the software. For pharmacies, Rupp and Warholak recommend that pharmacy computer systems should more readily alert staff of incoming e-prescriptions so that they can be processed in a timely manner, and that staff should be appropriately trained to recognize and respond to these alerts. Pharmacy management personnel should also have the ability to be alerted to e-prescriptions that have been waiting for a pre-determined amount of time for processing and they should then have a mechanism to alert pharmacy staff.

Software on the pharmacy side of e-prescriptions should move toward becoming truly electronic, and eliminate the need to print a hard copy of the electronic prescription for manual entry; this will reduce transcription related medication errors. Finally, pharmacies should be able to send electronic queries to prescribers related to the e-prescriptions they have received, and physicians should be able to respond to these queries electronically as well. This may allow for better communication between the prescriber and the pharmacy, as well as reduced wait time when clarification is needed. Additionally, faster and more efficient communication between the prescriber and the pharmacy will ultimately result in less wait time on the part of the patient in an instance when clarification is needed.

Another example of seeking reduced medication errors through technology is the automated dispensing system with bar code-aided medication verification. Flynn and Barker sought out to evaluate the impact of such a system in two pharmacies by analyzing the error rates before implementation and several months after implementation. Observations took place in one independent pharmacy over 13 days both before and nine months after implementation, and in one chain pharmacy over 12 days both before and two months after implementation. The authors looked for a reduction in target errors, which they defined as wrong drug, wrong strength, and wrong form errors, as these were the types of errors that automated dispensing systems are designed to avoid. Non-target errors were defined as all other errors, which were typically related to order entry errors not under the influence of the automated dispensing system. In the independent pharmacy, the overall error rate before the automated dispensing system was observed to be 2.7 percent and was reduced to 1.8 percent after implementation, a statistically significant difference. In addition, target error rates were reduced from 0.5 percent to 0.1 percent, which was also statistically significant.
In the chain pharmacy the overall rate of errors was 1.7 percent before installation and 1.9 percent after, which was not statistically significant. The same pharmacy saw a reduction in the target error rate from 0.3 percent to 0.1 percent, which was also not statistically significant, but approached significance at 0.04 percent. The authors noted that in the chain pharmacy several of the errors occurred after staff overrode the automated dispensing system, and posited that those decisions may have influenced the results of the study. They recommend that managers should have the ability to monitor overrides and should investigate as soon after each occurrence as possible. Additionally, they concluded that automated dispensing systems are effective at reducing target errors. However, more efforts need to be focused on reducing non-target errors, which mainly consist of order entry errors (Flynn & Barker, 2006).

OTHER PREVENTION STRATEGIES
Not all error prevention strategies require an investment in new technology. Sometimes changes in organization or workflow can have an impact on errors. A 2003 study by Flynn and colleagues observed the dispensing processes and documented error rates in 50 pharmacies located in six cities across the United States. They used direct observation by licensed pharmacists to inspect prescriptions as they were being filled and checked. If a discrepancy was noted, the observer alerted the pharmacist after the prescription was checked but before it was dispensed to the patient. To assess the effect of the observer, prescriptions in the will-call area were also analyzed for errors. A panel of pharmacists who rated each error on two qualities later assessed the clinical importance of observed errors. The qualities they rated were patient harm potential and the likelihood of patient harm actually occurring. Each quality was ranked on a scale of 1 (important or very likely) to 5 (not important or not very likely), with a total score of 6 or less deemed clinically important. A total of 4,481 prescriptions were analyzed, of which 1,961 were new prescriptions, 1,677 were refills, and 843 were uncategorized. The accuracy of new prescriptions was observed to be 96.8 percent, refills 99.3 percent, and uncategorized 99.6 percent. During the study, observers also documented error prevention strategies used by those same pharmacies. Prevention strategies were divided into the following categories: 1) work procedures enhancing organization, simplification; 2) inspection processes; 3) facility design, work environment; 4) modification of drug container; and 5) memory aid.

Work procedures contain strategies that can be easy to implement. Often these procedures involve little or no money, but require members of the pharmacy staff to alter their current methods. Organization is key in this strategy. The first change that can be implemented involves working on one patient’s prescriptions at one time or placing patient orders in separate bins. This reduces the likelihood of placing labeled medication meant for one patient in the order of a different patient. Returning drug stock bottles to the shelves immediately after filling to avoid overcrowding, and placing the stock bottle upside down after filling to avoid mix-ups is another strategy that can be employed. By keeping work areas clear of clutter there is a reduced chance of filling a prescription with an incorrect medication. An additional recommendation in this category is for all pharmacy staff to manage interruptions effectively by telling patients that you will be with them momentarily, and finishing the task at hand, or stopping at a reasonable place, before stopping to help a patient. When using this approach, communication and customer service skills are key so that patients do not feel that they are being ignored or unattended.

Inspection process modifications can also be implemented somewhat easily with little or no cost. The first is using a “smell check” for oral liquid products and some oral tablets. This becomes increasingly important when dealing with a patient who uses multiple liquid medications, as labels can easily be mixed up especially if there is an interruption or distraction. Counseling patients using the show and tell process can not only catch errors made during the dispensing process, but can also identify perceived errors such as a change in generic manufacturers, as well as errors made during prescribing. Patients should become familiar with the look of their medications as well as their indications. Another inspection process recommendation is to have a magnifying glass available for verifying medications with small imprints, or to have the stock bottle
available for comparison. Some medications, particularly differing strengths of a medication made by the same manufacturer, may be similar in size and color and my only differ by the characters on the imprint.

Facility design observations included additional lighting over the filling and inspection areas, as well as having anti-fatigue floor mats and chairs available. As mentioned previously, increased lighting has been associated with fewer dispensing errors. Modification of the drug container consisted of highlighting the drug labels or caps to indicate unusual strengths, which can draw staff awareness to deviations from normal routines and lead to better vigilance when filling prescriptions with these products. Another simple change consists of memory aid observations that include taking the patient label to the shelf to serve as a reminder and increase efficiency.

**LIQUID MEDICATIONS**

Liquid medications, both prescription and over-the-counter, can be a source of administration errors on the part of caregivers. This is an area where pharmacist involvement can have a big impact. A study by McMahon and colleagues looked into whether different levels of education with regard to prescription directions and dosing devices would have an impact on potential administration errors. The division of groups and results are summarized in Table 2. Participants were divided into three groups, each receiving a different amount of education on prescription directions and dosage devices and measurement. The first group of parents was read the prescription directions and then after returning from the pharmacy with the medication, they were asked to choose a measuring device and demonstrate how they would measure the dose. The second group of parents was read the directions and additionally received a measuring syringe plus a demonstration of how to measure the dose.

<table>
<thead>
<tr>
<th>Group</th>
<th>Intervention</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parents were given the prescription, verbal directions, and a choice of measuring devices</td>
<td>37% of parents dosed the medication correctly when asked to demonstrate the prescribed dose</td>
</tr>
<tr>
<td>2</td>
<td>Parents were given the prescription, verbal directions, and a medication syringe where the correct dose was demonstrated</td>
<td>83% of parents dosed the medication correctly when asked to demonstrate the prescribed dose</td>
</tr>
<tr>
<td>3</td>
<td>Parents were given the prescription, verbal directions, and a medication syringe where the correct dose was demonstrated and also marked at the correct dose</td>
<td>100% of parents dosed the medication correctly when asked to demonstrate the prescribed dose</td>
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The third group received the same education and demonstration as group two, and in addition the dose was marked on the syringe. Parents then had the medication filled at a pharmacy and returned to demonstrate what they thought was the correct dose measurement. A researcher then verified the parents’ measurements and if the parents’ dose was more than 0.2 mL above or below the target dose, then the parents were re-educated. Parents from group 1 who originally chose a device other than a medication syringe were educated to use a medication syringe for all future doses. The percentage of correct dosage demonstrated was 37 percent in group 1, 83 percent in group 2, and 100 percent in group 3. This study demonstrates the impact the pharmacist can have with the act of counseling parents on dosage with a demonstration of the correct dose on a marked syringe.

There are several different options available for the administration of oral liquid medications, which can be a source of confusion for many parents. Medication droppers are commonly used for infants, and parents or caregivers should be educated to administer the medication slowly into the back inside cheek side of the mouth. Parents should avoid quickly squirting the medication into the child’s mouth as this may cause choking. Oral medication syringes are the preferred method of delivery for children. They are not prone to spilling, as calibrated measuring spoons or measuring cups can be, and the parent can easily administer medications in the same manner used for droppers. These syringes are also available in a number of volumes, to accommodate a variety
of dosages. Oral medication cups are acceptable for measuring volumes greater than or equal to 15 mL, and are often a good choice for adults. A number of liquid medications come packaged with a measuring device from the manufacturer, commonly in the form of a syringe, cup, or dropper. In an instance where a product is packaged with its own measuring device, it is generally not necessary to provide an additional measuring device. However, the pharmacist should ensure that the markings on the measuring device correspond with the directions written by the prescriber. In all instances of dispensing an oral liquid medication, patients should be counseled to use a calibrated measuring device and not to use household teaspoons or tablespoons. In addition parents should be counseled on the importance of keeping the appropriate measuring device with each product, such as using a medication dropper for infant drops and not using a syringe which could lead to a possible overdose.

**PATIENT PREVENTION STRATEGIES**
The Institute of Medicine report “Preventing Medication Errors: Quality Chasm Series” stresses the importance of empowering patients to become involved in their health care. The report lists expectations that patients should have of their providers when they go to an appointment. Among the expectations are that patients should be listened to and respected by their providers, to always be told the truth, and to have information communicated to the entire team. As pharmacists we are part of that team, and patients should have these same expectations when they come to the pharmacy.

That same report also stresses the importance of patients carrying an up-to-date medication list that includes prescription, OTC, and dietary/supplement products as well as their indication and even a description of what the medication looks like. This list should also contain patient allergy information and emergency contact information. Patients should be encouraged to bring the medication list with them to physician visits to encourage medication reconciliation, and the list should be updated when medications are added or discontinued. Additionally, the IOM has made specific recommendations for patients to improve medication safety. Patients should make sure that the name of the medication they receive from the pharmacy is the same as what was written by the prescriber. They should also know that they are able to review their medication list with a pharmacist for further safety. Additionally, patients should know that they can receive counseling from a pharmacist, who will review the name and indication of the medication, how to use it, and what side effects to expect. They should also expect to receive written information about medications when they request it.

Pharmacists can help empower patients by teaching them what it means to be an alert consumer and involved in their health care. They can create and distribute (by hand or by email) pamphlets or newsletters with these tips, such as making sure that patients know what their medication should look like and what to do if it looks different. Pharmacies can also set up educational tables to talk about this topic with patients; pharmacy students can particularly be of service in creating materials and educating patients. Examples of topics include creating a medication list, storage of medications, disposal of medications, and medications that should not be crushed or broken. Once patients know the types of questions they should be asking and why, they can become active participants in the process and help increase medication safety.

**J.J. Case Study (Part 3)**
When J.J. returns to the pharmacy to pick up his amiodarone prescription, you meet him at the pharmacy to counsel him. You tell him that when you filled the amiloride prescription that you included an information leaflet that described the medication, and ask him if he read it. He tells you that he started to read the leaflet but had a difficult time understanding it, and figured he would just ask his physician some additional questions at his re-check. J.J. has been your customer off and on for a few years, and you never thought that he might have a health literacy problem, but now you are starting to consider the possibility.

**HEALTH LITERACY**
When considering the type of counseling that a patient requires, pharmacists must consider the patient’s level of health literacy. According to the IOM and the Department
of Health and Human Services (HHS), health literacy is “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.” Without realizing it, a pharmacist may deliver what would otherwise be appropriate counseling, only to have the patient walk away with a misunderstanding of a medication, which can then cause a medication error. Health literacy applies not only to comprehending and completing forms, but also everyday tasks such as selecting an OTC product, getting children immunized, and understanding and choosing an insurance plan. In 2003, the National Assessment of Adult Literacy (NAAL) administered an assessment to more than 19,000 adults to determine their level of health literacy, and the responses were placed into one of four categories: below basic, basic, intermediate, and proficient. The survey found that 12 percent had proficient literacy, 53 percent had intermediate literacy, 22 percent had basic, and 14 percent had below basic literacy. According to the Center for Health Care Strategies, patients with low functional literacy are less likely to understand written and oral information given by health care providers, act upon necessary procedures and directions, and they are also less likely to be able to navigate the health care system in a way that meets their needs.

Low functional literacy should not be confused with low health literacy, as a person with a high functional literacy may not have the motivation, understanding, or ability to seek out or process health information in a meaningful way. Health care professionals may be more likely to look for signs of low health literacy in individuals who have language barriers or in older patients. However, Easton and colleagues addressed the “hidden” population of patients with health literacy difficulties. This population generally does not give an indication of having low health literacy, and may have developed coping mechanisms to avoid addressing the subject. Through a review of 24 articles, they found that patients with low health literacy were significantly more likely to report their health as poor, and to perceive their children’s illnesses as being more severe than other children with the same level of symptoms. They also found that these patients had a more difficult time defining adherence, identifying medication, and recalling missed doses.

There are a few strategies that pharmacies can use to assist patients with low health literacy, thereby increasing understanding and reducing confusion that may lead to medication errors. For instance, medication schedules can be tailored to fit the patient’s routine. This can be achieved by color coding medications, or using daily events to serve as reminders to take medication. Pharmacists can verify that the patient has understood what they were told by using the “teach back” method. In this method the pharmacist would ask the patient to repeat how he or she is going to use the medication, and fill in any gaps or correct any misunderstandings that the patient may have. Pharmacy staff should remember to speak slowly and use layman’s terms when speaking to patients, and aim to keep conversations based around a fifth or sixth grade level to ensure understanding. In addition to verbal communication, pharmacists may also choose to use visual tools to increase learning. Pictures or diagrams can be taken home with the patient in case of a question. Additionally, medications that involve different methods of administration (such as injections and inhalers) may have patient training videos posted on the manufacturer’s website. The pharmacist may choose to show this type of video in a counseling room and then use the “teach back” method with the actual medication or a demonstration sample, again to ensure that the patient understood the material (Center for Health Care Strategies, 2005).

J.J. Case Study (Part 4)
At the end of your counseling session with J.J., he states that his physician explained that the medication error was not your fault, but he wants to know if anyone keeps track of these types of errors. He doesn’t want anyone to get in trouble. Is there someone that he could report this to?

ERROR REPORTING
In the event that a medication error occurs, pharmacy staff should report the error as soon as possible. Most pharmacies have a process for internal reporting of errors. However, there are also external reporting options that should be considered and utilized. Reporting errors to external
organizations helps add to the data of national databases that are trying to get an accurate estimate of the overall national incidence of errors. Additionally, these organizations can identify national trends that need to be reported to the FDA, manufacturers, or the public, such as look-alike/sound-alike drugs. Details of available voluntary reporting programs can be found in Table 3. One such reporting tool is available through the Institute for Safe Medication Practices (ISMP), called the Medication Errors Reporting Program (MERP) (Institute for Safe Medication Practices). This program encourages reporting of errors related to prescribing, dispensing, and/or administration of medications, and also allows for pictures or scanned copies of orders to be submitted with the report. Another program available is the FDA MedWatch program. This program encourages reporting of serious adverse events and product problems, but does not allow for submission of photos of products. There is a separate form available for patients to report their own adverse event; however the FDA encourages patients to bring the form to their prescriber to obtain the clinical information requested. Errors associated with e-prescribing should be recorded. One safety organization that focuses on e-prescribing errors is the Pharmacy Quality Commitment through its online PEER Portal.

**J.J. Case Study (Part 5)**

After experiencing a medication error, J.J. is interested in finding out how he can be more proactive about his healthcare. What types of resources are available to him?

**CULTURE OF SAFETY**

Over the last decade there has been a shift in the way errors are analyzed and thought about. In the past there was a tendency to assign blame for medication errors, whereas now there is a movement towards looking at errors as a learning opportunity. This newer approach is often referred to as a “culture of safety.” There are a number of studies on the culture of safety in the hospital and clinic settings, but few studies exist in the community pharmacy setting, especially in the United States. One study by Ashcroft and colleagues looked at safety culture assessment in community pharmacies in the United Kingdom. They describe different levels within the culture of safety, ranging from a lack of understanding of the need for risk management to integrating risk management into all processes.

Level 1 is called “pathological,” and in this instance subjects do not value risk management and view safety issues as a waste of time. Level 2 is “reactive,” in which every incident is considered to be very serious and an action is taken every time. Level 3 is “calculative,” and aims to anticipate every possible scenario and plan for it in advance. Level 4 is “proactive,” and subjects are on the alert and anticipating that risks will emerge. Finally, Level 5 is “generative,” and risk management is a priority and a part

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**Table 3. Voluntary Error Reporting Databases**

<table>
<thead>
<tr>
<th>Name</th>
<th>Parent Organization</th>
<th>Reportable Fields</th>
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</table>
| Medication Error Reporting Program | Institute for Safe Medication Practices | - Wrong drug, strength, route, or dose of medications  
- Look-alike/sound-alike drugs  
- Calculation or preparation errors  
- Misuse of medical equipment  
- Errors in prescribing, transcribing, dispensing and monitoring of medications  
- Ability to upload pictures of defective products or scanned copies of prescriptions |
| MedWatch                    | Food and Drug Administration | - Serious adverse events  
- Product quality problems  
- Product use error  
- Therapeutic inequivalence or failure |
| PEER Portal                 | Pharmacy Quality Commitment | - E-prescribing errors  
- Problems with e-prescribing technology  
- Collects e-prescribing experiences reported by pharmacies and prescribers |
of all processes. The researchers took this existing framework used in Manchester (U.K.) in primary care offices and aimed to alter that framework to be applicable to community pharmacy. They then conducted focus groups with pharmacy employees to determine if this framework would be accepted and thought to be feasible in the community setting. Many participants felt their existing pharmacy culture was pathological and expressed a desire to move to a more generative mindset.

The investigators have made their Pharmacy Safety Climate Questionnaire available through the Centre for Innovation in Practice website at www.pharmacy.manchester.ac.uk/cip/resources. This survey contains 34 questions and is meant to be completed individually by all staff members within the pharmacy to determine perceptions about the culture of safety within the pharmacy. They propose several uses for it, including raising awareness about differences in perception among staff, sparking discussion about the current level of patient safety culture, identifying areas for improvement, evaluating the effectiveness of interventions, and conducting benchmark exercises. With this type of instrument, it is important to give staff members the appropriate amount of time needed to complete the survey, usually 10 to 15 minutes, and to stress the importance of honest opinions.

J.J. Case Study (Part 6)
You decide that J.J.’s medication error can be an important opportunity for learning about patient safety, and present the case to your staff members. Some members of the staff wonder why this is even being brought up; the doctor ended up prescribing the wrong medication, and now the situation has been corrected. Other staff members are proposing drastic changes to prevent this specific type of error from happening again. What levels of patient safety culture are they displaying? How can you go about improving their response?

MEDICATION SAFETY RESOURCES
There are a variety of websites available to educate both patients and health care providers on medication safety. The following websites can be used to learn more about the topic.

The ISMP has two helpful websites. The first is www.ismp.org, which focuses on information for health care providers. The website offers newsletters that anyone can sign up to receive, with a specific edition for Community/Ambulatory Care which covers medication errors, adverse drug reactions, and recommendations to reduce medication errors. The site also contains recall information and safety alerts, a “do not crush” list, and error reporting information. Additionally under the section of “Tools to assess risk in community pharmacy,” there are resources to aid pharmacies in assessing and improving their safety practices.

The second resource offered by ISMP is targeted at educating consumers on medication safety, and can be found online at www.consumermedsafety.org. This website contains information on drug alerts, commonly confused medication names, a drug identifier, and patient error reporting. It also has a consumer-focused newsletter that addresses recent medication errors and the steps consumers can take to help prevent them. It also encourages preventive care, such as receiving the influenza vaccine, and discusses the importance of talking to a pharmacist about medications.

The American Society of Health-Systems Pharmacists (ASHP) created the website www.safemedication.com. This website contains easily readable information geared toward patients to help educate them about medication safety. It includes step-by-step guides on how to administer different types of medications, including: ear/eye drops, nasal sprays, metered dose inhalers, and others. The site also has a “What you should know about…” section that talks about topics such as using medication safely, preparing for an emergency, and gluten in medication. Additionally there is a feature that allows patients to print their own customized medication list.

The Agency for Healthcare Research and Quality (AHRQ) has information for both health care providers and patients at www.ahrq.gov. For patients, there are tips to prevent medication errors and information on how to take medications safely. A specific resource for community pharmacies on this site is a Pharmacy Health Literacy Assessment Tool, available at www.ahrq.gov/qual/pharmlit. This tool is designed to help
pharmacies raise awareness about health literacy among pharmacy staff, identify barriers that may keep patients with low literacy from accessing the services provided by the pharmacy, and identify areas for improvement.

Another resource for patients is available from the Centers for Disease Control and Prevention (CDC) at www.cdc.gov/medicationsafety. This website goes over the basics of medication safety, programs related to medication safety in different age groups, as well as campaigns and initiatives. The PROTECT Initiative is also featured on this site. This initiative aims to prevent unintentional medication overdoses in children by making recommendations for better child-resistant packaging, reducing medication errors through standardized OTC labeling, and educating the public through national campaigns.

J.J. Case Study (Part 7)

J.J. returns to your pharmacy one month later and tells you that he followed your suggestion about reporting the medication error. He would like to know where he can find more information about what consumers can do to limit or prevent medication errors. He thinks this would be good information to pass on to his friends and family. What suggestions do you have for him?

CONCLUSION

Medication errors in the community pharmacy setting is a topic that needs more research and voluntary reporting from community pharmacies to be fully understood. We know that depending on the particular study, errors have been documented to happen at a rate of anywhere from 1.7 percent to 24 percent, with clinically significant errors reported at 0.1 percent to 1.6 percent, and that in recent years the public and the media have been more aware of errors that happen in the community pharmacy setting. To some extent they can be categorized as either prescribing errors or dispensing errors, although each type has many different variables that contribute to the exact root cause. Available studies suggest that improvements in work environment, such as illumination levels and limiting interruptions or distractions, may decrease errors. Other studies suggest that management of pharmacist workload to less than 30 prescriptions per pharmacist per hour, medication therapy management, and patient empowerment may also reduce errors. Furthermore, technology in the form of computerized physician order entry, clinical decision support systems, electronic prescribing, and automated dispensing systems are some additional strategies that may lead to a reduction in errors.

Additionally, pharmacists should be aware of the hidden population of patients with low functional literacy and low health literacy and take the patient’s level of health literacy into account by adjusting counseling and educational materials accordingly. Ideally, patient counseling and materials should be written at a fifth or sixth grade level to ensure that they are understood by a wide variety of populations. When errors are discovered, they should be reported to either the ISMP or the FDA for review and reporting to the manufacturers, health care providers, and the public when appropriate. Remember that error reporting also adds to the body of existing knowledge about medication errors, and provides data that community pharmacies may then try to improve upon. Pharmacists should also work on developing and promoting a culture of safety within their pharmacies to encourage learning from medication errors for future prevention, rather than finding a person to take the blame. This can be done through non-judgmental reviews of pharmacy errors and by assessing baseline perceptions of the pharmacy staff and working to improve those perceptions. Finally, pharmacists should be individually encouraged to look for opportunities for improvement in their own pharmacies to enhance patient safety and to educate patients on what they can do to help prevent errors.

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Editor’s Note: For the list of references used in this article, please contact America’s Pharmacist Managing Editor Chris Linville at 703-838-2680, or at chris.linville@ncpanet.org.
CONTINUING EDUCATION QUIZ
Select the correct answer.

1. According to the Institute of Medicine (IOM), there is an adequate amount of literature discussing the incidence of medication errors in the community pharmacy setting.
   a. True
   b. False

2. Which of the following environmental factors may lead to a reduction in dispensing error rates?
   a. Decreased illumination of the work area
   b. Increased distractions in the pharmacy
   c. Increased interruptions during the dispensing process
   d. Increased illumination of the work area

3. Which of the following is true regarding the findings of the study conducted by Kistner and colleagues?
   a. There was a significant difference between the number of errors made and the number of prescriptions dispensed per hour.
   b. Managing individual pharmacist workload is important in preventing medication errors.
   c. There was a significant difference between the number of errors made and the number of prescriptions dispensed per pharmacist per hour.
   d. All of the above are true.

4. What rate of prescriptions per pharmacist per hour was associated with the lowest level of accuracy?
   a. Fifteen prescriptions per pharmacist per hour
   b. Twenty prescriptions per pharmacist per hour
   c. Twenty-five prescriptions per pharmacist per hour
   d. Thirty prescriptions per pharmacist per hour

5. What type of system provides advice regarding drug doses, routes, and frequencies, as well as drug allergy checks and drug-drug interaction checks?
   a. Computerized physician order entry
   b. Clinical decision support systems
   c. Electronic prescribing
   d. All of the above

6. Which of the following is a true statement?
   a. Only computerized physician order entry has been shown to reduce medication errors.
   b. Only clinical decision support systems have been shown to reduce medication errors.
   c. Combined computerized physician order entry and clinical decision support systems have been shown to reduce medication errors.
   d. None of the above is true.

7. One of the advantages of e-prescribing is:
   a. Omitted information on prescriptions
   b. Printed prescriptions are transcribed into the pharmacy data base.
   c. Pharmacists only need to call prescribers to correct doses.
   d. Information is transferred directly from the prescribing system directly into the patient’s pharmacy profile.

8. All of the following techniques to reduce errors are considered work procedures EXCEPT:
   a. “Smell check” for oral liquid products
   b. Working on one patient’s prescriptions at a time
   c. Managing interruptions
   d. Returning stock bottles to the shelves immediately after use

9. Which of the following methods is the best way to prevent liquid medication administration errors by parents?
   a. Counsel the parent on the dose prescribed and allow them to choose their own measuring device.
   b. Counsel the parent on the dose prescribed and provide them with a medication syringe.
   c. Counsel the parent on the dose prescribed and demonstrate the correct dose on a marked medication syringe.
   d. None of the above
10. What is the preferred device for oral liquid medication delivery in children?
   a. Dropper
   b. Oral syringe
   c. Medication cup
   d. Any of the above

11. Parents using liquid medications for their children should be counseled on:
   a. Quickly squirting the medication in the back of the child’s throat to prevent the child from spitting out the medication
   b. Properly using household teaspoons and tablespoons to measure medication
   c. Slowly administering medication in the back inside cheek of the child
   d. All of the above are appropriate counseling points.

12. Which of the following points should pharmacists cover with patients during counseling?
   a. Name and purpose of medication
   b. Side effects and what to do if they occur
   c. The role of the medication in the patient’s overall health
   d. All of the above

13. How can pharmacists encourage patients to become more active in medication safety?
   a. Show patients what their medications look like, and let them know to speak up if something doesn’t look right.
   b. Create a patient education table on keeping a complete medication list.
   c. Provide pamphlets on proper medication disposal.
   d. All of the above

14. According to the Center for Health Care Strategies, patients with low functional literacy are more likely to understand written and oral information given by healthcare providers.
   a. True
   b. False

15. In a review by Easton and colleagues, patients with low functional health literacy had problems:
   a. Defining adherence
   b. Identifying medication
   c. Recalling missed doses
   d. All of the above

16. Which of the following methods can pharmacists use to assist patients with low health literacy?
   a. Use the “teach back” method to verbally verify understanding.
   b. Tailor the medication schedule to fit the patient’s routine.
   c. Use visual aids that the patient can take home as a reference.
   d. All of the above

17. Which of the following is an advantage of the Medication Errors Reporting Program (MERP) over the MedWatch program?
   a. Reporting of serious adverse events
   b. Events are reported to the FDA and/or drug manufacturers.
   c. Pictures of products, containers, labels, or scanned copies of orders can be uploaded with the report.
   d. Therapeutic inequivalence problems can be reported.

18. You find that an error was made in your pharmacy and bring it up to the staff. They begin to blame each other for the error and wonder why it even needs to be discussed if the error was already corrected. What level of patient safety culture are they demonstrating?
   a. Pathological
   b. Reactive
   c. Calculative
   d. Proactive

19. When using the Pharmacy Safety Climate Questionnaire, only pharmacists should complete the survey.
   a. True
   b. False
20. Which organization has a tool to assess risk in community pharmacies?
a. Institute for Safe Medication Practices  
b. Food and Drug Administration  
c. Agency for Healthcare Research and Quality  
d. Centers for Disease Control and Prevention

Medication Errors And Prevention Strategies
Sept. 1, 2011 (expires Sept. 1, 2014) • Activity Type: Knowledge-based

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Quiz: Shade in your choice

1. a b c d e  11. a b c d e
2. a b c d e  12. a b c d e
3. a b c d e  13. a b c d e
4. a b c d e  14. a b c d e
5. a b c d e  15. a b c d e
6. a b c d e  16. a b c d e
7. a b c d e  17. a b c d e
8. a b c d e  18. a b c d e
9. a b c d e  19. a b c d e
10. a b c d e

Quiz: Circle your choice
26. Is this program used to meet your mandatory C.E. requirements?  
a. yes b. no
27. Type of pharmacist: a. owner b. manager c. employee
28. Age group: a. 21–30 b. 31–40 c. 41–50 d. 51–60 e. Over 60
29. Did this article achieve its stated objectives? a. yes b. no
30. How much of this program can you apply in practice?  
a. all b. some c. very little d. none

How long did it take you to complete both the reading and the quiz? ______ minutes