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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 erroneous medical decisions can result in harm to patients. Any step in the prescribing process can generate errors. Slips, lapses, or mistakes are sources of errors, as in unintended omissions in the transcription of drugs. Faults in dose selection, omitted transcription, and poor handwriting are common. Inadequate knowledge or competence and incomplete information about clinical characteristics and previous treatment of individual patients can result in prescribing faults, including the use of potentially inappropriate medications. An unsafe working environment, complex or undefined procedures, and inadequate communication among healthcare personnel, particularly between doctors and nurses, have been identified as important underlying factors that contribute to prescription errors and prescribing faults. Active interventions aimed at reducing prescription errors and prescribing faults are strongly recommended. These should be focused on the education and training of prescribers and the use of on-line aids. The complexity of the prescribing procedure should be reduced by introducing automated systems or uniform prescribing charts, in order to avoid transcription 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.

Keywords: Medication; Errors; Risk, Reporting; Health care professionals; Safety; Patient

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1. Background

A medication (a medicinal product) is ‘a product that contains a compound with proven biological effects, plus excipients or excipients only; it may also contain contaminants; the active compound is usually a drug or prodrug, but may be a cellular element’. The definition of a medication encompasses not only chemical compounds—drugs, prodrugs (which may themselves have no pharmacological activity), stereoisomers that may have only adverse effects, or compounds that are used for diagnostic purposes (such as contrast media); it 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 contaminants and adulterants, the former being accidentally present the latter deliberately added. Medication errors can occur in:

- *Choosing a medicine*—irrational, inappropriate, and ineffective prescribing, under-prescribing and overprescribing;
- *Writing 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;
- *Monitoring therapy*—failing to alter therapy when required, erroneous alteration.

Abbreviations: After Action Reviewers (AARs); Adverse Drug Event (ADE); Potential Adverse Drug Event (PADE); Adverse Drug Reaction (ADR); Medical Error (ME); Computerized Physician Order Entry (CPOE); National Institute for Health and Care Excellence (NICE); People's Dispensary for Sick Animals (PDSA); National Association of Boards of Pharmacy (NABP)

Objective: Discussion and projection of medication safety and the strategies to improve it’s efficiency.

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

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

2. Introduction

Medicines are the commonest medical interventions used in health care and safe use is important.6 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 improvement may be required. Err offered a similar conclusion relative to safety: flaws are unacceptable and common. According to a 2000 report citing UK medical defense organizations, 25% of all litigation 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); repeat 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 health care workforce by asking them to try harder to give safe care, when in fact, the courage, hard work, and commitment of health

care workers are the only real means to stem the tide of errors latent in the health care system. Growth in knowledge and technologies has never been so profound and prolific. However, research on the quality of care demonstrates that the health care system falls short in its ability to translate knowledge to practice and to apply new technologies safely and appropriately. These principles health care organizations could take now or as soon as possible to substantially improve patient safety include (1) providing leadership; (2) respecting human limits in process design; (3) promoting effective team functioning; (4) anticipating the unexpected; and (5) creating a learning environment.

3.1. 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 clinicians and nurses. For example, operating on the wrong eye or amputating the wrong leg are classic examples of an active error.

Adverse Event: Adverse 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 organizational structure. These are present, but may go unnoticed for a long time with no ill effect.

Medical Error (ME): 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 failures that can occur during the whole process of prescribing, independently of any potential or actual harm.

Prescription Error: Prescription errors encompass those related to the act of writing a prescription, whereas prescribing faults encompass irrational prescribing, inappropriate prescribing, under-prescribing, 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 achieve 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 circumstances. 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 determining 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 prolonged imaging studies instead of the operating room. The result could be a traumatic arrest and death.

Patient Safety: The process of amelioration, avoidance, and prevention of adverse injuries or outcomes that arise as a result of the healthcare process [1].

3.2. Scope of Safety Problems

The provision of high-quality, affordable, health care services is an increasingly difficult challenge. Due to the complexities of health care

services and systems, investigating and interpreting the use, costs, quality, accessibility, delivery, organization, financing, and outcomes of health care services is key to informing government officials, insurers, providers, consumers, 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 growing complexity of science and technology requires health care providers to know more, manage more, monitor more, and involve more care providers 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 health care system's ability to deliver them safety, effectively, and efficiently. The potential for errors of omission or commission to creep into the process is extraordinary. Workflow analysis has often been used with the goal of improving efficiency. In response to financial pressure and incentives driving provider organizations, minimizing slack time has become important [2], [3].

4. Understanding Error

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

- MEs are considered preventable while adverse drug reactions are generally are not.
- If an error occurs, but is intercepted by someone in the process, it might not result in an adverse event. These potential adverse events are often referred to as near misses.
- Capturing information regarding near misses could yield vital information regarding system performance.

5. Identifying Risk

Two approaches to the problem of human fallibility are possible: the individual and the system approach. The individual approach focuses on the errors of individuals, blaming them for forgetfulness, carelessness or moral weakness. The system approach concentrates on the conditions under which individuals work and tries to build defenses to avert errors or mitigate their effects. Health care professionals are human and can make mistakes. Reporting an error is often viewed as professional failure or negligence and is followed by sanction or punishment 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 versus benefit must be assessed. If a patient takes prescribed medications in a different manner 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 health care workers worrying constantly about the ever-present reality of error. Unfortunately, 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 hazards

- 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 conditions are not normal
- Contain or eliminated hazards if the barrier is not adequate
- Establish methods of escape and rescue should hazard containment fail

6. 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 more effective health care system [6].

Table 1. Scope of Ten Success Characteristics, Underlying Principles, and Safety Impact

Scope of Success Characteristic	Underlying Principle	Safety Impact
Leadership Maintain constancy of purpose Establish clear goals/expectations Foster positive culture Advocacy with in macro organization Formal, informal, on-the-spot	Leader balances setting and reaching collective goals with empowering individual autonomy and accountability	Define safety vision Identify constraints for safety improvement Allocate resources for plan development, implementation, monitoring and evaluation Build input of microsystem to plan development Align quality and safety goals Provide update to Board of Trustees
Organizational support Recognition, resources, information Enhance and legitimize work of microsystem	Larger organization finds ways to connect and facilitate work of microsystem, including coordination and handoffs between Microsystems	Work with clinical Microsystems to identify patient safety issues and make relevant local changes Put the necessary resources and tools into the hands of individuals without making it superficial
Staff focus Selective hiring Integration into culture and roles Aligning work with training competencies High expectations for performance, continuing education, professional growth, networking	Human resource value chain that links microsystem's vision with real people for hiring, orienting, continuously educating, retraining and providing incentives	Assess current safety culture Identify gap between current culture and safety vision Plan cultural interventions Conduct periodic assessments of culture
Education and training Ongoing education Organizational learning Work roles and competencies aligned Best use of people and resources	Team approaches to training create learning that is collaborative and focused on quality, safety and integrated into work flow	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 across microsystems as a resource
Interdependence of care team Trust Collaboration Willingness to help others Appreciation of complimentary roles Recognition of inputs to shared purpose	Multidisciplinary team provides care and every person is respected for individual vital role	Build PDSA into debriefings Use daily huddles for AARs and celebrate identifying errors
Patient focus Caring Listening Educating Response to special requests Innovating Providing smooth service flow Relationship with community resources	The patient is the common focal point, it's why we're all here	Establish patient and family partnerships Support disclosure and truth about medical error
Community and market focus Partnership with community for resource exchange Outreach Innovation and excellence	Resource exchange and information sharing to assure that patient needs are met	Analyze safety issues in community and partner with external groups to reduce risk to population
Performance patterns 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	Develop key safety measures Create the "business case" for safety
Process improvement Learning and redesign focus Continuous care monitoring Benchmarking Tests of change Staff empowered to innovate	Studying, measuring and improving care are essential elements of daily work	Identify patient safety priorities based on 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 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	Enhance error reporting system Build safety concepts into information flow (e.g. checklists, reminder systems, etc.)

7. Collaboration Across the Medication Use Process

Collaboration is essential to minimize patient risk in the medication use process. Health care providers within the organization need to

understand and identify how these components function and who is involved in making these steps safe. Clear understanding of the critical safety issues at each one of these steps are of particular importance 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 health care providers in the organization play a role in patient evaluation [7]. This evaluation would include assessing patient characteristics, medication selection, concurrent medications, medication dosage selection, and medication administration methods appropriate for the condition to be treated. The current system of prescribing, dispensing, administering, and monitoring, however, often places the responsibility on the individual to avoid making the mistake [8], [9]. Because this expectation seems unreasonable, organizations should focus efforts to improve medication use safety by using a systems-based approach that identifies:

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

8. 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 transcription of orders, often due to illegibility of the physician's handwriting
- Failure to note known medication allergies
- Inefficient order tracking, making it difficult to determine when a medication has been given, missed/discontinued or changed
- Poor communication between services, including between nurses and pharmacists
- Improper use of administration devices
- Lack of standardized dosing schedules or disregard of existing standards
- Lack of standardized system for medication distribution
- Lack of standardized procedure across units
- Errors in 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 nonexistent system for resolving conflicts related to medication orders
- Deficiencies in staffing or work assignments leading to excessive workloads, inconsistent availability of staff or inadequate management
- Lack of feedback and follow-up information on observed adverse drug events

9. 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 contextual, modal, or psychological. Contextual classification deals with the specific time, place, medicines, and people involved. Modal classification examines the ways in which errors occur (e.g. by omission, repetition, or substitution). However, classification based on psychological theory is to be preferred, as it explains events rather than merely describing

them. Its disadvantage is that it concentrates on human rather than systems sources of errors. These classifications have been discussed in detail elsewhere [10], [11].

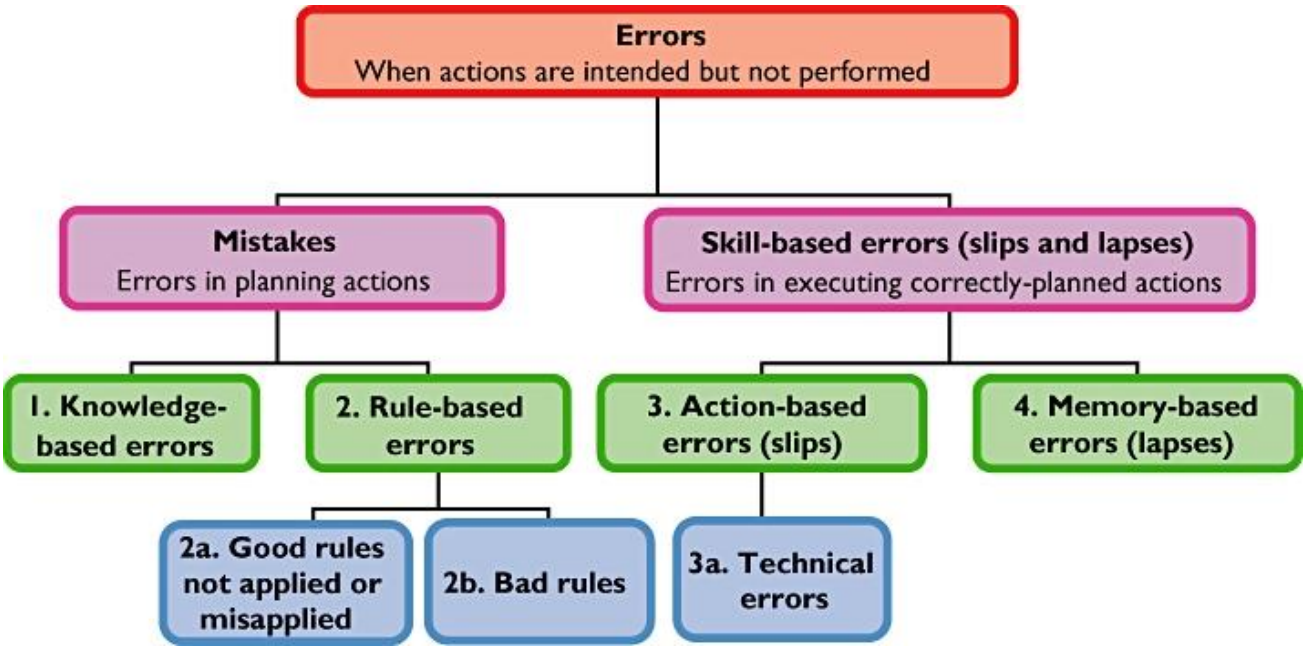

Figure: The classification of medication errors based on a psychological approach [11]

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 general knowledge that penicillin’s can cause allergic reactions; knowing that your patient is allergic to penicillin is specific knowledge; knowing that co-fluampicil contains penicillins is expert knowledge. 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 defined 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 to an infusion bottle of the wrong amount of drug. Memory-based errors occur when something is forgotten; for example, giving penicillin, knowing the patient to be allergic, but forgetting [12-14].

10. 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 faults due to erroneous medical decisions can result in harm to patients [15]. It can be due to prescribing faults—irrational, inappropriate, and prescription errors (ineffective prescribing, under prescribing, overprescribing; writing the prescription) [16]. Doctors in US incorrectly prescribe antibiotics in nearly a third of cases. Study finds more than half of US population receives prescription annually and estimates ‘inappropriate’ prescriptions in doctor’s office setting at up to 30% [17]. The NHS makes hundreds of millions of prescribing errors and mix-ups which contribute to as many as 22,300 deaths a year UK, according to a major report commissioned by the Government [18]. NHS

medication errors raise fears thousands could be dying because of 237 million mistakes every year, some 237 million errors are made annually (HuffPost UK, 2018). 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 result from illegible handwriting [20]. Prescription errors in LDC countries needs no further discussions, as only 13% drug in Bangladesh is sold under prescription, a study says 96.83% percent of the pharmacist recommended medicine taking inadequate history [21].

11. Failure to Give Prescription Orders

The use of verbal orders, electronic order transmission via facsimile machine, use of global prescription orders such as resume all previous orders provide many opportunities for miscommunication. Whenever possible, verbal orders should be avoided. Only specific personnel (e.g., physicians, pharmacists, nurses) should be allowed to dictate and receive verbal medication orders and only in approved circumstances. When used, verbal orders should be enunciated slowly and distinctly. Difficult medication names and instructions should be spelled out. Ambiguity should be clarified (Drug names can be mistakenly changed due to look alike or sound alike drugs listed in Table 2). The individual receiving the order should transcribe the order and then immediately read the information back to the prescriber. In the inpatient or long-term care setting, the prescriber should countersign and verify the verbal order as soon as possible. Many health care organisations 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. Careful inspection of the copy is necessary to evaluate if extraneous markings interfere with the actual order. Transmission of prescription orders in this manner still can contain illegible, ambiguous, or improper abbreviations. Failure to write a prescription order can also provide many opportunities for error. When medications are held or resumed or patient care is transferred to another location or provider, it is imperative that a complete review of medications is occurs. Simply stating resume all, hold all, or continue all previous medications is not acceptable practice [22-24]. However, clinical care has become increasingly dependent on computerized physician order entry (CPOE) systems. No study has reported the adverse effect of CPOE on physicians' ability to handwrite prescriptions. The unintentional shutdown of a long-running CPOE system might results that physicians fail to handwrite flawless prescriptions in the digital era. The contingency plans for computer disasters at health care facilities might include preparation of stand-alone e-prescribing software so that the service delay could be kept to the minimum. However, guidance on prescribing should remain an essential part of medical education [25].

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

12. 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. Although

not a panacea, use of a computerised medication order entry system can significantly contribute to the prevention of medication errors [26]. The type of health care information that is best suited for computerisation includes:

- General information storage (e.g., patient or medication information, retrieval)
- Repetitive functions (e.g., dosage guidelines, medication names, allergy information)
- Complex processes that depend on reproducible results
- Items where legibility is essential
- Items that require timely attention
- Items where accuracy is vital.

12.1. Guidelines for Prescribers

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

1. The name and strength of the drug dispensed will be recorded on the prescription label by the pharmacist unless otherwise directed by the prescriber.
2. Whenever possible, specific times of the day for drug administration should be indicated. (For example, Take one capsule at 8:00 am, 12:00 noon, and 8:00 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.)
3. The use of potentially confusing abbreviations, ie, qid, qod, qd, etc, is discouraged.
4. Vague instructions such as Take as necessary or Take as directed which are confusing to the patient are to be avoided.
5. If dosing at specific intervals around-the-clock is therapeutically important, this should specifically be stated on the prescription by indicating appropriate times for drug administration.
6. 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 8:00 am, 11:00 am, 3:00 pm, and 6:00 pm for cough.)
7. The Metric System of weights and measures should be used.
8. 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 renewal is authorised. Statements such as Refill prn or Refill ad lib are discouraged.
9. Either single or multi-drug prescription forms may be used when appropriately designed, and pursuant to the desires of local medical and pharmaceutical societies.
10. When institutional prescription blanks are used, the prescriber should print his/her name, telephone number and registration number on the prescription blank.

12.2. Guidelines for Pharmacists

1. 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 patient and any other information required by law.
2. Instructions to the patient regarding directions for use of medication should be concise and precise, but readily understandable to the patient. Where 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.
3. For those dosage forms where confusion may develop as to how the medication is to

be administered (for example, oral drops which may be mistakenly instilled in the ear or suppositories which may be mistakenly administered orally), the pharmacist should clearly indicate the intended route of administration on the prescription label.

4. The pharmacist should include an expiration date on the prescription label when appropriate.
5. Where special storage conditions are required, the pharmacist should indicate appropriate instructions for storage on the prescription label [27-29].

13. Error Potential in the Dispensing Phase

An example of the former type was a study in a UK hospital in which the researchers used semi-structured 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, prevention of dispensing errors will require a comprehensive approach including evaluation of:

- Work environment: workload, distractions, physical location of service, hours of operation
- Inventory management: outdated or unused products, look-alikes, sound- alike, clutter, labeling, purchasing of unit of use products
- Information resources: available references, updates, consultants, computer or decision support technology
- Performance evaluation: evaluation of staff competency and practice skill, knowledge and behaviors, cross-checking redundancies
- Patient involvement: patient education and review with show and tell techniques

Several critical steps have been advocated for improving dispensing accuracy:

- Secure or sequester high-risk medications
- Develop and implement standardized storage procedures
- Reduce distraction potential and improve workflow in dispensing environment
- Use reminders (labels, computer alerts) to prevent look-alike, sound-alike mix-ups
- Keep prescription order, label, medication and the medication container together throughout dispensing process
- Perform 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
- Perform a final check on the prescription label, if possible, using automation such as bar-coding
- Provide patient counseling [31-33]

14. Error Potential in the Administration Phase

A cross sectional study by Mendes et.al in a university hospital emergency (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 approximate 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
- Assuring appropriate indication for use
- Evaluating and interpreting use of terminology and order method (abbreviation, units of measure, 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
- Proper use of medication devices
- Patient education
- Documentation of treatment

15. 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 ensure 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, 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
- Improve the patient's knowledge about treatment [3], [35]

16. 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:

- Availability of medication information at time of prescribing
- Access to patient information at time of prescribing
- Availability of dosing information at time of prescribing
- Availability of allergy information at time of prescribing
- Accuracy or completeness of order by 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

17. Changing Systems Within Organizations

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

- Improving 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, access to patient information)
- Medication order tracking (streamlining and effective communication of patient needs)
- Communication (patient information, system performance, medication use)
- Device use (standardization and competency regarding use)
- Standardization of medication dose and distribution

18. Steps for Conducting a Root Cause Analysis

There are several key features for health care organizations to consider as the conduct 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

19. 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 adverse drug event reporting are cumbersome. Organizations have not adequately defined the process, the scope of collection, and members of the health care 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 QA 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 happens with all these events reported? Fear that individuals will be blamed for the error and that punitive action will be taken also 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 health care 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. Integration of all data and associated knowledge regarding medication use is needed. The integration of existing data, including ADR, medication error, pharmacy/nursing interventions, and medication interaction data, into one organization-wide database is the 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 honest 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].

20. 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 Medical Errors
- 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)

21. Role of Patients in Medication Errors

This area is relatively under-researched and there remain several unanswered questions. Little is known about how patients understand drug related problems or how they make attributions of adverse effects. Some research suggests that patients' cognitive models of adverse drug reactions bear a close relationship to models of illness perception. Recent 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].

22. 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, no 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 outcomes of care is an increasingly well-informed patient, as well as their payors and regulators from the public and private sectors. Focus on patient needs and wants, less on how we do it around here.

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