Medication Errors

Emmanuel E. Walker
University of Cape Coast, Ghana

Abstract: This paper discusses the medication errors including drug selection for patient, including failure to comply with legal requirements for prescription writing. It also discusses various monitoring errors.

INTRODUCTION

BACKGROUND

The goal of medication therapy is to achieve beneficial therapeutic outcomes and improve quality of life while minimizing risk to patients. Medications are given to almost every patient in a hospital and this may be the most important part of treatment. However, medications are not without risk and occasionally medications can cause harm.1

All prescription and nonprescription medications carry the inherent risk of causing adverse drug events that are often unpreventable, even when used at appropriate therapeutic doses and with appropriate monitoring in place.1 Many medication errors are probably undetected. This is because the outcome or clinical significance of many medication errors may be minimal, with few or no consequences that adversely affect a patient. Tragically, however, some medication errors result in serious patient morbidity or mortality.2

Medication errors are any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer.3 Such events may be related to

- professional practice since medication errors are not the sole responsibility of any single professional group, therefore, collaboration with other health professionals is central to establishing processes, policies, strategies and systems that will reduce their occurrence
- health care products including both prescription and non-prescription medications
- labeling and packaging to communicate information that is critical to the safe use of medicines
- storage of medicines to protect them from harm and deterioration
- prescribing, dispensing, administration and monitoring of medicines

A recent report by the Institute of Medicine (IOM) estimated that errors in medical management with medicines cause between 44,000 and 98,000 deaths each year in USA hospitals.4 In the USA it has been suggested that the rate of serious medication error is approximately 7%.5 Medication errors are not confined to the hospital settings alone. Reports from the Medical Defense Union and the Medical Protection Society revealed that 25% and 19% respectively of legal claims against general practitioners are related to medication errors.6,7

The occurrence of medication errors can compromise patient confidence in the healthcare system and in addition increase healthcare costs.8 Economic consequences may include the award of damages to the patient, extension of a patient’s stay in hospital and the potential financial support required for long term care of a patient who suffers permanent injury.9 In the USA, it has been estimated that the cost of adverse drug events, a proportion of which are due to medication errors was $5.6m per year for a 700 bed teaching hospital.10

Medication errors are rarely the fault of a single person and are generally multidisciplinary and multifactorial stemming from the complexity of the medication use process which includes five core steps: medication prescribing, order processing, dispensing, administration and monitoring.2 Evaluating the root cause of medication errors is essential to implementing changes to the medication use system and this can prevent the same errors from occurring in the future.

TYPES OF MEDICATION ERRORS

Prescribing Errors

Prescribing errors may be defined as an incorrect drug selection for a patient, be it the dose, the strength, the route, the quantity, the indication or the contraindications.11 This definition can be further expanded to include failure to comply with legal requirements for prescription writing. The prescriber must specify the information which the pharmacist...
needs to dispense the drug in the correct dosage and form suitable for the individual patient plus the directions the patient needs to administer it safely.\textsuperscript{12,13}

A study undertaken in a hospital setting by Lesar \textit{et al} (1997) found an error rate of 4 per 1000 prescription orders. Of the errors with potential for adverse patient effects, drug allergies accounted for 12.1\%, wrong drug name, dosage form or abbreviation for 11.4\%, incorrect dosage calculations for 11.1\% and incorrect dosage frequency for 10.8\%.\textsuperscript{10}

Some prescription errors recorded at the University of Cape Coast hospital include illegible handwriting, wrong or absent dosage regimen, prescribing antitussives for children below the age of six and the use of medical abbreviations.\textsuperscript{14}

\textbf{Dispensing Errors}

Dispensing errors are errors that occur at any stage during the dispensing process from the receipt of a prescription in the pharmacy through to the supply of a dispensed product to the patient.\textsuperscript{15} Studies in the USA have estimated that dispensing errors occur at a rate of 1\%-24\%.\textsuperscript{16} Dispensing errors may undermine the patient’s confidence in the pharmacist and increase the likelihood of litigation procedures.\textsuperscript{17}

These errors include the selection of a wrong product or strength. This occurs primarily when two or more drugs have a similar appearance or similar name (look-a-like/sound-a-like errors). Other examples include dispensing a wrong dose or dispensing a medicine to the wrong patient.

In 2013, an overdose of anti-retroviral drugs was dispensed to an HIV positive patient at the University of Cape Coast Hospital pharmacy.\textsuperscript{14} These medications were quickly recalled before they could be administered and the right dosage and quantity given back to the patient.

There have also been instances where prescribed medications have been dispensed to the wrong patient. For example, a patient was prescribed metronidazole tablets but ibuprofen tablets were dispensed instead.\textsuperscript{14} Similarity in product packaging was identified as the cause. But in all cases patients were recalled and the correct medication dispensed.

\textbf{Administration Errors}

A drug administration error may be defined as a discrepancy between the drug therapy received by the patient and the drug therapy intended by the prescriber.\textsuperscript{18} Drug administration is associated with one of the highest risk areas in nursing practice. For example, when a vaccine was administered into the gluteal muscle instead of the deltoid or when paracetamol suppository was accidentally inserted into the vagina of a child instead of the anus.\textsuperscript{14} The “five rights” have long been the basis for nurse education on drug administration i.e. giving the right dose of the right drug to the right patient at the right time and by the right route.\textsuperscript{16,17} Drug administration errors largely involve errors of omission where administration is omitted due to a variety of factors e.g. wrong patient, lack of stock, etc. Other types of drug administration errors include wrong administration technique, administration of expired drugs, wrong route, wrong rate, wrong dosage form and wrong formulation.

\textbf{Monitoring Errors}

Monitoring errors occur when appropriate clinical or laboratory investigations are not used to adequately assess patients response to prescribed therapy.

Examples include errors occurring as a result of the inappropriate monitoring of therapy and/or failure to monitor laboratory data. A high-risk example would be giving warfarin (an anticoagulant) when the patient’s international normalized ratio is found to be significantly elevated, which may result in excessive bleeding or giving an antihypertensive medication without monitoring the patient’s blood pressure.

\textbf{CAUSES AND PREVENTION OF MEDICATION ERRORS}

Medication use is a complex process and there are many drug related challenges at various levels involving healthcare professionals and patients. Although, medication errors can occur anywhere in the health care system from prescriber to dispenser to administrator and finally to patients, the simple truth is that many errors are preventable and the causes of these errors should not be seen as problems but rather as sources of information to improve patient safety and quality of care.

Inadequate information and knowledge of a patient have been implicated as a major cause of prescribing errors.\textsuperscript{1} In order to avoid prescribing a drug or selecting a dose that could be inappropriate or harmful to a patient, it is important for the prescriber to have access to the patient’s complete health

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
Aminophylline & Ami-triptyline \\
Carbamazepine & Carbimazole \\
Chlorpromazine & Chlorpropamide \\
Daonil® & Danol® \\
\hline
\end{tabular}
\caption{Drug names that may be confused}
\end{table}
information record at the time the patient is being seen, with information including patient age, weight, diagnosis history, all medications the patient is taking, laboratory test results, list of other physicians the patient has seen, past hospitalizations, past dose response relationships and drug allergies.

Illegible handwritten prescriptions and orders that are unclear, ambiguous or overly complex can also cause medication errors. A study conducted estimated that one-third of physicians' handwriting was illegible. Prescribers should therefore review all medication orders for accuracy, completeness and legibility immediately after they have been prescribed. This used to be a problem in the 80's, however in the developing world it isn't so now. Most hospitals in Ghana have moved away from handwritten prescription to computerized physician order entries (CPOE). At the University of Cape Coast hospital, all patient information are stored onto a computer and updated with each visit but prescriptions are still hand written leaving room for errors. If there is a question about legibility of a prescription to computerized physician order entries (CPOE). At the University of Cape Coast hospital, all patient information are stored onto a computer and updated with each visit but prescriptions are still hand written leaving room for errors. If there is a question about legibility of a handwritten prescription, the pharmacist or nurse should always clarify the order with the prescriber. So the issue of technology in hospital setting could offer some solution to medication errors.

Orders given verbally, rather than in written form, are inherently problematic because of different dialects and accents, misinterpretations of names and strengths, etc. Verbal medication orders should be discouraged and utilized only when written or electronic medication orders are not feasible. The key to a safe process is using “read back.” Here, the healthcare personnel should record the order directly onto the prescription pad or order sheet or computer as the prescriber is relaying it, after which the information will be read back to the prescriber. The prescriber should request the read back if it is not offered. During this process, spell the drug name and strength of the medication. For example, errors have been reported when the number 15 has been misinterpreted as 50. Always say “one five” for 15 or “five zero” for 50. At the University of Cape Coast Hospital such orders are seldom employed.

Interruptions can easily result in medication errors. It is important for all members of the team to eliminate or minimize interrupting a nurse who is preparing a medication or in the process of dispensing or administering a medication. Strategies such as no-distraction zones, “do not disturb” signs over medication preparation areas and use of colored vests worn by health care providers during the medication administration process are examples of methods for alerting colleagues not to interrupt health care providers while they are focused on such tasks. Unfortunately in our world one thing that interrupts health professionals the most is mobile phone calls. The priority level for such is much higher than most patient needs. A joke is told of a nurse who interrupted an injection being administered to listen to a mobile phone call.

The packaging and labeling of various dosage formulations often contribute to or fail to effectively prevent errors. The lack of safety designs worsens the problem of confusing nomenclature for different dosage formulations. According to the IOM, labeling and packaging issues cause 33% of medication errors including 30% of fatalities from medication errors. At the University of Cape Coast Hospital some medications dispensed to patients did not bear any label and for those that were labeled the information provided on some of the labels were inadequate for effective administration. Steps that have been put in place to prevent this includes educating staff about the importance of labeling and inspecting all medications before they are dispensed for labeling errors. Labeling and packaging practices that more effectively convey properties and risks of particular dosage forms would help differentiate formulations and would alert caregivers and patients of the proper use of a dose formulation.

Miscommunication amongst health care professionals is a common cause of medication errors. Abudato (2004) states that 90% of errors that occur within the healthcare industry are due to communication break down at the nurse-physician level. A study conducted found that poor communication was responsible for causing between 44 000 and 98 000 patient deaths annually in American hospitals alone. The elimination of communication barriers is a key element to medication error reduction strategies. Additionally, pharmacists may find it difficult to clarify prescriber orders with nurses and nurses may find it challenging to monitor medications dispensed at the pharmacy. In all settings, healthcare professionals who may receive information from clinicians, pharmacists, nurses or even from a patient questioning a prescription order must find ways to make feedback or communication a priority to help increase medication safety. At the University of Cape Coast Hospital regular interdisciplinary ward rounds and the availability of telephones at all departments also help to prevent miscommunication by allowing for easy feedback between health workers.
Look-alike and sound-alike drug names are a serious problem in healthcare, accounting for 29% of medication dispensing errors. Medication errors involving look-alike and sound-alike drug name mix-up can cause serious patient harm. It is often difficult to detect the error as the dispensed medication is presumed to have been prescribed for the patient. Examples include Isordil – Plendil, Celebrex – Cerebyx, Lamictal – Lamisil and Zyprexa – Zyrtec – Zantac. Many, if not all, of these drugs with similar names carry different indications for use, therefore recording the indication with the medication order can reduce confusion. Using bold print can also help to clearly distinguish letters which differ on product with look-alike drug names. This strategy is commonly referred to as “tall man lettering,” e.g., chlorPROMAZINE and chlorPROPAMIDE. In 2009, look-alike products of magnesium sulphate and metronidazole infusions produced by Intravenous Infusions Limited, Ghana caused five deaths when magnesium sulphate infusion was mistaken for metronidazole infusion and administered. Two near fatal cases were also recorded at the University of Cape Coast Hospital that same year. Subsequently the metronidazole infusion was withdrawn and repackaged.

Medical abbreviations are also a major cause of medication errors. The FDA and ISMP embarked on a joint campaign to eliminate the use of potentially confusing abbreviations, symbols and dose designations in various forms of medical communications. These abbreviations, symbols and dose designations have been proven to be a barrier to effective communication and have resulted in significant harm to patients. For example, instead of writing “QD” which is often misread as QID, it is recommended that health care professionals spell out the word “daily.” The Drugs and Therapeutics Committee at the University of Cape Coast Hospital mandates all clinicians to prescribe medicines using their generic names devoid of any abbreviations and this is monitored through quarterly prescriber care indicator studies.

The working environment of the health worker, poor lightening at the place of work, poor ventilation, workload, tiredness and frame of mind of the health professional have also been implicated as causes of medication errors.

REPORTING MEDICATION ERRORS

The occurrence of errors is inherent in any human activity. Prevention of medication errors is linked to accurate reporting of medication errors. It is estimated that 95% of medication errors are not reported because staff fear punishment. The important thing, from the institutional point of view, is to have adequate means for their communication, evaluation and correction of the involved processes.

It is essential to establish an environment of trust among the professionals involved, so that communication occurs effectively and continuously. This trust must also be associated with the evaluation process, where the focus is to identify risks and gaps in the medication use system. The corrective measures may include changes in the system itself, as well as educational measures for the care team.

Medical professionals, including physicians, nurses and pharmacists, do not deliberately commit medication errors. They are trained to deliver “error free” health care. However, when errors are discovered, there is an attitude of placing “blame” on the professional(s) involved in the incident. Formal punishment by the individual’s profession is sometimes administered, resulting in fines, license suspension or even license revocation. More importantly, the individual may be punished by the lost respect of his or her fellow health care professionals, which may be even more devastating than a professional reprimand.

When medication errors are concerned, the question of who was involved is of less importance than what, how and why the system went wrong. An investigation of medication errors should begin with an analysis of the medication use process and delivery channels within a health care system, rather than result in punitive action directly targeted to the health care provider involved with the error.

Although there is no acceptable level of error within the medical care system, the goal of health care organizations should be to evaluate errors when they occur and to make changes in the drug delivery process to prevent them from reoccurring in the future or elsewhere.

Health care professionals and consumers have the opportunity to report the occurrence of medication errors to a variety of organizations. Examples include the Institute of Safe Medication Practices (ISMP) in the USA and the Food and Drug Administration (FDA) in Ghana. These organizations collectively review error submissions. Case reports are published to educate healthcare professionals regarding errors and near errors. In some cases, the FDA may work with drug manufacturers and others to inform them about concerns with pharmaceutical labeling, packaging and nomenclature to enable them make appropriate changes to reduce the risk of medication errors.
At the University of Cape Coast Hospital all reported medication errors are documented and reviewed.

**PRACTICE AT UCC HOSPITAL PHARMACY**

The dispensing area at the University of Cape Coast Hospital pharmacy is well designed to minimize medication errors. There is adequate lighting that enables personnel to read prescriptions and dispense medicines appropriately with good ventilation to maintain the quality of medicines throughout their shelf life. Interruptions at the dispensary are kept at a minimum by restricting access to only pharmacy staff and forbidding the use of mobile phones.

To prevent medication errors at the pharmacy all in-coming prescriptions go through three processes. The prescription is first reviewed to rule out any medication errors before inputs are made onto a computer using software known as the PHIS. Any order that is incomplete, illegible or of any other concern is clarified with the prescriber before it is dispensed. Then, a second person pre-packs all the medicines on the prescription form after which a different person labels and dispenses the medications. This is the standard operating system of the pharmacy. By so doing any medication error that is missed by one person will be identified and prevented by the next person.

**RECOMMENDATIONS**

**BAR CODING**

One way in which electronic technology can improve patient safety and reduce medication errors is through the use of standard machine-readable codes ("bar codes"). Medication bar coding is a tool that can help ensure that the right medication and the right dose are administered to the right patient. Today’s technology imbeds increasing amounts of information within a scannable bar code on even the smallest packages. The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) recommends that the US Food and Drug Administration (FDA), the United States Pharmacopeia (USP) and pharmaceutical manufacturers collaborate to have the following information imbedded into a medication barcode:

- National Drug Code (NDC) number which identifies the unique drug, dosage form and strength
- Lot/Control/Batch number, which assists in cases of product recalls
- Expiration date, which helps to ensure that patients do not receive expired medications

**Electronic Prescribing**

Utilization of electronic prescribing by entering orders on a computer, better known as Computerized Physician Order Entry (CPOE), is a technology that can help prevent many medication errors. CPOE systems allow physicians to enter prescription orders into a computer or other device directly, thus eliminating or significantly reducing the need for handwritten orders. E-prescribing and CPOE can reduce medication errors by eliminating illegible and poorly handwritten prescriptions, ensuring proper terminology and abbreviations and preventing ambiguous orders and omitted information.

More advanced CPOE software incorporates additional safety features that allow the physician to have access to accurate patient information, including patient demographic information such as age, medication history and medication allergies.

**Electronic Drug Utilization Reviews**

Due to the technology of the electronic prescription record, pharmacists are able to conduct prospective online drug utilization reviews (DUR). The online DUR process allows the pharmacist to conduct a review of the prescription order at the time it is presented for filling and proactively resolve potential drug-patient problems such as drug-drug interactions, over-use, under-use and medication allergies. This technology allows the pharmacist to assess the prescription order at the time of dispensing and using information from the patient’s medical and/or pharmacy record, determine the appropriateness of the prescribed medication therapy.

Medication safety issues commonly addressed in an online DUR process include the following:

- Drug-disease contraindications
- Drug-drug interactions
- Incorrect drug dosage
- Inappropriate duration of drug treatment
- Drug-allergy interactions
- Clinical abuse or misuse

**AUTOMATED MEDICATION DISPENSING**

Automated medication dispensing systems are now widely used as a less labor-intensive method of dispensing medications. Automated pharmacy dispensing systems are more efficient at performing pharmacists’ tasks that require tedious, repetitive motions, high concentration and reliable record keeping, which can all lead to medication dispensing errors. When utilized appropriately, automated
medication dispensing systems help to reduce medication errors and improve patient safety.\textsuperscript{36}  
Many automated dispensing systems utilize the bar coding technology discussed earlier to ensure the right drug, dose and dosage form is used.  
The University of Cape Coast Hospital is considering the implementation of this system by the year 2109.

CONCLUSION  
In summary, medication errors are an unfortunate part of the health care delivery system. Health care provider attitudes must change in the approach to prevention of these errors. Patient education is an important aspect of any program to prevent medication misadventures.  
Organizations such as ISMP and the FDA, as well as individual managed care organizations can help to evaluate the cause of medication errors. The collection of data on medication errors and analysis of the health care delivery process will minimize the risk of medication errors and improve patient safety.  
The health care community must recognize that both people and systems contribute to medication errors. The focus should be on identifying the error-prone aspects of the medication use continuum with the goal of improving system safety and reliability rather than punishing the individual who committed the error.  
Neither committing nor reporting an error should become the basis for disciplinary or punitive action by an employer.\textsuperscript{32} Every error should be examined to determine what elements in the system allowed it to happen. In this way, those who manage health systems can learn from error and determine what corrections are needed to prevent similar errors in the future.  
Medication error reduction programs are necessary to achieve improvement in patient care and to satisfy the public demand for a safer health care system. Consumers expect a system of high integrity that will serve them well and not be a cause for peril when health care is needed. They want and deserve to be confident in the safety of the health care system. Those who pay for health care services (government, employers and individuals) would benefit from a reduction in costs that would result from the reduction in adverse events associated with medication errors.\textsuperscript{37}

REFERENCES  
14. Medication Error Book.(2013) University of Cape Coast Hospital Pharmacy  