Physical Environments That Promote Safe Medication Use

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In 2010, the U.S. Pharmacopeia (USP) published a new chapter on environments that promote the safe use of medications. The chapter describes the optimal physical environment needed to promote accurate medication use and how organizations can establish a safe workplace. Standards are provided in five key areas—illumination, interruptions and distractions, sound and noise, physical design and organization, and medication safety zones. This article discusses each area as well as recommendations from the new USP chapter.

ILLUMINATION

Improper lighting has contributed to medication errors. In a case cited in the USP, poor lighting led to the incorrect attachment of tubing to a patient-controlled analgesia (PCA) unit, causing the medication to run onto the floor. In another instance, dicyclomine (e.g., Bentyl, Axcan Scandipharm) 10-mg capsules were used to fill a prescription for 20-mg capsules because of poorly lit pharmacy shelves. Proper lighting improves accuracy and efficiency of medication-related tasks. Lighting should be brighter for workers older than 45 years of age and near the end of the work shift, when visual fatigue increases. The USP recommends the following steps to promote safety:

1. Fluorescent cool-white lamps or compact fluorescent lamps should be used.
2. Adjustable 50-watt, high-intensity task lights are preferable in areas where critical tasks are performed, including on mobile medication carts, in automated dispensing cabinets, and in patients’ rooms for nighttime administration of medications.
3. All lighting should be positioned to avoid glare on computer monitors.
4. Magnifying glasses should be provided to facilitate reading of labels with very small script.
5. Lighting fixtures should be routinely cleaned, as lighting levels can decrease by 25% over a period of 2 years if the fixtures are not cleaned.
6. Illumination levels should be approximately 100 foot-candles (lumens per square foot) in areas where critical tasks are performed in the pharmacy and on patient-care units.
7. An illuminance meter should be used periodically to determine the ambient brightness. The meter should be placed in key areas with the worker standing in a normal working position. In medication storage areas, readings should be taken on the top, middle, and bottom shelves.

INTERRUPTIONS AND DISTRACTIONS

Almost 45% of medication errors are attributed to distractions. In one pharmacy study, the most frequent sources of interruptions were requests by coworkers who asked for assistance. Because individuals have differing levels of distractibility, preventing interruptions is best accomplished by providing staff with the ability to control their exposure to disturbances. To maximize staff concentration when critical tasks are being performed, the USP recommends the following:

1. The potential for distractions should be kept to a minimum in critical medication-use areas.
2. Workers should be advised to avoid interrupting coworkers for non-urgent reasons while they are performing medication-related tasks. Techniques to help prevent interruptions include physical barriers, checklists to focus and refocus attention, and visual cues, such as having nurses wear an orange safety vest when administering medications.

SOUND AND NOISE

Noise can interfere with effective work performance and may pose a health hazard to hospitalized patients. Hospitals are particularly noisy, with studies reporting an average of 45 to 65 decibels (dB) of noise with peaks between 85 and 90 dB. At shift changes, noise levels have been recorded as high as 113 dB, well above the peak levels set by the Environmental Protection Agency (EPA)—45 dB during the day and 35 dB at night—and by the World Health Organization, which calls for 35 dB of background noise in patient rooms. In fact, the EPA requires ear protection for workers exposed to sound levels averaging 90 dB.

Of 58 studies reviewed by the USP, 29 showed that noise impaired performance, but seven studies showed that it improved performance. In one of the seven studies, unpredictable but controllable sounds improved accuracy in filling prescriptions. This finding may indicate that some environmental stimuli are needed to maintain optimal alertness and attention. To maintain a safe level of noise, USP recommends the following steps:

1. Sound levels in medication-use areas should be at the level of conversation (50 dB), which is slightly higher than the EPA recommendation. This level helps to ensure that critical verbal information can be heard accurately. A total elimination of noise is neither feasible nor desirable.
2. A quiet area should be provided for the staff to use during tasks involving critical medications.
3. Installing material that absorbs sound (e.g., ceiling, wall materials, or carpeting if permitted by infection control) helps to reduce noise and other sensory interference. Acoustical engineers can identify additional methods of noise reduction.
4. Sound levels in work areas should
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be measured periodically. Meters should be capable of reading from 0 to 200 dB. Measurements should be taken with the meter held away from the body while the worker stands and points the meter at the source of sound.

Physical Design and Organization of Workspace

The physical design of the workspace can influence the ability of staff members to use information and perform tasks. The height of counters and drug-storage areas can affect visibility. Dispensing errors occur more frequently when medications are stored on cluttered shelves because the items are more difficult to differentiate. The design of the workspace can also contribute to poor lighting conditions, distractions, interruptions, high noise levels, and hazardous medication safety zones. To reduce the risk of errors, the USP suggests the following steps:

1. Areas where medications are stored should be kept organized and uncluttered. At least 1 inch of space should be allowed between each drug.
2. The height of the work counters and supply areas should enhance the efficiency of tasks and the visibility of products.
3. When possible, adjustable fixtures (such as task lights, counters, and screens) should be used to promote efficiency, visibility, and safety.

Medication Safety Zone

The USP defines a medication safety zone as any critical area where medications are prescribed, transcribed, prepared, and administered. Examples include work surfaces in a medication room or countertops on medication carts or automated dispensing cabinets, locations where prescribing decisions are made, pharmacies, and patients’ bedside or homes where medications are administered. Mistakes have been linked to the faulty physical design of these safety zones, and methods prone to error have been used within these zones. Applying principles described in human factors literature, the USP recommends the following steps:

1. Drug-preparation areas should be designed in such a way that critical processes are conducted in a manner similar to that of work in the cockpit of an airplane. The information necessary to make decisions should be available in a user-friendly format, and all drug and patient information should be placed together in the same area.

2. Information and components should be arranged within safety zones in a manner that promotes correct choices and decreases distractions according to these principles:
   a. Importance principle: Essential components should be placed in convenient locations. For example, the information about how to use the equipment and troubleshooting should be located near or on the equipment.
   b. Frequency-of-use principle: Frequently used items should be located in areas where they can be easily found to help prevent workarounds.
   c. Function principle: Items that are related to a function, such as syringes, needles, and alcohol swabs, should be grouped together.
   d. Sequence-of-use principle: Items should be placed in an order that supports the sequence needed to perform the task correctly. For example, staff members should encounter sterile gloves first when they are opening a dressing change kit.

3. The design of bedside medication-administration areas should be standardized so that drug information and supplies can be easily located.
4. Medical equipment (such as infusion pumps) should be standardized (limited in variety) to reduce mistakes during operation.
5. Current technologies (such as automated dispensing cabinets, electronic prescribing, bar coding, and electronic medical records) should be used.
6. Constraints (such as limited access and limited use) and forcing functions (designs that allow correct performance only) should be implemented to reduce errors with high-alert medications. For example, neuromuscular blocking agents in an intubation kit should be sequestered to prevent accidental administration to patients who are not receiving mechanical ventilation.

References


The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site (www.ismp.org) or communicated directly to ISMP by calling 1-800-FAIL-SAFE or via e-mail at ismpinfo@ismp.org.