



Making Medication Dispensing Safer for All



As today's hospitals seek ways of reducing medication errors and making drug dispensing safer for all, they are finding that work environments designed specifically to support this high risk work can do much to alleviate mistakes. Herman Miller,

Inc., has long-time research and experience in "human factors" as a primary design consideration. This expertise is proving to play a key role in helping hospitals create safer, more efficient and effective medication dispensing rooms.

Medication errors are a serious problem for hospitals; in the U.S. alone, it's estimated they account for more than 7,000¹ deaths annually. And it's no wonder: People are performing critical tasks— selecting patient meds—in stressful environments, often in cramped outdated spaces that were not designed to support today's fast-paced and complex activities. Mistakes happen, often with tragic results.

As hospitals struggle to find solutions to this serious and widespread problem, they're realizing that work environments designed with human factors in mind can do much to mitigate circumstances where accidents happen.

What we know

The issue of medical errors was brought to light in a seminal healthcare report called, *"To Err is Human: Building a Safer Health System."* Published in 2000 by the U.S. Institute of Medicine (OIM), it had a profound impact on the healthcare industry and launched numerous initiatives by hospitals in the U.S. and elsewhere to get at the causes of what are known in the industry as ADEs: Adverse Drug Events.² The key, of course, is prevention: What can we do to keep people from making mistakes when it comes to dispensing medications?

Adding to the challenge is the fact that pharmacology has changed dramatically in the last 10 years, from the increased use of prescription drugs to the numbers and types of medicines used in treatments. According to one estimate, in any given week four out of every five U.S. adults will use prescription medicines, over-the-counter drugs, or dietary supplements of some sort, and nearly one-third of adults will take five or more different medications.³

As health care professionals zero in on finding solutions to ADEs, the study of "human factors" has come to the forefront. The term refers to human capabilities and limitations that may have an impact on any given situation—particularly when interfacing with systems, designs, or equipment. Human factors range from the age and height of a person to his or her reactions to stress. In other words, anything about a human being that may affect the way he or she performs tasks.

Research—by Herman Miller and others in the industry—has determined several key human factors that contribute to errors in hospital med dispensing rooms. The following are the most significant causes:

1. Interruptions/distractions – Med rooms are busy areas, when people get interrupted or distracted, mistakes get made.⁴
2. Stress/tension – Working in close quarters in poorly designed spaces can create error-prone situations.⁵
3. Misreading labels – Many meds today have similar names; eye strain, especially with older nurses, fatigue (long shifts), and poor memory can contribute to errors in grabbing the wrong drug.
4. Storage/inventory – Cluttered shelves and drawers and not having meds all in one place leads to mixups.⁶
5. Layout/designs – Many work areas do not support work flow; nurses are often working close to each other, reaching around one another in small areas. Furthermore, there's little standardization in med rooms, all are laid out differently, adding to confusion.⁷

Additionally, the average age of nurses is nearly 50⁸, and their average shift length is 12 hours, which can further contribute to problems. In addition to sight and memory errors, reach and mobility may cause strain and pain if items are not within an appropriate reach zone.

Therefore

Examining the common causes of ADEs, researchers identified two key areas of focus:

- Practices involved in the medication delivery system (stocking, storing, preparing, administering, and documenting the administration of medications)
- Environment (the spaces and equipment available in the clinical areas to store, prepare, and administer medications)

Design Problem

"To Err is Human"⁹ perhaps summarized it best: The key is to "design systems that make it hard for people to do the wrong thing and easy for them to do the right thing." In other words: Address the causes of errors and provide a **safe, efficient** work environment that is **functionally** designed and has **sufficient room** for safe

medication storage and preparation, with a goal of providing the traditional "rights" of patients: that the **right medication**, in the **right dose**, by the **right route** is given to the **right patient** at the **right time**.

Design Solutions

Herman Miller's research has shown that designing spaces to mitigate the risk of human error is critical, says Kathy Okland, RN/MPH, Clinical Strategist for Herman Miller Healthcare. "Medication rooms that are not designed with human factors in mind only contribute to problems affecting staff and patient safety," she states. "All clinical settings should be easy to use and safe to support efficient and effective patient care." After one hospital in Canada experienced two fatalities as a result of medication mixups, it formed a multidisciplinary team to study the complex issues of medication preparation and dispensing from all possible angles.

The pioneering team consisted of nurses, pharmacy staff, architects, human factors consultants, Herman Miller Healthcare Clinical Strategists, designers, and others. Their objective was to "minimize human limitations" with a goal of decreasing error rates related to the preparation and dispensing of medications.

"The consideration of human factors played a key role in this whole process," states Julie Sless, Vice President of Herman Miller Canada's Healthcare Division. "With the information the hospital provided about what causes errors, we could look for solutions that could help mitigate them."

The Canadian team determined that to achieve their goals, the following critical areas relating to the design of the workspace must be examined and changed accordingly:

Medication preparation area

Workspaces should be functionally and ergonomically designed to:

- Allow enough physical space for a number of nurses to work in the space in an uncrowded manner
- Help minimize noise, interruption, and distractions
- Enable staff to easily and safely locate necessary medications and supplies
- Include appropriate task lighting
- Make required information resources readily available
- Enable ready access to computer drug information resources

- Keep all necessary medications and equipment in one location for ease of medication preparation
- Include ledges at eye level to allow for liquid medications to be poured at eye level/height.

Storage/stocking:

Storage areas should:

- Store medication at eye-level height, in a well lit area
- Include clear labeling of medications and storage containers
- Keep medications and equipment as close as possible to the point of delivery to the patient
- Enable safe visualization of the medications through color coding types of medications
- Be large enough to avoid overcrowded medication stock and reduce clutter
- Allow medications to be arranged alphabetically by drug formulation, i.e. oral, injectable, external
- Store high risk medications away from other medications
- Minimize need for staff to "hunt and gather" medications and equipment
- Organize controlled medications
- Improve storage strategies of multiple doses of the same medication
- Improve storage of "look-alike/sound-alike" drugs (e.g. dimenhydrINATE and diphenhydrAMINE)

Labels:

Labels on medication storage containers must be:

- Clear and large enough for staff to read safely
- Updated as recommended by the Institute of Safe Medication Practices (ISMP), including:
 - Legible, Arial font, bolded
 - Black print on white background
 - tallMAN lettering

The Herman Miller Healthcare Clinical Strategists knew that a well-designed, ergonomic environment could help alleviate many of the problems identified by the Canadian team. During the design process, every detail was examined and analyzed.

"We had to design the rooms so that there was enough space for nurses to move around with storage that was within easy reach.

We also had to separate the narcotics, provide access to computers, and so on," explains Sless. "It really became an exercise in mathematics because we only had so much space between the walls, especially in renovated areas."

As for cutting down on interruptions, the medication preparation areas were designated for that function only, which would help improve nurses' focus and concentration. Open medication areas were renovated into closed spaces and only medications and medication supplies were stored in these rooms; everything else was removed and stored in other areas.

The Herman Miller Co/Struc® system, made up of modular components, provided some key solutions in terms of storage:

- Overhead storage put reference resources within the nurses' reach zone.
- Medication shelves were placed according to the height and range of motion for the majority of nurses to provide easy access to medications, computers, and supplies.
- Deep drawers provided plenty of room to store meds and eliminated clutter.
- Drawer labels were made more legible with color-coding and larger font sizes for quick and easy identification.
- Labels were placed at eye-level and backed by well-placed task lighting and magnifying glasses to improve visual identification.

After finalizing the initial design, the team was hoping to create and test a template that could be used to standardize medication rooms as much as possible within hospitals, and, eventually, throughout the entire region. "The idea of familiarity is important because nurses not only move from one department or floor to another, but also from one hospital to another," emphasizes Sless. "If they're in basically the same setup, they don't have to spend time searching."

Research, too, shows that standardization makes remembering where things are much more intuitive, and therefore, less conducive to errors.¹⁰

However, part of the challenge in standardization is the fact that medication rooms are not at all consistent in size or shape, plus, some hospitals might be starting from scratch if planning to build

new; others may be renovating existing rooms. So the team needed to have basic principles in place, but couldn't be too rigid with one "cookie cutter" concept for every single room.

The Co/Struc modularity offered the hospital huge advantages during this process. "We started out with seven pilot rooms, which we could equip with what we thought was the best design, then went back later to reassess what worked and what didn't, and changed things accordingly," explains Sless. "For example, in one case we brought storage drawers down lower, in another case, we raised them up. It was all about providing control over the environment for nurses and making it as simple as possible for them to access what they needed. With (built-in) millwork, you're at the mercy of the way the room is constructed. If you need to make changes, even small tweaks, it's a major project and large capital expenditure."

Using the strategies outlined above, the Herman Miller team expanded their pilot program in Canada, and since 2008, more than 40 medication room renovations have either been completed or are underway.

Metro Health Hospital Begins Its Search

At about the same time the Canadian hospital was beginning to design its medication rooms, a Grand Rapids, Michigan, hospital, Metro Health, was in the process of planning a move into a new facility. They, too, wanted to create the safest possible work environment for dispensing medications, beginning with the pharmacy operation on the lower level of the hospital, where drugs are pulled, checked and dispensed to the hospital floors.

As Pharmacy Director Pete Haverkamp states, "The more we can do down here to make it easier for the nurses upstairs to find the right drug and get it to the patient without delay, the better."¹¹

When planning their pharmacy area, Mr. Haverkamp turned to Herman Miller dealership WorkSquared to help him create a safe, efficient environment that would support their important work.

Mr. Haverkamp also wanted to move staff members closer together to allow for easier collaboration. Previously, his office, the clinical

staff and the main pharmacy department were all located in different areas, which was inefficient and impractical.

So one of his first questions for WorkSquared was, "How do we create an environment that gives people their own separate work areas but supports professional collaboration as well? Because the closer we can work as a team, the better service we can provide to our patients," Haverkamp observes.

Another issue they wanted to address was comfort. With a pharmacy department that's open 24/7, pharmacists spend much of their time at computer stations reviewing orders. "And you don't want someone who's tired and uncomfortable reviewing orders," states Mr. Haverkamp.

Modularity Offers Advantages

"Initially, we had talked quite a bit about whether to go with casework or modular furniture, and we quickly validated that we made the right decision once we moved in," says Mr. Haverkamp about the advantages of modularity. "You see things on paper at the planning stage and think, 'Ok, that looks good!' But it wasn't until we began to 'live' with the space that we realized there were some things we wanted to change. We've already moved things around quite a bit, and had we gone with casework, we would not have been able to do that."¹²

Just as interruptions and distractions are problems for nurses in med rooms, they are also an issue for the pharmacists working behind the scenes.¹³ One of the most effective solutions for this was also the simplest and least expensive: Using a roll of red tape and a heavy-duty Action Office® system countertop, they created a 'safe zone' indicated by a strip of tape on the counter, where high-risk activities occur. Visually, it alerts the staff that when people are in that area they are not to be interrupted. Once that task is completed, the drug is moved to the "has been checked" area and technicians know that it is now safe to send the drug up to the hospital floor.



As in Canada, a color-coding system was also employed on the shelves where drugs were stored. Most standard drugs are in blue bins, but red bins are used to indicate "high alert" meds: these are products that are associated with some type of error and are potentially dangerous. This provides a visual clue to remind staff to slow down and be especially careful when pulling from this bin. Another type of container with a hard plastic top that must be opened manually is used for drugs that can be extremely dangerous, a further reminder to be cautious.



Co/Struc deep shelving storage proved to be ideal for managing inventory more efficiently. "We wanted to follow the design principle of having one spot for each product, so we didn't have products duplicated in two different areas, which is much more inefficient,"

explains Mr. Haverkamp. It's also safer because as the research shows, it lessens the chances of mistakes.¹⁴

As for creating a more collaborative work area for Mr. Haverkamp and his management team, which includes Clinical, IT and Purchasing, the combination of Action Office and Co/Struc systems is working well. "The fact that we are now close to one another and can just jump into conversations lets us operate more as a team," says Mr. Haverkamp. "It's a huge advantage when things come up like how we're going to manage a particular drug shortage, or whatever the issue is."

Herman Miller ergonomic seating has proved to be especially comfortable for the pharmacists on duty—and durable. "Our staff is extremely satisfied with the Mirra® chairs," says Mr. Haverkamp. "The quality has held up very well, too, especially compared to the chairs we purchased from another vendor for a different area. Those chairs always seem to be out for repairs while we haven't had a single one go out—and our pharmacists are in them a lot."

Equa® chairs, with more passive ergonomics, were used for the higher counters. They, too, provide comfort and quickly move up or down to accommodate individual users. Caper® chairs, which easily scoot around, were selected for the conference rooms and lounge area.

"We continue to observe what works and what doesn't and make changes accordingly," said Mr. Haverkamp about the entire pharmacy area. "We're very thankful that the furniture is flexible enough to allow us to do that."

Summary

Although definitive studies have not yet been conducted at either of the hospitals featured here, there is no doubt that the changes and improvements implemented over the past few years have had profound and positive effects on the way people work.

The feedback from nurses, pharmacists, and other staff at both hospitals has also been very positive; they not only appreciate the

new layouts and the workflows they support, they like the fact that if they do want to change or add something, they can.

In fact, Mr. Haverkamp advises that one of the first steps any hospital should take when making improvements is to talk to the people involved in the day-to-day work. Both Metro and the Canadian hospital sought the opinions of nurses, technicians, pharmacists and administrative teams during the planning stages. In other words, it's not just human factors that need to be taken into consideration, but human input as well.

As hospitals internationally embark on initiatives to improve the quality of care through Lean, Six Sigma, Releasing Time to Care, or other process improvement programs, modular changeable environments are critical to their ongoing success. Process improvement is a long journey, and the physical environment needs to adapt as new work process are implemented to optimize their effectiveness.

And as pharmacy and nursing staff age, it is important to accommodate their physical limitations. An environment designed with human factors criteria will make a significant contribution to staff and patient safety.


Speaking on behalf of the Herman Miller and dealership team, Julie Sless says, "We are extremely pleased to have played a contributing role in the safe dispensing of medication to patients. I feel that our resources and expertise truly helped solve a critical and important problem. Hospitals that are pro-active about making these types changes are breaking new ground in health care, and in the end, it will not only benefit all concerned, it might even help save lives."

References:

- ¹ *To Err is Human: Building a Safer Health System*, Institute of Medicine of the National Academies eds. Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson (Washington: National Academy Press, 2000), p. 2.
- ² "Preventing Medication Errors." Institute of Medicine of the National Academies, Report Brief, July 2006: 1.
- ³ *Ibid.*, p. 1.

- ⁴ Barclay, Laurie, MD, "Interruptions Linked to Medication Errors by Nurses," Medscape Medical News, p.1.
- ⁵ "Workflow by Design Part II: Changing the Environment to Increase Safety," ISMP Medication Safety Alert, Vol. 7, Issue 4, April 2008, p. 1.
- ⁶ Ibid., p. 2.
- ⁷ Ibid., p. 1.
- ⁸ "Old, But Not Out: The Aging Nurse in Today's Workplace," Stokowski, Laura A., RN, MS, Medscape Today, December 29, 2008, p. 1.
<http://www.medscape.com/medscapetoday>
- ⁹ "Preventing Medication Errors," Institute of Medicine of the National Academies, Report Brief, July 2006: 1.
- ¹⁰ "Standardizing the Storage and Labeling of Medications: Part 2," Institute for Safe Medication Practices Canada, CJHP, Vol. 60, No. 3, June 2007, p. 203.
- ¹¹ Interview with Pete Haverkamp, April 7, 2010.
- ¹² Interview with Pete Haverkamp, May 27, 2010.
- ¹³ "Workflow by Design Part III: Stages in the Dispensing Area," ISMP Medication Safety Alert, Vol. 7, Issue 5, May 2008, p. 2.
- ¹⁴ Ibid., "Workflow by Design Part II," p. 4.

© 2010 Herman Miller, Inc., Zeeland, Michigan

©  Herman Miller, Action Office, Capex, Co/Struc, Equa, and Mirra are among the registered trademarks of Herman Miller, Inc.