Drug Storage

PHARMACEUTICAL COMPANIES spend a significant amount of time studying the effects of various drug storage protocols. In addition, pharmacies must maintain proper medication storage conditions to ensure drug quality. Product expiration dates are based on ideal storage conditions. Pharmacies must have a system for classifying and/or organizing all medicines, and some products may require special storage.

Objective:

Review approved drug storage procedures and drug storage temperature standards.

Key Terms:

- compounded medications
- controlled substances
- efficacy
- generic drug name
- intravenous
- narcotic
- ophthalmic
- oral
- potency
- topical
- United States Pharmacopeia (USP)

Understanding Drug Storage

When pharmaceutical companies develop medications, they examine many factors: effective dose, drug administration, safety, and efficacy. **Efficacy** is the ability to produce a desired effect (e.g., the desired drug effect). Drug companies also spend a significant amount of time studying the effects of various drug storage protocols. These studies determine if the medication is stable at room temperature, needs to be refrigerated, or needs to be frozen.

APPROVED DRUG STORAGE PROCEDURES

Certain procedures exist to ensure safety.

Labeling and Storing Drugs

After drugs are received in the pharmacy, they must be stocked or shelved under proper labeling and storage conditions. All pharmaceutical products should be stored in containers that do not adversely affect the quality of the product and that provide adequate protection from external influences. Drugs must be stored properly to:

- Avoid deterioration
- Avoid contamination
- Maintain packaging integrity
- Guarantee quality and **potency** (the capacity to produce strong physiological or chemical effects)
- Reduce prescription errors

Drug storage environments include the following characteristics:

- Adequate temperature
- Sufficient lighting
- Clean conditions
- Humidity controls
- Cold storage facilities
- Adequate shelving

FIGURE 1. Drug storage areas are designed to ensure approved conditions. These areas should be clean and maintained within acceptable temperature limits to ensure that all medications remain safe and effective for the consumer.

Hospital Pharmacies

Most hospital pharmacies organize drug storage according to a precise system. Two systems of organization are used by most facilities: route of administration and alphabetical order.

Route of Administration

Typically, medications are categorized and placed in defined areas of the pharmacy based on the specific route of administration, such as:

- **Intravenous** is medication administered into a vein.
- **Ophthalmic** is medication related to the eye.

- **Topical** is medication applied directly to a part of the body.
- **Oral** is medication related to the mouth. Oral drugs may be further divided into solid dosage forms (capsules and tablets) and liquids (suspensions and solutions) and placed in separate areas.

Alphabetical Order

Another way medications are organized is in alphabetical order using the generic name of each drug. A **generic drug name** is the chemical name of a medication marketed under its chemical composition rather than a brand name. Medications should be stored in their original packaging. For example, Diazepam is a chemical name (generic name) of a sedative. It is marketed under several other names, including Valium.

Controlled Substances

A **narcotic** is a controlled substance or drug that relieves pain. **Controlled substances** are drugs whose manufacture, possession, or use is regulated by the government. Narcotics and other controlled substances are often stored in a secure area of the hospital pharmacy. These drugs may be placed in a locked cabinet or in an automatic dispensing cabinet that requires a personal code and password.

Compounded Medications

Hospital pharmacies typically have a separate storage area for intravenous bags and medications that have been compounded. **Compounded medications** are treatments produced by combining two or more ingredients or parts; they are often prepared in anticipation of a prescriber order.

FIGURE 2. All compounded medications and intravenous fluids must be stored in an environment that protects them from extreme temperature changes and light, according to the manufacturer's guidelines.

Retail Pharmacies

Medications stocked in retail pharmacies can be organized in several ways.

Alphabetical by Medication Name

In some pharmacies, organization of medications is alphabetically by the medication name on the bottle. In this case, similar brand and generic products may not be located next to each other.

Alphabetical by Brand Name

In some pharmacies, organization of medications is alphabetically by brand name, with the generic located next to the brand name product.

Alpha-Generic

In some pharmacies, organization of medications is alpha-generically in which all products are stored in alphabetical order by their generic name.

Alphabetical by Subgroups

In some pharmacies, organization of medications is in alphabetical order, but drugs are assembled into subgroups (section categories). For example, section-specific categories could include the following, with all in alphabetical order within each section:

- Eye drops
- Liquids
- Suspensions
- Topicals
- Capsules and tablets

Separate Sections

Some pharmacies have separate sections for certain types of medications that are not "mixed in" with the stock bottles of pills. Separate areas may include:

- Birth control pills
- Liquids
- Topical treatments
- Injectable medications
- Inhalers

Fast-Moving Medications and Controlled Substances

Some pharmacies store fast-moving medications close to the dispensing counter. In addition, controlled substances should be stored separately from other medications. These medications are generally kept in a locked cabinet or safe that only the pharmacist can access. Controlled substances may be organized alphabetically by brand, generic, or the name listed on the bottle.

- The building used to store controlled substances must have an electronic alarm system connected directly to a local law enforcement agency.

- The room in which controlled substances are stored must be equipped with self-closing and self-locking doors. The doors must be kept closed and locked at all times when not in use.
- Refrigerated controlled substances must be stored in a locked refrigerator separate from any other refrigerated medications. The room must be lockable and locked after hours.

Error Prevention Strategies

Regardless of the type of stock organization protocol used, similar error-prevention strategies should be incorporated. For instance, separating similar bottles or products that are different dosages of the same medications with dividers helps prevent technicians from pulling the wrong medication off the shelf to fill an order. Also, stickers or signs are used for high-alert medications or for those prone to more dangerous errors.

FIGURE 3. Organization and rigorous management of the pharmacy has been shown to markedly reduce errors when dispensing medication. Proper lighting, adequate counter space, and a comfortable temperature helps facilitate a smooth flow from one task to the next, thus reducing the chances of a dispensing error.

DRUG STORAGE TEMPERATURE STANDARDS

The temperature in a pharmacy can impact the effectiveness of certain medications.

USP

All medications have specific storage conditions determined by the manufacturer. All prescription drugs shall be stored at appropriate temperatures and under appropriate conditions in accordance with requirements, if any, in the labeling of such medications or with requirements set forth by the **United States Pharmacopeia (USP)**—a collection of legally recognized standards for drugs. Many medications are approved for storage at room temperature.

Room Temperature Storage

USP defines room temperature as a range between 59°F and 86°F or 15°C and 30°C. Drugs should not be stored above or below this temperature range unless authorized by the manufacturer. Some medications are sensitive to light and can decompose under these conditions. It is recommended to store medications in the original container or an amber-colored vial to decrease the transmission of light through the bottle.

FURTHER EXPLORATION...

ONLINE CONNECTION: Packing Vaccines for Transport

To maintain the safety and efficacy of vaccines, they must be stored properly according to the manufacturer's recommendations. Certain events (e.g., power outages, storage unit malfunctions, and natural disasters) can jeopardize a facility's ability to ensure that correct temperatures are maintained. A written emergency plan that specifies actions to take when faced with these situations will allow the facility to protect its vaccine stock. Visit the CDC website to review the article at

http://www.cdc.gov/vaccines/hcp/admin/storage/downloads/emergency-transport.pdf

Refrigerated Storage

Some drugs require refrigeration to maintain stability. Refrigerated temperatures are in the range of 36°F to 46°F or 2°C to 8°C. Medications should not be stored on the refrigerator door or in bins; they should be placed on shelves in the middle of the refrigerator to ensure the most stable temperatures.

- Thermometers should be placed in the refrigerator to maintain adequate temperatures.
- A temperature log is kept that documents the temperature of the refrigerator twice a day.
- Medications stored in the refrigerator are given space between each item to allow adequate airflow between products.

Frozen Storage

Frozen medications are stored between –13°F and –14°F or –25°C and –10°C. If a pharmacy stores frozen medication, it should be in a standalone freezer. The temperatures in a standalone freezer are more stable than temperatures in a freezer located on top of a refrigerator. As was true with refrigerated medications, with frozen medications:

- Thermometers are placed in the freezer to maintain adequate temperatures.
- A temperature log should be kept that documents the temperature of the freezer twice a day.

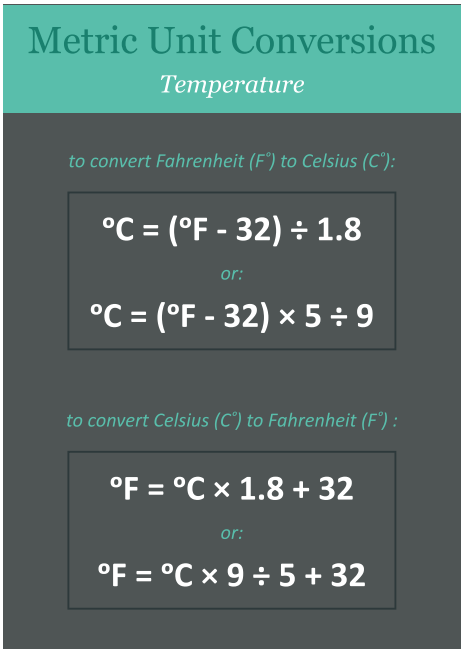

FIGURE 4. Employees must make sure drugs are placed in the appropriate area for storage. If you are unsure of proper storage, check with the pharmacist or look at the package or product labeling under the "storage and stability" section. When necessary, convert °F to °C and °C to °F to ensure safe drug storage.

Medication Storage Temperature Terminology

- Freezer storage: Any temperature between –13°F and –14°F or –25°C and –10°C
- Cold storage: Not to exceed 46°F or 8°C
- Cool storage: Any temperature between 46°F and 59°F or 8°C and 15°C
- Room temperature storage: Any temperature between 59°F and 86°F or 15°C and 30°C
- Warm storage: Any temperature between 86°F and 104°F or 30°C and 40°C
- Excessive heat storage: Any temperature above 104°F or 40°C
- Dry storage: Conditions do not exceed 40 percent humidity at room temperature

Summary:

Maintaining proper storage conditions for medications is essential to ensuring the quality of the drug. All medications have specific and optimal storage conditions determined by the manufacturer. All prescription drugs must be stored at appropriate temperatures. They must also be stored under appropriate conditions in accordance with labeling and/or other requirements set forth by the United States Pharmacopeia. Also, hospital pharmacies and retail pharmacies must each have a system for classifying or organizing medicines to ensure their safety and efficacy. Some products may require special storage. It is important to clearly identify special storage products and ensure that all employees understand how to properly store all medications.

Checking Your Knowledge:

1. Explain why drugs must be stored according to the manufacturer's guidelines.
2. List five environmental conditions that should be considered when storing medications.
3. Describe how a hospital pharmacy organizes drugs according to routes of drug administration.
4. Explain how medications are organized in the retail pharmacy.
5. Describe what is meant by the following drug storage terms: room temperature, refrigeration, and freezer temperatures.

Expanding Your Knowledge:

Visit your local pharmacy. Ask the pharmacist to explain which organizational system is used for storing medications. Ask to see the refrigerated or freezer storage areas and see the log sheet used to document temperatures. Share your findings with the class.

Web Links:

Drug Standardization, Storage, and Distribution
http://www.ismp.org/communityRx/aroc/files/KEV.pdf

Mistakes in Storage May Alter Medication
http://www.nytimes.com/2011/08/16/health/16consumer.html

Storing Meds in the Fridge or Freezer
https://www.pbahealth.com/wp-content/uploads/2014/07/Technician_Tutorial_Stay_Cool_Storing_Meds_in_the_Fridge_or_Freezer_.pdf