

Framework for Patient Safety

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ABSTRACT

Medication errors are common in general practice and in hospitals. Both errors in the act of writing (prescription/dispensing/administration errors) and prescribing faults due to flawed medical decisions can result in harm to patients. Any step in the prescribing process can kindle errors. Slips, lapses, or mistakes are sources of errors, as in unintended omissions in the recording of drugs. Faults in dose selection, omitted transcription, and poor handwriting are common. Inadequate awareness or competence and incomplete information about clinical characteristics and previous treatment of individual patients can result in prescribing faults, including the use of potentially incorrect medications. An unsafe working environment, complex or undefined procedures, and inadequate communication among healthcare personnel, particularly between doctors and nurses, have been identified as significant underlying factors that contribute to prescription errors and prescribing faults. Active interventions aimed at reducing prescription and prescribing faults are strongly recommended. These should be dedicated on the education and training of prescribers and the use of online aids. The complexity of the prescribing procedure should be reduced by introducing automated systems or uniform prescribing charts, in order to avoid recording and omission errors. Feedback control systems and immediate review of prescriptions, which can be performed with the assistance of a hospital pharmacist, are also helpful. Audits should be performed periodically.

Objective: Discussion and projection of medication safety and the strategies to improve its efficiency.

Methods: The research is conducted through secondary data search from several sources including books, technical newsletters, newspapers, journals, and many other sources. The present study was started since the beginning of 2018. PubMed, ALTAVISTA, EMBASE, Scopus, Web of Science, and the Cochrane Central Register of Controlled Trials was thoroughly searched. The keywords were used to explore different publishers' journals such as Elsevier, Springer, Willey Online Library, and Wolters Kluwer that were extensively followed.

Findings: A medication intervention is a sophisticated technique of both arts and science. Improvement is valued when the total system coordination brings an overall improvement in every aspect of prescribing, dispensing, administration, and monitoring. Error in any stage ruins the effort of the total system.

Keywords: Errors, Healthcare professionals, Medication, Patient, Reporting, Risk, Safety.

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BACKGROUND

A medication (a medicinal product) is "a product that contains compound(s) with proven biological effects, plus excipients or excipients only; it may also contain impurities; the active compound is usually a drug or a prodrug, but may be a component." The definition of a medication includes not only chemical compounds—drugs, prodrugs (which may themselves have no pharmacological endeavor), stereoisomers that may have only adverse effects, or compounds that are used for diagnostic purposes (such as contrast media) but also includes cellular elements, such as inactivated or attenuated viruses for immunization, blood products (such as platelets), viruses for gene therapy, and embryonic stem cells; "contaminants" includes chemical and biological impurities and additives, the former being unintentionally present, the latter deliberately added. Medication errors can occur in:

- Selecting a medicine—irrational, inappropriate, and ineffective prescribing, underprescribing and overprescribing;
- Lettering the prescription—prescription errors, including illegibility;
- Manufacturing the formulation to be used—wrong strength, contaminants or adulterants, wrong or misleading packaging;
- Dispensing the formulation—wrong drug, wrong formulation, wrong label;
- Administering or taking the drug—wrong dose, wrong route, wrong frequency, wrong duration;
- Nursing therapy—failing to alter therapy when required, unintentional alteration.

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INTRODUCTION

Medicines are the commonest medical intrusions used in healthcare and safe use is important. Over the past 20 years, a number of initiatives aimed at improving medication safety have been introduced into hospitals. Clinicians, policymakers, and patients now want to know whether progress has been made and where further enhancement may be required. Error offered a similar conclusion relative to safety: flaws are unacceptable and common. According to a 2,000 report citing UK medical defense organizations, 25% of all lawsuit claims in general medical practice were due to medication errors and involved prescribing and dispensing errors (including a wrong, contraindicated or unlicensed drug, a wrong dosage, or wrong administration); repeated prescribing without proper checks; failure to monitor progress; and failure to warn about adverse effects (which might, however, not be regarded as a medication error). The effective remedy is not to browbeat the

healthcare workforce by asking them to try harder to give safe care, when in fact the courage, hard work, and the pledge of healthcare workers are the only real means to stem the tide of errors that are latent in the healthcare system. Growth in knowledge and technologies has never been so profound and prolific. However, research on the quality of care determines that the healthcare system falls short in its ability to translate knowledge to practice and to apply new technologies safely and appropriately. These principles healthcare organizations could take now or as soon as possible to substantially improve the patient safety include (1) offering leadership; (2) concerning human limits in process design; (3) promoting effective team functioning; (4) anticipating the unexpected; and (5) creating a learning milieu.

Important Definitions

Active Error

Active errors are those taking place between a person and an aspect of a larger system at the point of contact. Active errors are made by people on the front line such as physicians and nurses. For example, operating on the wrong eye or amputating the wrong leg are classic examples of an active error.

Adverse Event

Untoward events may be preventable when there is a failure to follow accepted practice at a system or individual level. An adverse event attributable to an error usually is a preventable adverse event.

Latent Error

These are errors in system or process design, faulty installation or maintenance of equipment, or ineffective administrative structure. These are present but may go unnoticed for a long time with no ill effect.

Medical Error

The failure to complete the intended plan of action or implementing the wrong plan to achieve an aim. An unintended act or one that fails to achieve the intended outcome. This definition is clearly oriented to the outcome of the error. However, it does not take into account catastrophes that can occur during the whole process of prescribing, independent of any potential or actual harm.

Prescription Error

Prescription errors include those related to the act of writing a prescription, whereas prescribing faults encompass irrational prescribing, inappropriate prescribing, underprescribing, overprescribing, and ineffective prescribing, arising from erroneous medical judgement or decisions concerning treatment or treatment monitoring. Appropriate prescribing results when errors are minimized and when the prescriber actively endeavors to attain better prescribing: both actions are required.

Negligence

Failure to meet the reasonably expected standard of care of an average, qualified healthcare worker looking after a patient in question within similar conditions. For example, the healthcare worker may not check up on the pathology report which led to a missed cancer or the surgeon may have injured a nerve by mistaking it for an artery.

Negligent Adverse Events

A subcategory of preventable, adverse events that satisfy the legal criteria used in defining negligence. The injury caused by substandard medical management.

Near Miss

Any event that could have had an adverse patient consequence but did not. Near misses provide opportunities for developing preventive strategies and actions and should receive the same level of scrutiny as adverse events.

Noxious Episode

Untoward events, complications, and mishaps that result from acceptable diagnostic or therapeutic measures deliberately instituted. For example, sending a hemodynamically unstable trauma patient for persistent imaging studies instead of the operating room. The result could be a traumatic arrest and death.

Patient Safety

The process of improvement, avoidance, and prevention of adverse injuries or outcomes that arise as a result of the healthcare process.¹

Scope of Safety Problems

The provision of high-quality, affordable, healthcare services is a progressively difficult challenge. Due to the complexities of healthcare services and systems, investigating and interpreting the use, costs, quality, accessibility, delivery, organization, financing, and outcomes of health care services are key to informing government officials, insurers, providers, patrons, and others making decisions about health-related issues. Appropriate medication use is a complex process involving multiple organizations and professions from various disciplines combined with a working knowledge of medications, access to accurate and complete patient information, and integration of interrelated decisions over a period of time. The rising complexity of science and technology requires healthcare providers to know, manage, monitor, and involve more than ever before. Current methods of organizing and delivering care are not able to meet the new expectations of patients and families because the knowledge, skills, care options, devices, and medications have advanced more rapidly than the healthcare system's ability to deliver them safely, effectively and efficiently. The potential for errors of omission or commission to creep into the process is special. Workflow analysis has often been used with the goal of prosperous efficiency. In response to financial pressure and incentives driving provider organizations, minimizing slack time has become important.^{2,3}

UNDERSTANDING ERROR

Clinicians' fears of lawsuits and their self-perceptions of ineptitude could be dispelled by the organizational cultures emphasizing safety rather than blame. To comprehend what is known or what is not known about medication-related adverse events, common definitions must be established and understood. Organizations must come to a common understanding regarding medical errors (MEs), reporting requirements, and risks to capture and act upon error potential within their own medication use systems. The potential benefits of intrainstitutional and web-based databases might assist pharmacists and other providers to prevent similar hazards and advance patient safety.⁴ These definitions of ADE, potential adverse drug event (PADE), and adverse drug reaction (ADR) provide the following insights regarding adverse events and medication use:

- MEs are considered preventable while ADRs are generally not.
- If an error occurs but is interrupted by someone in the process, it might not result in an adverse event. These potential untoward events are often referred to as near misses.

- Capturing information regarding near misses could yield vital information regarding system performance.

IDENTIFYING RISK

Two approaches to the problem of human fallibility are possible: the individual and the system approach. The individual approach emphasizes on the errors of individuals, accusing them for forgetfulness, sloppiness, or moral weakness. The system approach concentrates on the conditions under which individuals work and try to build defenses to avert errors or mitigate their effects. Healthcare professionals are human and can make mistakes. Reporting an error is often regarded as a professional failure or negligence and is followed by sanction or penalization of the individuals involved. Medications are inherently toxic, and there is a risk to taking them and, perhaps, not taking them. Each time a practitioner prescribes a product, a treatment risk vs benefit must be assessed. If a patient takes prescribed medications in a different method than prescribed or if over-the-counter products and alternative agents are added, there are additional risks. Side effects and tragic rare reactions are also difficult to anticipate. This results in healthcare workers worrying constantly about the ever-present reality of error. Regrettably, in many organizations, the response to error targets the people rather than the system involved in the production of an error.^{3,5} Reason has identified that there are a variety of defenses put into systems to provide the following functions:

- Create understanding or awareness of threats
- Give guidance on how to operate safely
- Provide alarms and warnings when risk or danger is evident
- Place barriers between hazards and individuals or other systems
- Restore system to a safe state when circumstances are not normal
- Contain or eliminated hazards if the barrier is not adequate
- Establish methods of escape and rescue should hazard containment fail.

TARGETING MEDICATION SAFETY AT THE MICROSYSTEM LEVEL

Nelson and colleagues suggest that understanding and nurturing clinical microsystems (Table 1) may create an opportunity for leverage toward the goal of a safety and a more effective healthcare system.⁶

COLLABORATION ACROSS THE MEDICATION USE PROCESS

Collaboration is essential to diminish patient risk in the medication use process. Healthcare providers within the organization need to understand and identify how these components function and who is involved in making these steps safe. Clear consideration of the critical safety issues at each one of these steps is of particular significance because the primary goal of adverse event identification is adverse event prevention. Each step can be considered a risk point and provides opportunities for internal checks and balances. At each step in the medication use process, it is often assumed physicians, nurses, pharmacists, and other healthcare providers in the association play a role in the patient evaluation.⁷ This evaluation would include weighing patient characteristics,

medication selection, concurrent medications, medication dosage selection, and medication administration methods suitable for the condition to be treated. The current system of prescribing, dispensing, administering, and monitoring, however, often places the accountability on the individual to avoid making the mistake.^{8,9} Because this expectation seems unreasonable, organizations should focus on efforts to improve the medication use safety by using a systems-based approach that identifies:

- Errors that occur most often
- Possible root causes of errors
- Error preclusion strategies to make it harder for the same or similar errors to occur
- If an organization has a system that makes it harder to commit an error, it will be more difficult for errors to go on undetected and for harm to come to patients.

SYSTEM FAILURES IN THE MEDICATION USE PROCESS

Varieties of systems failures have been identified in hospitals that have studied factors associated with adverse events.³ These system failures are listed below:

- Deficiencies in medication knowledge, including prescribing of incorrect medications, doses, forms, frequency, or routes of administration
- Failure to verify the identity or dose of medication administered, often due to look-alike packaging or similarities between medication names
- Inaccessibility of patient information including laboratory test results, current medications, and information on the patient's current condition
- Incorrect recording of orders, often due to illegibility of the physician's handwriting
- Failure to note known medication sensitivities
- Inefficient order tracking, making it difficult to determine when a medication has been given, missed/discontinued, or changed
- Poor communication between services, including amid nurses and pharmacists
- Improper use of administration devices
- Lack of consistent dosing schedules or disregard of existing standards
- Lack of consistent system for medication distribution
- Lack of consistent procedure across units
- Errors in the preparation of intravenous medications (when performed in the patient care area)
- Poor information transfer when patients are moved from one patient care area to another
- Inadequate or fictional system for resolving conflicts related to medication orders
- Lack in staffing or work assignments leading to excessive workloads and inconsistent availability of staff or inadequate management
- Lack of feedback and follow-up information on observed untoward drug events.

CLASSIFICATION OF MEDICATION ERRORS

The best way to understand how medication errors happen and how to prevent them is to consider their classification, which can be

Table 1: Scope of ten success characteristics, underlying principles, and safety impact

<i>Scope of success characteristic</i>	<i>Underlying principle</i>	<i>Safety impact</i>
Leadership		
<ul style="list-style-type: none"> • Maintain constancy of purpose • Establish clear goals/prospects • Foster positive culture • Advocacy within macroorganization • Formal, informal, on-the-spot 	<p>Leader balances setting and reaching collective goals by empowering individual autonomy and responsibility</p>	<ul style="list-style-type: none"> • Define safety vision • Identify constraints for safety improvement • Allocate resources for plan improvement, implementation, monitoring, and evaluation • Build input of microsystem to plan development • Align quality and safety goals • Provide update to Board of Trustees
Organizational support		
<ul style="list-style-type: none"> • Recognition, resources, information • Enhance and legitimize work of microsystem 	<p>Larger organization finds ways to connect and facilitate the work of microsystem, including harmonization and handoffs between microsystems</p>	<ul style="list-style-type: none"> • Work with clinical microsystems to identify patient safety issues and make related local changes • Put the obligatory resources and tools into the hands of individuals without making it superficial
Staff focus		
<ul style="list-style-type: none"> • Selective hiring • Integration into culture and roles • Allying work with training competencies • High expectations for performance, continuing education, professional growth, networking 	<p>Human resource value chain that links microsystem's vision with real people for hiring, orienting, uninterrupted educating, retraining, and providing incentives</p>	<ul style="list-style-type: none"> • Assess current safety culture • Identify gap between current culture and Safety vision • Plan cultural interventions • Conduct periodic assessments of culture
Education and training		
<ul style="list-style-type: none"> • Ongoing education • Organizational learning • Work roles and competencies aligned • Best use of people and resources 	<p>Team approaches to training create learning that is combined and focused on quality, safety, and integrated into work flow</p>	<ul style="list-style-type: none"> • Develop patient safety curriculum • Provide training and education of key clinical and management leadership • Develop a core of people with patient safety skills who can work amid microsystem as a resource
Interdependence of care team		
<ul style="list-style-type: none"> • Trust • Collaboration • Willingness to help others • Appreciation of complimentary roles • Recognition of inputs to shared purpose 	<p>Multidisciplinary team provides care and every person is respected for individual vital role</p>	<ul style="list-style-type: none"> • Build people's dispensary for sick animals (PDSA) into debriefings • Use daily huddles for after action reviewers (AARs) and reveal identifying errors
Patient focus		
<ul style="list-style-type: none"> • Caring • Listening • Educating • Response to special requests • Innovating 	<p>The patient is the common focal point; that is why we are all here</p>	<ul style="list-style-type: none"> • Launch patient and family partnerships • Support disclosure and truth about medical error

Contd...

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<i>Scope of success characteristic</i>	<i>Underlying principle</i>	<i>Safety impact</i>
<ul style="list-style-type: none"> Delivering smooth service flow Relationship with community resources 		
Community and market focus		
<ul style="list-style-type: none"> Partnership with community for resource exchange Outreach Innovation and excellence 	Resource exchange and information sharing to ensure that patient needs are met	Analyze safety issues in community and partner with external groups to reduce risk to population
Performance patterns		
<ul style="list-style-type: none"> Patient outcomes Cost avoidance Streamlined delivery Data feedback Positive competition Open dialog about performance 	Outcomes are routinely measured, with feedback to microsystems leading to change based on data	<ul style="list-style-type: none"> Develop key safety measures Create the "Professional case" for safety
Process improvement		
<ul style="list-style-type: none"> Learning and redesign focus Continued care monitoring Benchmarking Tests of change Staff authorized to innovate 	Studying, measuring, and improving care are essential elements of daily work	<ul style="list-style-type: none"> Identify patient safety priorities based on the assessment of key safety measures Address the work that will be required at the microsystem level Establish patient safety "demonstration sites" Transfer the learning
Information and IT		
<ul style="list-style-type: none"> Information is key Technology links information and care Communication and channels 	Information is a connector designed to support work of the unit for the right information at the right time	<ul style="list-style-type: none"> Improve error-reporting system Establish safety concepts into information flow (e.g. checklists, reminder systems, etc.)

contextual, modal, or psychological. Contextual classification deals with the specific time, place, medicines, and people concerned. Modal classification examines the ways in which errors occur (e.g. by omission, replication, or substitution). However, classification based on psychological theory is to be chosen, as it explains events rather than merely relating them. Its demerit is that it concentrates on human rather than systems' sources of errors. These classifications have been discussed in detail elsewhere (Flowchart 1).^{10,11}

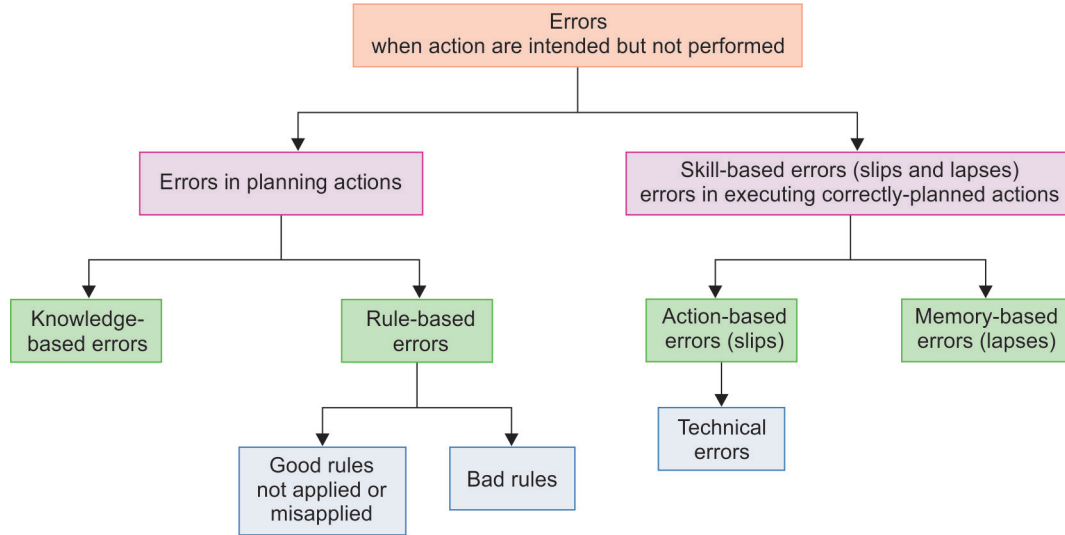
Mistakes can be divided into (i) knowledge-based errors and (ii) rule-based errors. Failures of skill can be divided into (iii) action-based errors ("slips," including technical errors) and (iv) memory-based errors ("lapses"). Knowledge-based errors can be related to any type of knowledge, general, specific, or expert. It is a general knowledge that penicillin's can cause sensitivity reactions; knowing that your patient is sensitive to penicillin is a specific knowledge; knowing that cefluampicil contains penicillins is an expert knowledge. Negligence or ignorance of any of these facts could lead to a knowledge-based error. Rule-based errors can further be categorized as (a) the misapplication of a good rule or the failure to apply a good rule and (b) the application of a bad rule. An action-based error is defined as "the performance of an action that was not what was intended." A slip of the pen, when a doctor intends to write diltiazem but writes diazepam, is an example.

Technical errors form a subset of action-based errors. They have been distinct as occurring when "an outcome fails to occur or the wrong outcome is produced because the execution of an action was imperfect." An example is the addition of the wrong amount of drug to an infusion bottle. Memory-based errors occur when something is forgotten; for example, giving penicillin, knowing the patient to be allergic, but forgetting.¹²⁻¹⁴

PRESCRIPTION AND DISPENSING IRREGULARITIES WORLDWIDE AT A GLANCE

Medication errors are common in general practice and in hospitals. Both errors in the act of writing (prescription errors) and prescribing mistakes due to erroneous medical decisions can result in harm to patients.¹⁵ It can be due to prescribing faults—irrational, unsuitable, and prescription errors (vain prescribing, under prescribing, overprescribing; writing the prescription).¹⁶ Doctors in US incorrectly prescribe antibiotics in nearly one-third of cases. A study finds that more than half of the US population receives prescription annually and estimates "inappropriate" prescriptions in doctor's office setting at up to 30%.¹⁷ The National Health Service (NHS) makes hundreds of millions of prescribing mistakes and mix-ups which result in 22,300 deaths a year in UK,

Flowchart 1: Classification of medication errors based on a psychological approach¹¹



according to a major report commissioned by the government.¹⁸ NHS medication errors elevate fears that thousands could be dying because of 237 million errors every year, and some 237 million errors are made annually. Error rates varied from 7.1% to 90.5% for prescribing and from 9.4% to 80% for administration in the middle east.¹⁹ However, UAE bans handwritten medical prescriptions due to 7,000 deaths worldwide resulting from illegible handwriting.²⁰ Prescription errors in least developed countries (LDC) need no further discussions, as only 13% drug in Bangladesh is sold under prescription; a study says that 96.83% percent of the pharmacist recommended medicine taking inadequate history.²¹

FAILURE TO GIVE PRESCRIPTION ORDERS

The use of verbal orders, electronic order transmission via xerox machine, the use of global prescription orders such as resuming all previous orders provides many chances for miscommunication. Whenever possible, verbal orders should be avoided. Only specific personnel (e.g. physicians, pharmacists, and nurses) should be allowed to dictate and receive verbal medication orders and only in approved conditions. When used, verbal orders should be articulated slowly and distinctly. Difficult medication names and instructions should be spelled out. Ambiguity should be clarified (drug names can be wrongly changed due to look-alike or sound-alike drugs listed in Table 2). An individual receiving the order should transcribe the order and then immediately read the information back to the prescriber. In the in-patient or long-term care setting, the prescriber should countersign and verify the verbal order as soon as possible. Many healthcare organizations now

use facsimile transmissions for prescription order transmission. Streaked, blackened, or faded areas and phone line noise appearing as random markings are often present on facsimile transmissions. Vigilant inspection of the copy is necessary to evaluate if extraneous markings interfere with the actual order. Recording of prescription orders in this manner still can contain illegible, ambiguous, or improper abbreviations. Failure to write a prescription order can also provide many chances for error. When medications are held or resumed or patient care is transferred to another location or provider, it is imperious that a complete review of medications occurs. Simply stating resume all, hold all, or continue all previous medications is not an acceptable practice.²²⁻²⁴ However, clinical care has become progressively dependent on computerized physician order entry (CPOE) systems. No study has reported the adverse effect of CPOE on physicians’ ability to handwrite prescriptions. The unintended shutdown of a long-running CPOE system might result in physicians failing to handwrite flawless prescriptions in the digital era. The contingency plans for computer catastrophes at healthcare facilities might include the preparation of stand-alone e-prescribing software so that the service delay could be kept to the slightest. However, supervision on prescribing should remain an essential part of medical education.²⁵

ERROR POTENTIAL IN THE PRESCRIBING PHASE

The three most common forms of prescribing errors include dosing errors, prescribing medications to which the patient had an allergic history, and errors involving the prescribing of inappropriate dosage forms. In the examples listed, timely access and use of information is essential to avoid adverse drug events (ADEs). Although not a panacea, use of a computerized medication order entry system can significantly contribute to the prevention of medication errors.²⁶ The type of healthcare information that is best suited for computerization includes:

- General information storage (e.g. patient or medication information, retrieval)
- Repetitive functions (e.g. dosage guidelines, medication names, sensitivity information)
- Complex processes that depend on reproducible results
- Items where legibility is important

Table 2: Examples of look-alike and sound-alike drugs

List 1		List 2	
Adriamycin	Achromycin	Methotrexate	Metolazone
Albuterol	Atenolol	Myleran	Mylicon
Alupent	Atrovent	Nicardipine	Nifedipine
Amikin	Amicar	Orinase	Ornade
Apresoline	Priscoline	Pediapred	PediaProfen
Brevital	Bretylol	Penicillin	Penicillamine
Carafate	Cafergot	Percodan	Percocet
Cefoxitin	Cefotaxime	Phenobarbital	Pentobarbital



- Items that require timely attention
- Items where accuracy is vital.

Guidelines for Prescribers

The following guidelines are recommended for prescribers when writing directions for drug use on their prescription orders:

- The name and strength of the drug dispensed will be recorded on the prescription label by the pharmacist unless otherwise directed by the prescriber.
- Whenever possible, specific times of the day for drug administration should be indicated. (For example, take one capsule at 9:00 AM, 1:00 noon, and 10:00 PM is preferable to take one capsule three times daily. Likewise, take one tablet two hours after meals is preferable to take one tablet after meals).
- The use of potentially puzzling abbreviations, i.e., qid, qod, qd, etc., is discouraged.
- Vague instructions such as take as necessary or take as directed which are confusing to the patient are to be avoided.
- If dosing at specific intervals around-the-clock is therapeutically significant, this should specifically be stated on the prescription by indicating appropriate times for drug administration.
- The symptom, indication, or the intended effect for which the drug is being used should be included in the instructions whenever possible. (For example, take one tablet at 8:00 am and 8:00 pm for high blood pressure or take one teaspoonful at 9:00 AM, 11:00 AM, 4:00 PM, and 7:00 PM for cough.)
- The metric system of weights and measures should be cast-off.
- The prescription order should indicate whether or not the prescription should be renewed, and if so, the number of times and the period of time such as renewal are authorized. Proclamation such as Refill prn or Refill ad lib are discouraged.
- Either single or multidrug prescription forms may be used when appropriately designed and pursuant to the desires of local medical and pharmaceutical societies.
- When institutional prescription blanks are used, the prescriber should print his/her name, telephone number, and registration number on the prescription blank.

Guidelines for Pharmacists

- Pharmacists should include the following information on the prescription label: name, address, and telephone number of pharmacies; name of prescriber; name, strength, and quantity of drug dispensed (unless otherwise directed by the prescriber); directions for use; prescription number; date on which prescription is dispensed; full name of the patient and any other information required by law.
- Instructions to the patient regarding directions for the use of medication should be concise and precise but readily understandable to the patient. Whenever the pharmacist feels that the prescription order does not meet these criteria, he should attempt to clarify the order with the prescriber in order to prevent confusion. Verbal reinforcement and/or clarification of instructions should be given to the patient by the pharmacist when appropriate.
- For those dosage forms where confusion may develop as to how the medication is to be administered (e.g. oral drops which may be wrongly imparted in the ear or suppositories which may be wrongly administered orally), the pharmacist should clearly

indicate the intended route of administration on the prescription label.

- The pharmacist should include an expiration date on the prescription label when suitable.
- Where special storage conditions are required, the pharmacist should indicate proper instructions for storage on the prescription label.²⁷⁻²⁹

ERROR POTENTIAL IN THE DISPENSING PHASE

An example of the former type was a study in a UK hospital in which the researchers used semistructured interviews of pharmacy staff about self-reported dispensing errors. The most common causes mentioned were being busy (21%), being short-staffed (12%), being subject to time constraints (11%), fatigue of healthcare providers (11%), interruptions during dispensing (9.4%), and look-alike/sound-alike medicines (8.5%).³⁰ The dispensing process has both mechanical and judgmental components. As a result, preclusion of dispensing errors will require a wide-spread approach including evaluation of:

- Work environment: Workload, interruptions, physical location of service, and hours of operation
- Inventory management: Outdated or unused products, look-alikes, sound-alike, clutter, labeling, and procuring of unit of use products
- Information resources: Available references, appraisals, consultants, computer, or decision support technology
- Performance evaluation: Evaluation of staff proficiency and practice skill, knowledge and behaviors, and cross-checking redundancies
- Patient involvement: Patient education and review with show and tell techniques

Several precarious steps have been advocated for improving dispensing accuracy:

- Secure or sequester high-risk medications
- Develop and implement standardized storage procedures
- Reduce distraction potential and advance workflow in dispensing environment
- Use reminders (labels and computer alerts) to prevent look-alike and sound-alike mix-ups
- Keep prescription order, label, medication, and the medication container together throughout dispensing process
- Accomplish a final check on prescription content including verification with original prescription order and label
- Enter a manufacturer identification code into the computer profile and on prescription label
- Accomplish a final check on the prescription label, if possible, using automation such as bar-coding
- Provide patient counseling.³¹⁻³³

ERROR POTENTIAL IN THE ADMINISTRATION PHASE

A cross-sectional study by Mendes et al. in the Emergency Department of a University Hospital (São Paulo) in 2018 reveals no hand hygiene and use of aseptic technique in more than 70% and 80%, respectively. Upon administration, no hand hygiene and no use of aseptic technique in more than 80% and around 85%,

respectively. In more than 30% of observations, there was more than one medication at the same time for the same patient, of which approximately 18% were compatible, more than 55% and 25% were incompatible and were not tested, according to the Micromedex database, respectively.³⁴ However, the administration phase serves as a last final check on processing the entire medication order itself and includes:

- Evaluating the written order for appropriateness and completeness
- Ensuring appropriate indication for use
- Evaluating and interpreting the use of terminology and order method (abbreviation, units of measure, and use of verbal orders)
- Dosing calculation or verification
- Identification of the patient
- Timing of treatment in context of other therapies
- Preparation and possibly dispensing of medication
- Correct use of medication devices
- Patient education
- Documentation of treatment.

MEDICATION ERROR—PREVENTION STRATEGIES

- Elimination of handwritten medical records and physician orders/computerized provider-order entry systems
- Institute fail-safe tracking of medications and laboratory tests to confirm that patients receive correct medications and tests on time
- Automated dispensing cabinets
- Implement bar-coding
- Establish protocols and guidelines that outline standardized practices
- Provide all medications in unit dose packaging and ready for patient administration
- Standardize medication procedures such as protocols for the use of hazardous medications, medication terminology, and medication names
- Make it difficult for someone to do something wrong by error proofing
- Medication reconciliation
- Make relevant patient information available at the point of patient care
- Advance the patient's knowledge about treatment.^{3,35}

RECOMMENDATIONS FOR PRESCRIBING IMPROVEMENTS

Many opportunities exist to improve the safety of the medication use process. The prescribing phase of the medication use process, however, encompasses the majority of medication errors that result in preventable ADEs. The knowledge that ADEs can be prevented compels organizations to identify the factors or system failures that contribute to the errors in the prescribing phase. Such factors identified in the prescribing phase include:

- Accessibility of medication information at the time of prescribing
- Access to patient information at the time of prescribing
- Accessibility of dosing information at the time of prescribing
- Accessibility of sensitivity information at the time of prescribing

- Accuracy or extensiveness of order by the prescriber
- Legibility of handwriting
- Use of abbreviations
- Use of decimals in expressions of weight and measure
- Use of varied units of measure
- Medication name look-alikes or sound-alikes.

CHANGING SYSTEMS WITHIN ORGANIZATIONS

The following items have routinely been identified as a top 10 list for improvement in the literature:

- Improving the knowledge about medications (availability, access, and timeliness)
- Dose/identity tracking of medications (process understanding of distribution)
- Available patient information (availability, access, accuracy, and timeliness)
- Order transcription (elimination of process)
- Allergy defense (hard stop capabilities and access to patient information)
- Medication order tracking (streamlining and effective communication of patient needs)
- Communication (patient information, system performance, and medication use)
- Device use (standardization and competency regarding use)
- Standardization of medication dose and distribution.

STEPS FOR CONDUCTING A ROOT—CAUSE ANALYSIS

There are several key features for healthcare organizations to consider conducting a root-cause analysis:

- Identify a multidisciplinary team to assess the error, failure, or adverse event of interest
- Establish a way to communicate findings and data elements required to conduct the analysis
- Create a plan with target dates, responsibilities, and measurement/data collection strategies required for the investigation
- Define all elements of the process and issues clearly
- Brainstorm all possible causes or potential causes
- Identify interrelationships of causes or potential causes
- Sort, analyze, and prioritize cause list
- Determine which processes and systems are part of the investigation
- Determine special and common causes
- Begin the design and implementation of the change while engaging in the root-cause analysis
- Repeat each of the steps listed previously as appropriate
- Focus on being thorough (ask why) and credible (be consistent, dig deep, and leave no stone unturned!)
- Target system improvement, particularly the larger systems
- Redesign to eliminate root cause(s)
- Measure and assess new design.

BARRIERS ASSOCIATED WITH SAFETY IMPROVEMENT

There are many reasons why organizations struggle with improving safety within their organization. Often, traditional methods such as

medication error or ADE reporting are cumbersome. Organizations have not adequately defined the process, the scope of collection, and members of the healthcare team do not understand why there is a need to collect and discuss the data. Many involved in the reporting end of the process never hear about the information gleaned from the analysis. Additionally, data collection and discussion about medication errors or adverse events are often fragmented. Pharmacy might collect and discuss some of the data, while nursing may be responsible for other parts and risk management or quality analyst may get involved for other issues. As a result, frustration occurs due to a lack of communication, integration, and input. Documentation systems are also cumbersome and often do not fit in well with other day-to-day care responsibilities. What occurs with all these events reported? Panic that individuals will be blamed for the error and that punitive action will be taken which limits individual participation in the process. Having a plan and an organizational understanding of the aim regarding safety improvement is essential. Many parts of the healthcare team contribute to the use of medications within the organization. All members within the organization must be aware of the importance of medication use safety, mindful of the potential for error and their role in averting it, and what the organization has in place to assure that safety is a priority. Assimilation of all data and the associated knowledge regarding medication use are needed. The integration of existing data, including ADR, medication error, pharmacy/nursing interventions, and medication interaction data into one organization-wide database is a key to an effective ADE quality management program. The overall impact of the database could be measured by examining the impact that the reduced incidence of ADEs has on health outcomes: clinical, economic, patient satisfaction, and health status outcomes. Specific goals for adverse event improvement activities generally include:

- Increase documentation
- Aggregate data effectively
- Organizational education and training regarding prevention and detection
- Use data to improve the medication use system
- Minimize patient risk
- Maximize health outcomes
- Create an open and authentic environment where there is a focus on system improvement and reporting
- Remove focus on individual and punitive process
- Meet regulatory standards.

Many groups have identified methods to improve the safety of the medication use process. National and local groups have strategies to share and stories to tell. It is important to learn and replicate best practice and build on the success of others.³⁶⁻⁴⁰

SOURCES OF LEARNING ABOUT PATIENT SAFETY

- The Agency for Healthcare Research and Quality (AHRQ)
- The American Hospital Association (AHA)
- Anesthesia Patient Safety Foundation (APSF)
- Annenberg Patient Safety Conferences
- Institute for Healthcare Improvement (IHI)
- Institute for Safe Medication Practices (ISMP)
- Joint Commission on Accreditation of
- Healthcare Organizations (Joint Commission, JCAHO)

- Leapfrog Group
- Malcolm Baldrige National Quality Program
- Massachusetts Coalition for the Prevention of MEs
- Minnesota Hospital and Healthcare Partnership (MHHP)
- National Academy for State Health Policy (NASHP)
- National Coalition on Health Care (NCHC)
- National Committee for Quality Assurance (NCQA)
- National Patient Safety Foundation (NPSF)
- National Quality Forum (NQF)
- United States Pharmacopeial Convention (USP).

ROLE OF PATIENTS IN MEDICATION ERRORS

This area is relatively underresearched and there remains several unanswered questions. Little is known about how patients understand drug-related problems or how they make attributions of adverse effects. Some research propose that patients' cognitive models of ADRs bear a close relationship to models of illness perception. Recent National Institute for Health and Care Excellence (NICE) guidelines recommend that professionals should ask patients if they have any concerns about their medicines, and this approach is likely to yield information conducive to the identification of medication errors.^{41,42}

CONCLUSION

The path to safer medication use and improvements in patient safety is not about a destination. This is a journey that must involve iterative learning. There are no absolute solutions and mystical pronouncements that will tell the profession of pharmacy what to do to fix the system. The problems it faces will not be solved by the level of thinking that created them. The profession is forced to consider new approaches, new knowledge, and to consider ways of thinking, acting, and being that are outside our traditional approaches. Ultimately, the judge of the quality of work, the services delivered, and the outcome of care is an increasingly well-informed patient, as well as their payors and regulators from the public and private sectors. Focus more on patient needs and wants and less on how we do it around here.

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