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Patient Safety: Your Personal Medication Error Rate: Checkpoints and Reality Checks

ABSTRACT: Pharmacists and pharmacy technicians must be careful not to make errors, but errors slip through from time to time. Organizations (healthcare systems, hospitals, and pharmacies) often use systems-based approaches to error prevention. Pharmacy employees need to know about systems-based approaches, but they also need to know about approaches they can use themselves to reduce their own chances of error. This activity describes factors that increase the likelihood of error and methods that are proven to help individuals focus. We discuss–and strongly recommend–knowing your limit, tracking and recording errors, collaborating with coworkers, employing tools that increase accuracy, and stopping the workflow when things "feel" wrong.

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INTRODUCTION

Pharmacists and pharmacy technicians: We strive to provide safe, high quality care to people when they are unwell, but sometimes we miss the mark. No one likes to make an error, and in our field, errors can have devastating consequences: preventable illness and injury, unnecessary hospitalizations, disability, and sometimes even death. Experts who have extrapolated data indicate that medical errors now account for 9.5% of all deaths in the United States, which if true, would make medical mistakes the third leading cause of death after heart disease and cancer.[1]

Most of us know that the first step in resolving a medication error is being able to identify where errors occur and factors that contribute to their occurrence. Tracking in this way allows us to integrate preventive measures into our systems and habits to reduce future occurrence. It's also important to create a safe environment for individuals involved in the error so that they are not afraid to report or address future errors.[2]

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EDUCATIONAL OBJECTIVES

After participating in this activity pharmacists and pharmacy technicians will be able to:

- Discuss the difference between systemic approaches to medication errors and individual (personal) responsibilities for medication errors
- Outline various causes for medications errors that can be traced back to individuals
- Discuss ways in which peoples' unique work habits influence their propensity to make errors
- Identify methods to reduce an individual's medication error rate and apply them appropriately

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Pharmacists and pharmacy technicians are eligible to participate in this application-based activity and will receive up to 0.2 CEU (2 contact hours) for completing the activity, passing the quiz with a grade of 70% or better, and completing an online evaluation. Statements of credit are available via the CPE Monitor online system and your participation will be recorded with CPE Monitor within 72 hours of submission

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Pause and Ponder:
How many medication errors have you made recently? Do you know how the errors happened?

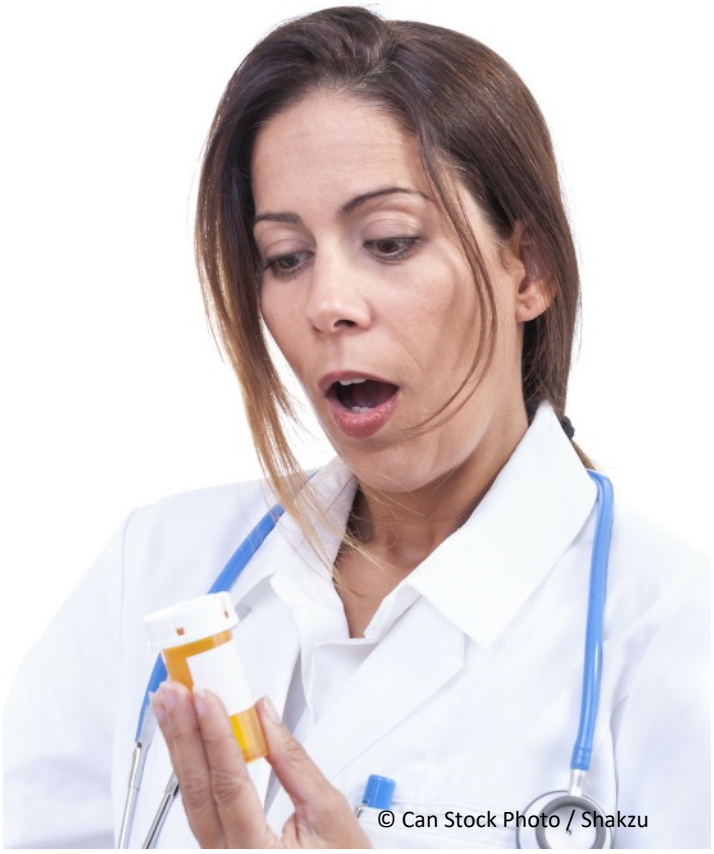
But medication errors are not only due to external factors. Psychosocial and cognitive factors can greatly impact the rates at which errors occur. Individuals who identify factors in themselves that might contribute to errors can take the next step: working on improving.

Definitions of "Medication Error"

To identify and prevent medication errors properly, it would be ideal to have a clear, unambiguous definition. Unfortunately, various researchers, groups, and individuals use different definitions. Consider a medication error to be like a dropped third strike or a fielding error, because the pharmacy team is like a baseball team. Each person has a role and individual actions impact the team's overall performance. Let's compare:

An error is a failure to complete a planned action as intended or the use of an incorrect plan of action to achieve a specific endpoint.[3] We could attribute this incorrect action to bad judgment, ignorance, or inattention. In baseball, team members expect outfield players to throw the ball to infield players in time to tag the opponents "out." Sometimes, the shortstop fails to call the plays to the outfielders. It is especially important that all the players understand the plays and make no assumptions. In pharmacy, technicians may be responsible for removing and reordering expired medication stock. When a new patient is admitted to the hospital and needs the medication immediately, the pharmacist hurries to process the order. The pharmacist assumes that all medication in stock is in-date and approves an intravenous bag, but what if it is not? At the final verification step, the pharmacist finally notices the medication's expiration date. With no in-date stock, the pharmacist cannot send the intravenous drug. This mistake disrupts patient care. The pharmacist assumed the technician team members had kept inventory in-date, and failed to pay attention and double check before proceeding.

An error is the enactment of a misconception due to incorrect information or part of a statement that is incorrect.[3] In baseball, the catcher is responsible for relaying signals to the pitcher indicating where to pitch the ball. If executed incorrectly, the batter might have a better chance of reaching first base. A similar example in pharmacy might be when a doctor sends a new prescription with a higher-than-expected quantity, fails to update the prescription or instructions, but verbally tells the patient to take a higher dose. The pharmacist proceeds to process the prescription. The insurance rejects the claim highlighting the calculated days-supply did not match the quantity indicated. While the pharmacist works on the prescription, the patient comes to the pharmacy demanding her prescription. The pharmacist cannot contact the doctor who wrote the prescription and the doctor's colleagues are unsure. The pharmacist decides to dispense a lower quantity per the old instructions so the insurance will approve it. With the prescription now approved, the pharmacist dispenses the prescription, but because the patient follows the doctor's verbal directions, she runs out sooner than indicated on the prescription. She returns a few days later demanding more. Someone will have to coordinate information among the insurance, the doctor, and the pharmacist. This could have been avoided if the doctor had noted that the patient would be taking the same drug at an increased dose. It might also been avoided if the pharmacist has consulted the patient early on.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An error is the departure from what is ethically acceptable or an incorrect result produced by automation.[3] In baseball, a shortstop player is responsible for directing the plays in the infield. If she throws the ball to the first base player—which may be an ingrained reaction to prevent bases from loading—instead of throwing it to the catcher to prevent a home run, it's an error. Not only does this play allow a home run, but if the batter lands on a base, the chance of an additional homerun if the next hitter hits is also greater. This is similar to an increasing problem as healthcare systems move toward the use of electronic health records. Most systems are programmed to increase efficiency with the autofill function—meaning the computer will fill a field automatically based on the most common entry—which can increase avoidable errors. Too often, healthcare personnel blindly accept the computer-generated entry or calculations. This can result in a patient being given too much or too little drug and disrupt the quality of care.

In summary, medication errors occur in many ways (see **Table 1**). When a medication error occurs, it reduces the margin of safety associated with that outcome and also decreases the chance of achieving a desired outcome. Some medication errors result in adverse drug reactions (ADR) but many do not. Dispensing a medication to which a patient is allergic will cause an ADR. Dispensing doses too low or too high to treat a condition also induces ADR.[3] Regardless of whether the patient experiences an adverse drug reaction, errors create problems. Other clinicians will assume the patient received the medication that was documented or intended. They will make decisions based on that assumption. In addition, the error may simply waste resources.

Finally, many of us have made errors that actually improved something. For example, a person making carrot soup may misread the words "1 garlic clove" as "1 teaspoon of cloves." The soup will be different—and possibly better—than if the cook used garlic cloves. Some drugs and indications for those drugs have been discovered by accident. In medicine, however, errors are almost never "Happy Accidents" and we need to make every effort to reduce and eliminate them.

Systemic Failures: Avoiding Blame

Many healthcare systems and providers now stress approaches that analyze errors as systemic failures. Systems, by nature, are interrelated units that work together toward the same goal. Most medication errors occur as a result of multiple, compounding events—signaling collapse of a faulty system—rather than an individual's isolated act.[4,5] Using a systems approach avoids assigning blame, explores relationships between various parts of the system, and recognizes that cause and effect may be separated by space or time.[4,6]

Many experts describe systemic failure using a Swiss cheese analogy. The holes in Swiss cheese represent the faults within a system. If an error passes through one of the holes in one slice of Swiss cheese, one would hope that the holes of the next slice of cheese don't align, blocking the error. If the holes of the Swiss cheese slices all align, that medication error would slip through and reach the patient. Recognizing the placement of each slice can decrease the likeliness that a medication error will occur and it's also key in identifying systemic failures.[7,8]

This Swiss cheese analogy can be applied to pharmacy, where pharmacy staff establish multiple checkpoints during the filling process to ensure prescriptions are filled correctly (reviewing, scanning barcodes, verifying tablet appearance, etc.). However, many pharmacy employees—leaders and employees—look for explanatory causes for trouble and blame, criticize, or silence healthcare providers who make errors.[4] For this reason, some experts refer to the individual who makes an error as the "second victim." Lack of support from colleagues and supervisors can greatly affect the coping of the involved health care providers, leading to greater distress or protracted recovery.[9]

Table 1. Types of Medication Errors

- Departure from what is ethically acceptable
- A misconception resulting from incorrect information
- Part of a statement that is not correct
- The occurrence of an incorrect result produced by a computer
- A wrong action attributable to bad judgment, ignorance, or inattention
- Inadvertent or unintentional failures to act or plan (when failure to act is intentional [like taking shortcuts when you know better], it's a violation, not an error)

Source: Reference 3

Pause and Ponder:
What systems-based approaches does your organization use?

Fears of blame and punishment can deter individuals from reporting their errors, which can prevent the creation of a culture of safety (see the **Sidebar** on the next page). Admitting one's mistakes allows open discussion with peers and performance improvement experts can prevent further patient harm if the systemic "hole" causing the mistake is identified and fixed.[2,4] Let's look at systems-based approaches to preventing errors first, and then examine why individual approaches are also needed.

QUALITY IMPROVEMENT APPROACHES

Various workplaces take different approaches to errors, but certain approaches have been proven to be more successful than others (see **Table 2**). The two most common approaches to analyzing medication errors are tracking and trending. Almost every workplace requires employees to complete incident reports if they make an error. A responsible individual should look at incident reports over time to determine:

- What type of errors are most common?
- If a particular drug or product is involved in multiple incidents and why
- The time of day or workload volume when the error occurred
- The individual or individuals involved

This amounts to detective work, in which the responsible party investigates medication errors individually and collectively to track and trend predisposing factors. If he or she sees that certain factors are trending (occurring more than once), the workplace can take action to try to prevent the error from happening again.[10] Sometimes the action is as simple as heightening employees' awareness that errors have occurred. Other times, the workplace might place a sign on a shelf indicating that a product is a look-alike or sound-alike product, mark bottles with bright colors to differentiate them, use TALLman lettering (see **Sidebar**, next page), or conduct training so staff is better educated.

TECH TALK: What is a Culture of Safety?

The concept of creating a culture of safety originated outside healthcare in organizations that do intrinsically complex and hazardous work. In healthcare, as in other industries, a culture of safety prevents and reduces errors. A culture of safety is a workplace that commits to safety at all levels, from frontline providers to managers and executives. Workplaces that have a culture of safety

- Recognize the high-risk nature of their activities and publically announce a desire to operate safely at all times
- Encourage individuals to report errors or near misses without fear of reprimand or punishment
- Promote collaboration across ranks and disciplines to find solutions to patient safety problems
- Commit time and money to address safety concerns

Many pharmacy technicians have the skill sets necessary to take the lead in monitoring errors and help their workplaces improve. Improving safety is a circular process. It starts with assessing the current workplace culture. The Agency for Healthcare Research and Quality (AHRQ)'s Patient Safety Culture Surveys and the Safety Attitudes Questionnaire (https://www.ahrq.gov/sops/index.html) are available in English and Spanish and can identify areas where error may occur.

Once you've assessed your workplace, you must plan and implements change. If, for example, coworkers indicate that teamwork is poor, you can work with management to schedule team-building exercises. Concurrently, you'll need to track errors carefully and determine their causes and contributing factors. Your workplace will usually have a standard form or incident report to collect data, but if it doesn't you should identify one that works for you and your coworkers.

After making changes, you'll need to reassess periodically, acknowledging that there is always room for improvement.

SIDEBAR: What is TALLman Lettering?

TALLman lettering is the practice of writing part of a drug's name in upper case letters to help distinguish sound-alike and/or look-alike drugs from one another. The goal is to visually differentiate drug names and avoid medication errors. The Office of Generic Drugs of the U.S. Food and Drug Administration (FDA) encourages manufacturers to use TALLman lettering on labels. Many hospitals, clinics, and health care systems use TALLman lettering in their computerized order entry, automated dispensing machines, medication admission records, prescription labels, and drug product labels.

The Institute for Safe Medication Practices created a list of TALLman lettering for drug names. Most—but not all—of the drugs on the list are generic products. Find the list here: https://www.ismp.org/recommendations/tall-man-letters-list.

Here's a snapshot from the center of the list:

Drug Name With Tall Man Letters	Confused With
hydr**ALAZINE**	hydr**OXY**zine – **HYDRO**morphone
HYDROmorphone	hydr**OXY**zine – hydr**ALAZINE**
hydr**OXY**zine	hydr**ALAZINE** – **HYDRO**morphone
medroxy**PROGESTER**one	methyl**PREDNIS**olone – Methyl**TESTOSTER**one
methyl**PREDNIS**olone	medroxy**PROGESTER**one – methyl**TESTOSTER**one
methyl**TESTOSTER**one	medroxy**PROGESTER**one – methyl**PREDNIS**olone
mito**XANTRONE**	Not specified
ni**CAR**dipine	**NIFE**dipine
NIFEdipine	Ni**CAR**dipine
predniso**LONE**	predni**SONE**
predni**SONE**	predniso**LONE**
risperi**DONE**	r**OPINIR**ole
r**OPINIR**ole	risperi**DONE**

Source: Reference 11

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Table 2. Common Approaches to Medication Error-Related Performance Improvement	
Term	**Definition**
Tracking	• Assessing performance, generally monthly; following the course or trail of someone or something, usually to find them or note its location. In pharmacy, this could include: ○ Determining the type and frequency of medication errors ○ Identifying errors that occur in the prescribing, dispensing, or administration processes ○ Compiling a monthly report that specifies the number and type of errors, the type of staff reporting each error, and the error's location
Trending	• Monitoring the general direction in which something is developing or changing. In pharmacy, monitoring has led to expansion of the pharmacists' role. Examples include vaccination administration and collaborative practice agreements in certain states. • Looking for patterns in terms of who, what, when, and where so staff can propose ways to prevent similar errors • Common areas that should be monitored include workload, time of day when the errors occurred, individual's experience, communication, environmental factors, number of prescriptions prescribed for the patient, high-risk drugs, confusing drug nomenclature, and adherence to policy and procedure.
Root cause analysis	• A full investigation of the causes of unexpected events followed by identification and implementation of appropriate and effective strategies to prevent similar occurrence in the future. • Asking "Why?" until it cannot be answered. It helps pharmacies take a process-driven, system-based approach to address errors.
Workplace re-engineering	• Planned elimination, addition, or distribution of functions or duties in the workplace focused on innovative strategies to develop leaders, engage employees, and foster healthy workplace culture. • Is often influenced by excessive or insufficient labor, poor patient outcomes, or political or economic changes.
Disaster drill or mock code	• An exercise or demonstration that tests the readiness and capacity of a hospital, a community, or other systems to respond to a possible public health emergency or other disaster.
Source: References 12-17	

In the event a serious error occurs, workplaces need to go beyond simple steps. One such step is to conduct a root cause analysis (RCA). RCA starts by reviewing *what* and *how* an event occurred, and expands the investigation to identify *why* it happened. Many organizations explain to their employees that RCA is the art of asking "Why" until no more questions beginning with "Why" are possible. Armed with that information, the RCA team can develop workable corrective measures that prevent future events of the type observed. RCA is not flawless, but it ensures that teams of people look at very serious errors and develop approaches that could prevent them in the future.[18]

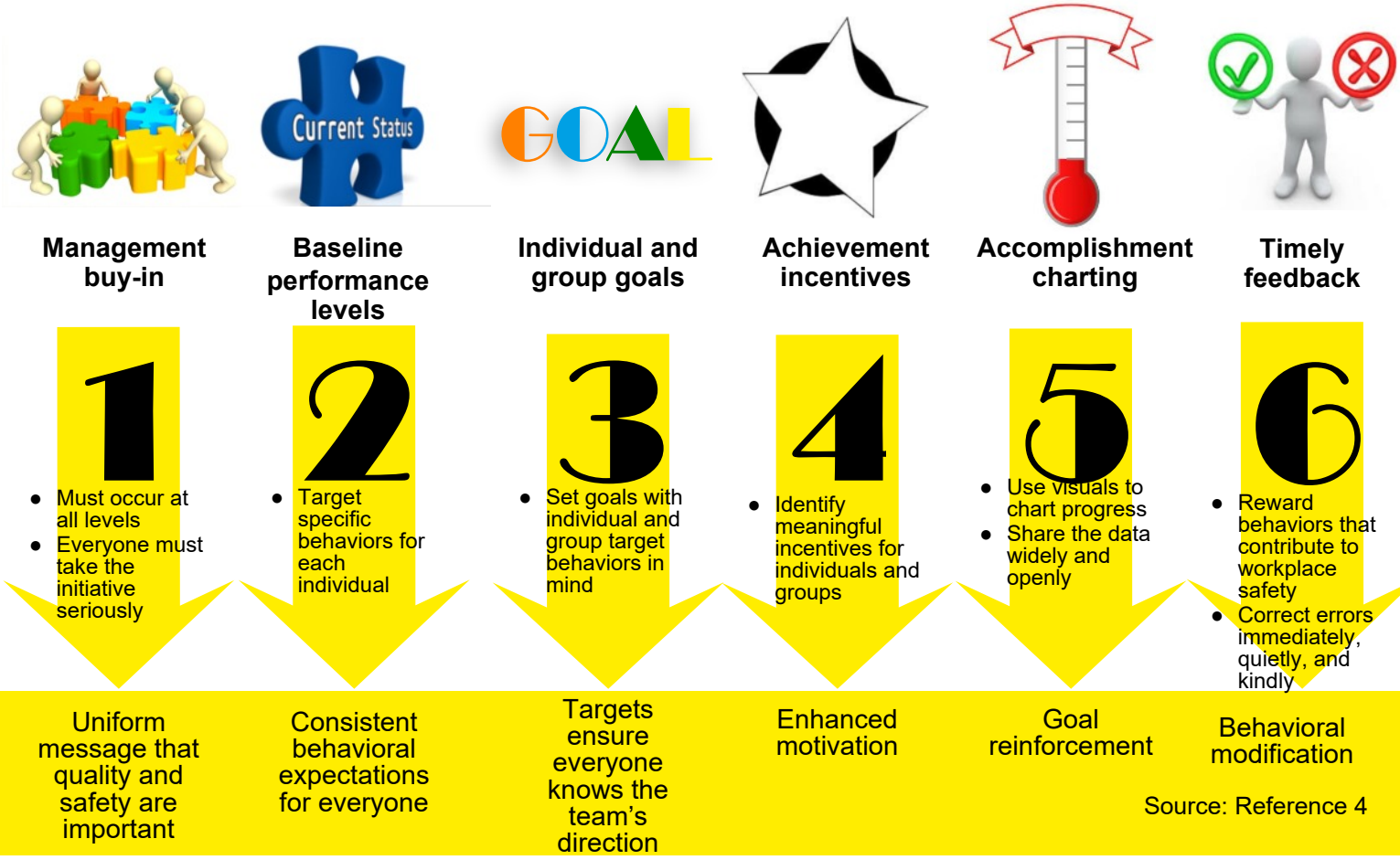
Finally, errors are more likely to occur when unusual, unexpected, or unanticipated situations arise. For this reason, many organizations run disaster drills and observe them closely. In this way, they can identify areas where their systems are weak and implement corrective measures.[19]

Successful Programs

To create the best possible error prevention program, organizations can look at what has been proven to work. It's clear that behavior-based programs create better outcomes than technology or any other approach.[4] A leading researcher in pharmacy error identified six elements common to the most effective behavior-based programs (see **Figure 1**).[4]

Efforts that address the system and the individual *jointly* and *individually* are prudent. Consider a systemic safety measure: the widespread use of technology that is "smart." Relying on technology and assuming it never fails may make some individuals become complacent and less vigilant until it is too late.[4] Examples in community pharmacy are automated inventory systems and bar-code scanners. A person who enters data into a system—this would be an employee in the inventory management section in most pharmacies or healthcare systems—has a slight chance of entering an incorrect drug name. If no one

Figure 1. Common Elements: Effective Behavior-Based Performance Improvement Programs"



Source: Reference 4

catches the error, the last chance to prevent an error rests with the pharmacist who verifies that the tablet matches the description in the system before it is dispensed to the patient. The final check—a step that cannot and must not be automated—is an individual responsibility. Taking the extra seconds to verify the drug (while remembering that sometimes technology fails) can save a patient from what could have be a deadly mistake.[4]

Many psychosocial factors also influence work performance. Work-as-imagined (work that is anticipated and described in official policies and procedures compiled by administrators or policy makers) and work-as-done (the way that employees actually accomplish work) are often quite different.[20] Factors associated with the process of filling prescriptions are shown in **Table 3**.

Many things can adversely affect accuracy[23-25]:

- The physical environment (inadequate illumination, environmental distractions, and noise)
- Interruptions in workflow
- Facility design
- Technology
- Poorly designed labels
- Interpersonal relationships (e.g. number of interfaces with people and the level of stress and conflict caused by those interactions), and
- Workload

Table 3. Psychosocial Factors that Influence Work Performance

- Anxiety or depression
- Changing workload
- Competing tasks
- Determination to "get the job done" despite barriers
- Distraction or interruption
- Hurrying
- Insufficient decision support
- Insufficient staffing
- Knowledge gaps
- Lack of experience
- Lack of non-technical skills training (e.g. communication, decision-making, reasoning, team work, time management)
- Machinery or hardware that is difficult to operate
- Perception that an error could lead to criminal charges
- Rapidly changing or evolving roles
- Use of "work-arounds" to overcome barriers
- Vague or incomplete policy or procedure

Source: References 6, 20-22

Many pharmacy employees associate high workload with increased error rates. They are often surprised to learn that low-workload conditions are more closely linked with errors than high-workload conditions. Consider a study conducted in 2000 that involved pharmacists, pharmacy technicians, and 21,672 prescriptions. Pharmacy employees made more process errors under low-workload conditions (11.2%) than under high-workload conditions (6.1%) and during periods when the workload shifted downward in volume (at the start of a shift or after a break).[26,27] In general, pharmacists were more vulnerable to mistakes when processing fewer than 15 prescriptions per hour than when processing more than 25 prescriptions per hour. (Author aside: We include these numbers because the study reported them, not as a hard and fast rule. We acknowledge that everyone has unique working habits and some people can feel burned out processing fewer prescriptions than others.) A little bit of task tension (from perceived workload) seemed to result in fewer errors while filling prescriptions. However, there may be limits to the increases in task tension that would provide desirable results—too much stress and tension can become a problem. Overall, low levels of objective workload and subjective task tension were associated with more errors.[24,28]

Personal qualities can also play a role. Impulsivity, task frustration, fatigue, perceptual ability, concern for doing well, a lack of physical hardiness, and magnitude of personal effort expended can cause more errors to progress through the verification process unnoticed. Individuals should examine their task-related anxiety and overall job-related depression (a strong predictor of overall job stress) and address them if possible. Their supervisors should also do the same to help individuals cope; if not, this will affect job satisfaction and performance.[4,20] Workplace support is also an important factor and the study mentioned earlier also demonstrated its importance. Pharmacists who had supervisors who they perceived as helping them set task goals and gain appropriate autonomy made fewer errors. Pharmacists who had supervisors who were overly autocratic (meaning domineering or overly involved in supervision) experienced tension that interfered with dispensing prescriptions accurately. Pharmacists who believed the number of breaks they receive was adequate to meet their needs made fewer process errors.[24] Later studies also confirm that poor leadership and insufficient support can adversely influence accuracy.[20]

ERRORS: WHAT WE KNOW

Errors are inevitable, but we must be able to recognize when we are prone to making errors to be able to limit them. Everyone has periods of increased errors—for instance during dramatic shifts in workload. Entering the pharmacy during peak hours can be stressful and predispose some individuals more than others to make errors they wouldn't usually make. When we are flustered, our sense of logic escapes us momentarily.[4,24]

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Some individuals make more frequent or predictable errors than others because of different cognitive styles. A classic study found that pharmacists whose cognitive styles include attention to detail made fewer errors. It also found that about 12% of pharmacists have difficulty attending to details, and that the same 12% of pharmacists made 33% of errors.[24] By using high-intensity task lights, exaggerated product label names (labels that are large and multicolored), NDC numbers, and specially designed devices for holding prescriptions at eye level during data entry, pharmacy staff who had difficulty being attentive to details made fewer errors.[24] A 1999 incident monitoring study found poor communication and failure to check medical records when questions arose also contributed to errors.[29] A more recent study conducted between September 2013 and November 2014 involving 500 North West London primary care clinicians noted the top three problems relating to medication errors were incomplete medication reconciliation during transitions of care, inadequate patient education about medication use, and poor discharge instructions.[30] Clearly, we healthcare providers have some communication problems.

A patient case in Pennsylvania illustrates the alarming consequences of poor communication between healthcare providers and fewer medication reconciliations. The patient was first hospitalized for uncontrolled blood pressure and acute kidney injury. At discharge, one of her prescription medications was Norvasc® (an antihypertensive). The patient experienced worsening fatigue, slow movements, personality changes, and a 'stoic' facial expression with suboptimal blood pressure control. Soon after, she was hospitalized the second time for chest pain

and underwent angioplasty. Several weeks later, she was diagnosed with anxiety and depression and received prescription medications for these conditions. The patient was admitted a third time to the emergency room after a fall with light-headedness and poor ambulation. It was only at the third visit that the medication reconciliation team realized her outpatient pharmacy accidentally dispensed Navane® (generic name as thiothixene, an antipsychotic) instead of Norvasc®. When thiothixene was discontinued, her clinical status improved. This preventable medication error occurred because the physician and pharmacy staff deemed the written prescription legible, when in actuality, it was not.[8] In other words, they guessed.

Typically, people make mistakes or slips most frequently when new to the profession and lacking experience. A long period follows during which mistakes are rare. Eventually everyone develops unique work habits, and error rates tend to increase again, usually as bad habits develop.[27,31]

Finally, humans work on autopilot around 80% of the time.[4,28,32,33] This means that 80% of the time, we don't fully register what we are doing in our brain; we don't engage with the task at hand and instead just go through the motions. Pharmacists have an "inner pharmacist" who should kick in and take them out of autopilot mode when out-of-the-ordinary issues arise.[28,32,33] Often, when faced with errors after-the-fact, we clearly recall the circumstances under which they occurred because we wake up from our autopilot. We'll talk more about autopiloting below.

How People Work

Workload in the pharmacy has been traditionally measured as the number of prescriptions dispensed per hour or day, or the number of prescriptions dispensed per pharmacist. Experts predict that the typical pharmacist's workload has and will increase for two reasons:

- an increase in demand from an aging population and
- the addition of pharmacist-provided services (e.g. medication therapy management and immunizations).

Instead of focusing only on the number of prescriptions, pharmacists, pharmacy technicians, and the organizations that employ them should focus on understanding the individual's subjective experience of work demands. For pharmacists, verifying patient's information, performing patient consultation and drug utilization reviews, and verifying prescriptions for accuracy can be demanding to the point that high workload negatively impacts performance. For technicians, similar factors—performing repetitive and mundane tasks, expanding roles, and high-risk assignments—may increase stress or create situations in which they must multi-task. Understanding that work is a process and not a series of discrete events can help maintain the "big picture."[28] That big picture is that pharmacists and pharmacy technicians must promote patient safety; dispensing to keep up with the pharmacy queue—the people who are in line or who have called in—is not prudent.[34]

PAUSE AND PONDER:

At what times during the day are you most likely to go on autopilot?

- What tasks are you most likely to be doing?
- What does it take for you to refocus?

Over the course of the day, filling many prescriptions is bound to cause a person to go on autopilot—which is understandable. Humans are creatures of habit and routine. All humans work on autopilot around 80% of the time.[4,28,32,33] Autopiloting occurs when the brain recognizes a situation and rapidly selects appropriate responses using familiar, predictable behavior context. The brain does this to preserve energy. Essentially, we perform most tasks reasonably well without thinking much about them. Many readers will sigh with recognition when they read this example: many people have left home on a non-work day to go someplace that's in the general direction of work. They may be surprised to find themselves in their workplace's parking lot. That's autopilot. In the retail setting, pharmacy technicians and pharmacists autopilot the most when they are dealing with insurance coding and billing to third-party insurers.[35] Autopiloting is usually safe, but when unusual situations occur, disaster can ensue.

Our autopiloting should stop when we encounter stressful, unfamiliar situations because our brains don't know how to react appropriately in unfamiliar situations. In stressful situations, we tend to misapply familiar rules and knowledge. Intense emotion blocks our sense of logic. In these situations, we have to remember to exercise mindfulness—taking a little bit of time away from the general workflow to assess the situation calmly and proceed with a plan of action.[4] It's also crucial for each worker to know his or her own tendency to make errors and do what is necessary to refocus.[4] However, recognize that some people's propensities and capabilities are hardwired.[31] They cannot change their abilities and will approach work the same compulsive way, regardless of training.

Technology introduces a specific kind of autopiloting: complacency. Using technology to help us work is effective but technology has limitations.[36] Technology makes us lazy and unfamiliar with the manual processes that have been automated. It is not unusual for individuals to become complacent because we believe a machine designed for a specific purpose will complete the task correctly for us. We tend to trust that technology will work well all the time. It doesn't.[37] For instance, refilling the cassette of a carousel with the wrong medication will not prevent the machine from filling the prescription. This error can go undetected unless the pharmacist performs a final check before dispensing to the patient. This emphasizes the importance of the pharmacist's individual responsibility as mentioned earlier.[4,37]

Self-improvement

While all of us prefer not to make errors, it's unreasonable to expect an error rate of zero.[4] Errors will happen. As noted above, some people make more errors than others, and a landmark study found that 12% of pharmacists made roughly one-third of the errors reported.[24] Certainly, we all have coworkers (or friends or neighbors) who seem to make more errors than others, and those who seem to be remarkably accurate. Where do you fall on the spectrum?

Examining your own error rate requires insight. This term—insight— is used most often in psychiatry, and is defined as the patient's awareness and understanding of the origins and meaning of his or her attitudes, feelings, behavior, and disturbing symptoms.[38] It means understanding oneself. It has a slightly different meaning in the context of medication errors. In problem solving, it means being able to see how one's actions and habits contribute to errors, and then making appropriate changes.[39,40]

Some people, and especially those who are error-prone, have poor insight. It may result from fixation, over-reliance on experience and past circumstances, rushing to solve a problem, or using the same approach over and over and expecting different results. Let's look at each of these individually.

Fixation error refers to the tendency for the brain's perceptual field to narrow and shorten in a crisis.[41,42] When this happens, we develop a compulsion to fixate on the problem we think we can solve, and ignore almost everything else. Sometimes, this compulsion is stymieing—it prevents us from doing anything else or moving forward with a solution. During periods of fixation, time becomes distorted; minutes often seem longer than usual. In addition, the fixated individual may not hear input from others. Even the most skilled and experienced professionals can fixate in periods of high stress.[41,42]

An example in everyday life is that of a stalled car stuck on a level crossing as a distant train barrels toward it. The driver starts and restarts the engine, when the best way to save his life is to exit the car and run. In pharmacy, fixation errors occur when the provider concentrates on a single aspect of a case or problem to the detriment of other more relevant aspects. To break out of a fixation, individuals must be able to recognize the demand for a new approach to the problem and to produce a solution that works. Individuals who tend to fixate need to learn to[41,42]:

- Ask themselves what is different about the current problem
- Heighten awareness of the people around them and listen
- Invite others into the problem solving team to identify alternatives

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Over-reliance on experience and past circumstances often occurs during emergencies. In this case, the individual tends to rely on past experience (even if it doesn't apply in the current situation), and has difficulty abandoning assumptions based on that experience. In short, the person applies incident-specific experience to a situation that is probably much broader in nature. An example would be assuming non-adherence to treatment for a patient who has asthma, when the actual problem is that the inhaler is faulty or requires skills like visual acuity or manual dexterity that the patient lacks. In addition, during emergencies, individuals may have trouble recalling information accurately (elevated cortisol levels tend to change cognition and thinking). Often, using a cognitive aid like a checklist, decision tree, or an algorithm can help clarify thinking and lead to faster—and better—solutions.[43]

It's interesting that many pharmacy staff members say, "I was rushing," when they analyze errors, but few studies have looked at or identified *rushing* as a cause. Rushing to problem-solve can increase the likelihood of error. An older study found that physicians linked 10% of errors to rushing or fatigue.[29] Experts in medication error science also indicate that rushing contributes to error.[44] An older study in Canada looked at a pilot program that transferred order entry responsibilities from pharmacists to pharmacy technicians. At the end of the study, the technician's error rate had increased from 2.5% to 6%. Analysis indicated that technicians were rushing to enter orders, and re-training technicians to slow down—and be mindful of their work—reduced the error rate to below the baseline level.[45] Often, technicians may try to fill more quickly or pharmacists rush the final verification step of dispensing as the customer line lengthens, and errors occur.

Table 4. Improving Your Own Accuracy	
Do this…	**And then do this…**
Periodically review your errors and near-misses.	• Analyze errors to determine if you see a trend like confusing look-alike, sound-alike or spell-alike drugs. • Determine if you can take steps to reduce the likelihood of a similar error happening again. • Develop and use checklists if errors occur in multi-step processes.
Schedule visual and hearing exams more frequently as you age.	• Wear appropriate glasses or hearing aids at work. • Ask your employer for assistive devices (supplemental lighting, a magnifier, or a phone amplifier), or secure these yourself.
Solicit feedback from peers and supervisors about ways to reduce your own and others' errors.	• Maintain a quiet, composed demeanor in the workplace.
Address workplace distractions as soon as you become aware of them.	• Reduce noise and clutter, improve lighting.
Understand technology's limitations.	• Maintain your skills so that if technology fails, you can revert to the pre-technology work method.
Maintain your skills so that if technology fails, you can revert to the pre-technology work method.	• Resolve disputes immediately, and retire grudges. • Provide feedback to coworkers constructively.
Address developing personal problems (alcohol or drug abuse, depression, marital discord) early.	• Engage with your employer's employee assistance program before your supervisor refers you.
Understand that some people make errors because they lack knowledge.	• Address your own knowledge gaps, and promote a culture of learning.
Avoid relying on "workplace re-engineering" or "work task design" to prevent errors; these may fail as the workplace composition and focus changes.	• Learn to engage and listen to your "inner pharmacist" or "inner technician" when something is out of the ordinary.
Source: Reference 4	

When we discuss medication errors, it's critical to talk about data entry errors because they represent about 25% of all medication errors.[23] The pharmacy has many repetitive tasks like data entry or filling prescriptions. Many of these tasks can be completed without conscious awareness. This autopilot function contributes to data entry errors like misspellings or errors recorded on the patient's profile. The vast majority of data entry errors are inconsequential, but some are dangerous.[23]

Many factors could impact the cognitive system directly. Pharmacists and pharmacy technicians can take some simple steps to increase accuracy in the pharmacy (see **Table 4**). **Figure 2** suggests a few additional steps, but individuals will find the best solutions are those they develop themselves and tailor to their own habits and circumstances.

Reducing Workplace Turbulence

Workplace turbulence occurs when something causes discomfort or decreases workplace stability. Some things that cause workplace turbulence include poor temperature control (it's either too hot or too cold), noise, clutter, uncertainty, or working with people who have different styles or personalities that are abrasive to you. These things affect accuracy and productivity. If workplace distractions are the problem, making small changes to decrease turbulence can make large differences.[27,31]

If the problems are environmental, ask the appropriate person to help resolve them. Establishing good relationships with the people who provide environmental support—people in building supervision, maintenance, and housekeeping—is imperative. They can often help adjust the ambient temperature or reduce clutter. Learning to work *with* instead of *against* or *parallel to* coworkers and supervisors can improve the environment.[4] The key is telling your supervisor how you best hear constructive criticism and delivering constructive criticism to others in a positive way—and in the way they receive it best.

Finally, be aware of when you are fatigued or unable to perform at your peak, and enlist coworkers' help by asking them to monitor your work.[27,31]

Poka-Yoke

Since the 1960s, many industries have adopted the principles of poka-yoke to prevent errors. Poka-yoke is a systems approach, but unlike many systems approaches, the people closest to the work (not administrators or policy makers) propose the action. Defined broadly, poka-yoke refers to any behavior-shaping constraint in a process that prevents faulty behaviors by the worker. An industrial engineer at Toyota developed this

Figure 2. Error Prevention Techniques in the Pharmacy

1 Use cues to slow processes and engage attention

- Know the prescription volumes at which errors occur in your workplace; work together to increase vigilance above or below breakpoints
- Acknowledge when workload or long lines are creating pressure out loud to coworkers
- Place a SLOW DOWN sign in the prescription pile or queue every 15 prescriptions on high volume days

2 Find creative solutions

- Consider highlighting the prefix of drug names ending in similar suffixes (i.e. -cillin, -umab or -platin) in your favorite color
- Create a crib sheet to self-proof your work
- List all generic drugs that come as white tablets on a blackboard or a white board alphabetically with their markings; annotate every prescription with the tablet marking

3 Pay attention to visual processes

- Check vision routinely and encourage others to do so
- Keep documents at eye level when entering data into the computer
- Use supplemental lighting
- Always have a magnifying glass available
- Use the "show and tell" method of explaining to others; patients will notice differences

4 Ask for training that addresses the problem

- Training can correct a lack of drug knowledge or bad habits acquired mid-career
- On-the-job training is often available, but it may not meet a specific need.
- Be responsible and seek training on your own; it's career-enhancing. Select training that
  - addresses knowledge gaps
  - covers likely exceptional events

concept, and it encourages workplaces to look at common mistakes and develop processes that make it impossible for workers to make the mistake in the future. Basically, it's defensive workplace design. It depends on involving the people closest to the work to identify what to mistake-proof and develop ideas to prevent very specific mistakes. In pharmacies, four poka-yoke principles are used often, and can be applied in many more areas.[46,47]

First, workplace managers need to **empower employees to pause or even stop the work process** entirely if they believe that an error is in process.[27,46,47] Employees need to be able to ask four questions respectfully:

- Did we do everything?
- Did we do everything right?
- Does it look, sound, and feel right?
- Are these our usual work conditions?

Next, everyone in the pharmacy community from manufacturers to distributors to providers who work in direct patient care need to **make it easier for people to do the right thing than the wrong thing**. An example from one of the author's workplace experiences can clarify this principle. Years ago, she worked at the National Cancer Institute (NCI) and a company was developing a new monoclonal antibody (MAB). The MAB was lyophilized and came in a fairly large multidose vial. It needed to be reconstituted with 20 mL of a specific diluent. The manufacturer provided the MAB with a vial of the diluent that contained 30 mL. The astute reader will see the potential for error. In many cases, pharmacists and pharmacy technicians who worked in investigational drug preparation looked at the package, and simply transferred the diluent—all 30 mL of it—into the larger vial. The resultant solution was an incorrect dose. Can you see why? Diluting a 400 mg vial with 20 mL creates a 20 mg/mL solution. Using 30 mL creates a 13.33 mg/mL solution. After investigational drug employees identified and reported this error several times, and the NCI reported it to

the manufacturer, the simple poka-yoke fix was implemented. Although it took quite some time to implement the change, eventually the manufacturer packaged the MAB with a vial of diluent that had the correct amount needed in it—20 mL.

People who work in pharmacy in any capacity can make it easier to do the right thing than the wrong thing in numerous ways. Let's discuss four of them.[27,46,47] The solution noted above is an example of kitting.

- Putting items that will always be used together in that same container, and making sure that the items that are assembled are the correct sizes or doses or quantities, is **kitting** at work. It results in fewer missing parts, and it also accelerates your process. Some experts estimate that it can cut errors by as much as 80%.[48] Other examples of kitting are creating bowel evacuation kits for patients having colonoscopies, or assembling packages of items that are frequently prescribed together for specific procedures or treatments.
- **Keying** simply means that a process can't be started without a key or tool of some sort. The requirement to remove your ATM card before receiving cash is an application of this principle so people don't leave their cards in the machine. An example in the pharmacy is a computer that requires the user to insert an ID card to start the system. This increases accuracy and prevents users from signing in early in the day, walking away from the computer, and allowing others to operate under his or her sign-in code. Another example of a type of keying is moving pseudoephedrine to behind the counter in the pharmacy. Adding that step—requiring customers to sign for pseudoephedrine and limiting quantities—ensures there is a check in the process. States that have implemented this step have decreased the amount of pseudoephedrine diverted to methamphetamine production significantly.
- **Interlocking** uses simple mechanisms so that parts will only fit with other appropriate pieces. These are simple, low cost devices that prevent parts from being assembled incorrectly. An everyday example of poka-yoke for someone who always forgets or loses his keys is to place the keys in the shoes he will wear tomorrow. An example in pharmacy might be providing drugs meant to be administered intrathecally in a device that cannot attach to any intravenous equipment.
- **Tell-tales** let you know when you have made an error. Barcoding is a type of telltale. When you scan a barcode and it doesn't match the barcode on the actual order, it sends you an alert that you've made an error.

The last poke yoke principle is this: **Make mistakes obvious to workers immediately and discretely** so they can make on-the-spot corrections, and allow people to take corrective actions or stop the work flow before irreversible damage is done.[27,46,47] This small kindness brings errors to the error-maker's attention, and allows immediate learning.

Finally, What Works?

We've listed a number of ways to address medication errors. Certainly, this is a lengthy list. You may ask yourself, "Do any of these interventions work better than others?" The answer is, "It depends." Few studies have been conducted that measure reductions in error rates in pharmacies, but those that have been suggest that certain measures are more effective than others.

Many authors indicate that the best way to prevent errors is by using poka yoke, and the most important step is to allow each worker to completely stop the work process when he sees something that is out of the ordinary or below the established work standard. Many pharmacy employees hesitate to stop the workflow because they fear that it will increase waiting time. Ultimately, stopping the workflow saves time. Coworkers can problem solve, or remove the product or item that is wrong or about to be wrong.[49]

Meta-analysis indicates that intensifying the checking process, and perhaps adding a second verification for high risk drugs or doses that have to be calculated, reduces errors.[50]

Good communication, especially with the patient, is also an effective way to identify errors.[50] For decades, pharmacists who practice in the Indian Health Service have counseled every patient, briefly opening each bottle so the patient can observe the medication. This process—which takes much less time than one might expect—identifies errors at the point of counseling, and effectively prevents errors.[51]

Use of TALLman lettering has been shown to help healthcare workers discriminate among drugs with similar names, but findings are mixed and it may have the most impact for nurses.[52-54] As this is an inexpensive intervention, clinicians should use it when they can.

Most experts agree that our approach to medication errors must be multifaceted. The important components that should be included are to be certain that[55,56]

- healthcare providers and patients are educated about medication
- qualified individuals conduct medication reconciliation often
- healthcare providers employ computerized systems, but recognize their limitations
- every healthcare provider knows that injectable drugs, prescriptions for children and the elderly, and drugs that require monitoring (like warfarin, digoxin, and phenytoin) are highest risk for error, and
- every organization has a feedback system to ensure healthcare providers know when they make an error.

For individuals, it's critical to realize that while "no blame" is appropriate for many errors, sometimes, errors are the individual's fault. In pharmacies that are evolving and evolved, a culture of safety has to be a just culture, as in a morally right, equitable, reasonable culture. A just culture identifies and addresses systems issues, but hold individuals accountable for reckless behavior. We need to stratify errors in our workplaces, and in our own minds. Medication errors can be human errors (e.g., inadvertent slips, lapses or mistakes), at-risk behaviors (e.g., taking shortcuts), or reckless behavior (e.g., blatantly ignoring required safety steps). Note that most people will engage in at-risk behaviors and see positive results, which reinforces the behaviors. These are the hardest to correct, but the most critical to address because they happen so often. Reckless behavior, whether it results in a serious outcome or not, must be addressed.[57,58] In a just culture, the severity of the event isn't as important as the behavior associated with the error.

CONCLUSION

Despite our best intentions, some errors escape the confines of the pharmacy. Randomly checking completed work that has apparently passed verification sometimes identifies problem areas. But, some errors are just that—unfortunate events that could not be anticipated and occurred because of a confluence of factors. Even though reaching a medication error rate of zero is improbable, we should still make efforts to acknowledge our professional responsibility in our own work habits. Creating solutions tailored to our habits and circumstances—not the number of prescriptions filled—can help reduce error rates and encourage a focus on a workplace culture of patient safety as the big picture in pharmacy.

Figure 3. Advancing Pharmacists and Pharmacy Technicians Role in Stemming Opioid Overdose

Best

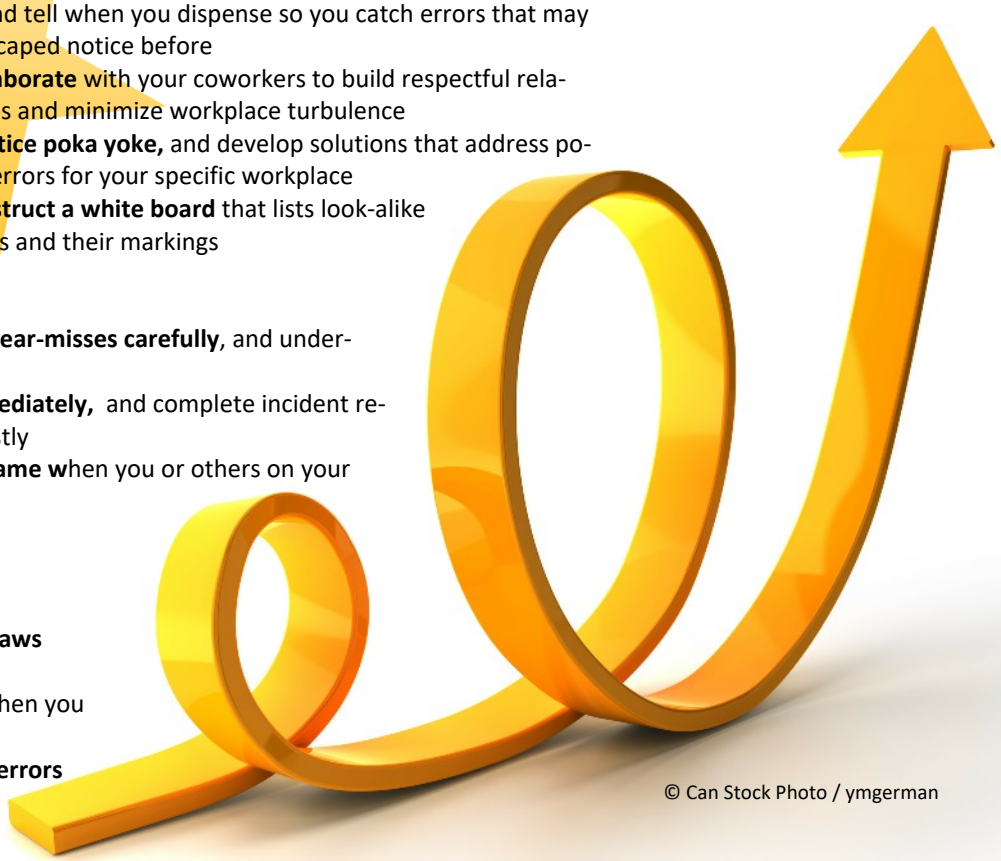
1. **Be COMMUNITY CHAMPIONS** and whenever possible, show and tell when you dispense so you catch errors that may have escaped notice before
2. **Collaborate** with your coworkers to build respectful relationships and minimize workplace turbulence
3. **Practice poka yoke,** and develop solutions that address potential errors for your specific workplace
4. **Construct a white board** that lists look-alike products and their markings

Better

1. **Track your errors and near-misses carefully**, and understand how they happened
2. **Report your errors immediately,** and complete incident reports thoroughly and honestly
3. **Don't play the blame game w**hen you or others on your team make errors

Good

1. **Be familiar with federal and state laws** concerning safe medication practices
2. **Know your limits** and never work when you are fatigued, ill, or upset
3. **Know your employer's policies on errors** and follow them



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