MEDICATION ADMINISTRATION ERRORS

Medication safety is a significant part of the overall concern about the safety of the U.S. healthcare system. In 1999 the Institute of Medicine (IOM) released a report titled "To Err Is Human: Building a Safer Health System." The report estimated that medication errors cause 7,000 deaths annually. In Missouri the most frequently cited deficiency during Medicare certification surveys of LTCFs includes problems with communication of physician orders and medication administration records.

Many factors contribute to medication errors. This document provides examples of typical medication errors, and hazards that may lead to errors, based on medication orders and medication labeling. The examples may not all be applicable to the LTCF setting, but illustrate potential hazards that may occur with other medications.

Liquid Dosage Forms

Liquid products provide potential hazards for many reasons, including:

- The order may specify only a volume dose rather than a mg dose
- The strength or concentration may not be specified in the order, and multiple concentrations may be available
- Droppers or other dosing implements may be marked specifically for one product and are not interchangeable with others
- Products of the same concentration may be labeled and packaged differently
- The prescriber may incorrectly use a term such as elixir, syrup, solution, drops or concentrate that implies a specific product or concentration
- Labeling on the package may not clearly identify the product
- Different concentrations may be dispensed for orders written at different times

Because of the hazards of multiple concentrations and multiple types of preparations, orders should always include the specific mg dose to be administered. The order should include the specific concentration or brand name to be used when either of these is an important factor for dispensing or administering. Pharmacy labeling should always include the concentration.

Other reported errors in administering liquids due to misreading orders or labels also include:

- Administer as teaspoonful(s) when ordered as mL
- Administer as mL when ordered as mg
- Administer ten-fold overdose when order written without "leading zero" in front of decimal point (written .5 mL instead of 0.5 mL, administer 5 mL)
- Administer ten-fold overdose when order written with "trailing zero" after decimal point (written 1.0 mL instead of 1 mL, administer 10 mL)
- Unit dose cups of different drugs from the same manufacturer, especially generic labeled drugs, often have very similar labels and are the same physical size. Different dose quantities of the same drug are also packaged in the same physical size containers.

Opioid (narcotic) liquid products, primarily morphine and oxycodone, have been involved in dispensing and administering errors because of their multiple products with similar names,

the same concentration for different drugs, same size containers, and similar package labels. Available products include:

- Morphine 10 mg/5 mL
- Morphine 20 mg/5 mL Roxanol
- Morphine 20 mg/mL Roxanol, Roxanol T
- Morphine 100 mg/5 mL Roxanol 100
- Oxycodone 5 mg/5 mL Roxicodone
- Oxycodone 20 mg/mL Roxicodone Intensol
- Oxycodone 5 mg/5 mL w/acetaminophen Roxicet

Errors have resulted in massive opioid overdoses because products vary up to twenty times in potency.

Chloral hydrate is available in both 250 mg/5 mL and 500 mg/5 mL concentrations. Many medication errors, including fatal overdoses, have been reported. Problem order examples are:

- Chloral hydrate 5 cc prn sedation
- Chloral hydrate 500 mg 30 " before office visit
- Chloral hydrate 250 mg/5 mL, 12 mL before procedure

In the second example, the physician meant the "symbol to represent minutes (although it actually means seconds), but the pharmacist read it as cc. In the third example the pharmacist dispensed 120 mL, a common dispensing quantity, rather than 12 mL, for a single dose.

Acetaminophen is available in several concentrations from many manufacturers variously labeled as liquids, solutions, elixirs, suspensions, concentrates, and drops. For example:

- 80 mg/0.8 mL Drops
- 80 mg/1.66 mL Liquiprin Drops
- 80 mg/2.5 mL Elixir
- 80 mg/5 mL Elixir
- 100 mg/mL Tylenol Infant Drops, Tempra 1
- 120 mg/5 mL Elixir
- 160 mg/5 mL Suspension, Tylenol Children's Elixir, Tempra 2 Syrup
- 500 mg/15 mL Tylenol Extra Strength Liquid

Many errors have been reported because orders were written specifying only the volume amount to administer, e.g. "Tylenol 10 cc prn fever," or "Tylenol syrup 1 tsp." On at least one brand the concentration is listed on the outer carton and not on the bottle, and the dropper does not contain an mg dose graduation. Some facilities may keep this medication as a non-prescription stock item, and keep only one concentration. The Tylenol Infant Drops bottle is designed to admit a dropper, but prevent pouring from the bottle.

Ferrous sulfate iron supplement liquid products are available as:

- 90 mg/5 mL (18 mg of elemental iron/5 mL) syrup
- 220 mg/5 mL (44 mg elemental iron/5 mL) elixir

- 75 mg/0.6 mL (15 mg elemental iron/0.6 mL) drops

One product is labeled as both "Ferrous Sulfate Solution" and "Iron Supplement Drops." It is very important for orders for these products to be clear and complete. Both the mg dose and the concentration should be specified in the order to eliminate confusion about ferrous sulfate vs. elemental iron doses, e.g.: "Ferrous sulfate 220 mg/5 mL, 220 mg 3 times daily" or "Elemental iron 15 mg/0.6 mL, 30 mg 3 times daily."

Look-alike Names

Same indication for use

The available list of look-alike names is quite extensive. Some of these have the same indication for use, which may contribute to comfort in a wrong interpretation. For example, Procet and Percocet are both analgesics, and Panlor DC and Synalgos DC also are both analgesics.

Same strength, same dosing frequency

Look-alikes available in the same strength, and with similar dosing frequencies, make differentiation difficult. Reminyl (for Alzheimer's) and Amaryl (antidiabetic) are both available as 4 mg tablets and may have the same dosing frequency.

No indication for use specified in order

A look-alike product Occlusal (a salicylic acid solution for removal of warts and calluses) was improperly ordered instead of Ocuflox (an antibiotic solution for ophthalmic use), with the instructions to "Use as directed." Without an indication for use or specific directions, the pharmacist was not aware that the wrong product had been ordered, but an inquiry prevented possible serious damage to an eye.

Use TALLman Letters

The FDA recommends that manufacturers use TALLman letters to help differentiate look-alike names. Pharmacies, facilities, and individuals would also benefit from using this concept. Each facility should develop a list of look-alike names commonly used in the facility and the recommended TALLman format.

- Chlorpropamide chlorproPAMIDE
- Chlorpromazine chlorproMAZINE
- Tolazamide TOLAZamide
- Tolbutamide TOLBUTamide

Combination Products

Products that contain multiple active ingredients are often available in a single, fixed combination with a name that does not include a strength, such as:

- Tylox (oxycodone 5 mg/acetaminophen 500 mg)
- Roxicet Solution (oxycodone 5 mg/acetaminophen 325 mg per 5 mL)
- Lortab Elixir (hydrocodone 7.5 mg/acetaminophen 500 mg per 15 mL)

Orders for higher doses may specify the dose of the primary ingredient, such as "Tylox 10 mg," which requires knowledge of the content of the dosage form.

When more than one strength of a combination is available the name may include the strength of the active ingredients, or may be a variation of the basic name that indicates a different strength, such as:

- Lortab 2.5/500 (hydrocodone 2.5 mg/acetaminophen 500 mg)
- Lortab 5/500 (hydrocodone 5 mg/acetaminophen 500 mg)

- Lorcet HD (hydrocodone 5 mg/acetaminophen 500 mg)
- Lorcet Plus (hydrocodone 7.5 mg/acetaminophen 650 mg)
- Lorcet 10/650 (hydrocodone 10 mg/acetaminophen 650 mg)

- Vicodin (hydrocodone 5 mg/acetaminophen 500 mg)
- Vicodin ES (hydrocodone 7.5 mg/acetaminophen 750 mg)
- Vicodin HP (hydrocodone 10 mg/acetaminophen 660 mg)

- Roxicet (oxycodone 5 mg/acetaminophen 325 mg)
- Roxicet 5/500 (oxycodone 5 mg/acetaminophen 500 mg)
- Roxilox (oxycodone 5 mg/acetaminophen 500 mg)

Codeine and acetaminophen or aspirin combination products have traditionally been named with the abbreviation "No." indicating the codeine content, for example:

- Tylenol with Codeine No. 1 (codeine 7.5 mg/ acetaminophen 325 mg)
- Tylenol with Codeine No. 2 (codeine 15 mg/ acetaminophen 325 mg)
- Tylenol with Codeine No. 3 (codeine 30 mg/ acetaminophen 325 mg)
- Tylenol with Codeine No. 4 (codeine 60 mg/ acetaminophen 325 mg)

The product "Tylenol with Codeine No. 3," for example, is commonly referred to as "Tylenol #3." Errors occur when codeine 30 mg/acetaminophen is ordered as "Tylenol #3," and three tablets of plain Tylenol are administered.

It is important that the content of any combination product is known by the prescriber, dispenser, and person administering, and that the dose is clearly specified. The dispensed product should be clearly labeled with the brand name and the strength of the product.

"Extended Release" Products

Various terms, including "extended release" and "sustained release," indicate dosage forms that provide drug availability from a single dose over an extended time period. Although the terms are used generically they may have specific meanings within brand names. It is important to differentiate between orders for "immediate release" and various "extended release" dosage forms of the same drug, as the same strength may be available in multiple forms.

Most immediate release forms are not identified as such, although one company does identify some products with an IR suffix. "Extended release" products usually include a suffix such as ER, CR, TR, SR, CD, SA, LA, XL, XT or Contin. The suffixes do not imply an equivalent meaning between different drugs or different brands. Some products from a single manufacturer may have more than one extended release form. Different suffixes may indicate a different dosage form, different length of action, or different indication for use:

- Cardizem (immediate release tablet) 30, 60, 90, 120 mg
- Cardizem SR (sustained release capsule) 60, 90, 120 mg
- Cardizem CD (extended release capsule) 120, 180, 240, 300, 360 mg
- Cardizem LA (extended release tablet) 120, 180, 240, 300, 360, 420 mg

Multiple units of the same "extended release" dosage form do not always produce the same effect as a single unit of the same dose and dosage form. For example, two 25 mg units may be equivalent to one 50 mg unit, but three 25 mg units may not be equivalent to one 75 mg unit. Do not combine units for changes in dose unless authorized by the physician or pharmacist.

Verbal Communications and Sound-Alike Names: "Read Back"

One of the most valuable methods of eliminating medication errors based on communication problems is the "read back" procedure for telephone orders, and it is a 2005 JCAHO Long Term Care National Patient Safety Goal. This procedure is commonly used in some industrial and service sectors, but healthcare personnel have traditionally been "too busy" to do this.

The person receiving the order should write the order down and "read it back," including the spelling of any drug name that might be confusing and stating in words the meaning of any abbreviations used. "Reading back" rather than "repeating back" assures that the receiver has both heard and transcribed the order correctly. Any corrections should be written and confirmed by again "reading back."

Prohibited Abbreviations

Each facility should develop a list of abbreviations that may not be used in the facility in handwritten, pre-printed, or electronic format. Please review the list of error-prone, dangerous abbreviations and their possible misinterpretations in the separate document. The nine most dangerous abbreviations that should never be used are:

- U
- IU
- QD
- QOD
- Trailing zero after decimal point (2.0 mg)
- Lack of leading zero before decimal point (.2 mg)
- MS
- MSO4
- MgSO4

Additional high-risk abbreviations and suggested replacements include:

- ug mcg
- HS half-strength or at bedtime
- TIW 3 times weekly or three times weekly
- SC Sub-Q, subQ or subcutaneously
- SQ Sub-Q, subQ or subcutaneously

- D/C discharge or discontinue
- cc mL
- AS left ear
- AD right ear
- AU both ears
- OS left eye
- OD right eye
- OU both eyes

Do not abbreviate any drug names.

Microgram vs Milligram & Confusing Decimal Point

Levothyroxine is often ordered in micrograms rather than milligrams, requiring conversions that often result in decimal point errors, especially when performed mentally (25 mcg = 0.025 mg, 250 mcg = 0.25 mg). The pharmacy label should always include the term used in the order.

Levothyroxine is available in strengths from 0.025 mg to 0.3 mg, and specific doses may require the use of multiple tablets or multiple strengths. Orders for 0.25 mg have often been erroneously written or dispensed instead of 0.025 mg, resulting in ten-fold overdoses.

Leading/Trailing Zero

Omitting a leading zero or adding a trailing zero, as described earlier. A levothyroxine order for "Levoxyl, 25 iQD" was intended to be 0.25 mg (250 mcg) but was dispensed as 25 mcg (0.025 mg). Orders such as "Synthroid 25.0 mcg" are also interpreted as 250 mcg. An order for "levothyroxine 0.75 mg," which is an extremely high dose, should have been 0.075 mg.

An agreement between the facility, prescribers and pharmacies to use consistent terminology and format in orders and labels would help alleviate the problems associated with micrograms/milligrams, decimal points and zeros.

Spacing, Commas and Punctuation

Use proper spacing between words, numbers, and punctuation. Numbers written closely to names can be misinterpreted. Place commas and periods or decimal points appropriately close to the words or numbers they are used with:

- propranolol20mg is easily misread as 120 mg
- 10U has been misread as 100
- Levoxyl . 25 was misread as Levoxyl 25

Commas should be properly spaced for dose numbers expressed in thousands. Do not use the Latin abbreviation M to express thousands, as it is sometimes used as an English abbreviation for millions:

- 5,000 units, instead of 5000 units or 5 M units

Use the word thousands for doses in the hundreds of thousands:

- 150 thousand units, instead of 150000 units or 150,000 units

Write out the word million for doses expressed in millions:

- 5 million units, instead of 5000000 units or 5,000,000 units or 5 M units

Do not use periods after dosage unit abbreviations. An unnecessary period can be misread as the numeral 1 if written poorly:

- mg instead of mg.
- mL instead of mL.

Best Practices

There are many valuable "best practices" recommendations to prevent communication errors, such as facility requirements for order format, terminology, prohibited abbreviations, a specific process for clarifying any unclear order, labeling, limiting concentrations used, and use of automated technology.

Persons interpreting medication orders should be aware of the concept of "confirmation bias," where a person selects what is familiar or expected, rather than what is actual. It is human nature to associate items by certain characteristics, and familiarity with certain products may cause a person to see what they think it is, rather than what it is.

The CMT can help prevent medication errors by being alert to the types of medications and orders that are prone to misunderstanding and by confirming basic information about the medication and resident prior to administering.