INSIDE YOU WILL LEARN ABOUT:

How Human Factors Ergonomics considers the interactions among staff members, patients, and equipment to support strategic design decisions.

The importance of creating design mock-ups and developing case studies to test designs in various use cases.

The value of cognitive walkthroughs with staff, patients, and family members to explore operations in new or renovated spaces and identify areas for improvement.

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How Applying a Human Factors Ergonomics Approach Helps Optimize the Design, Function, and Safety of Units at Yale New Haven Health System

You apply a Human Factors Ergonomics (HFE) approach for Yale New Haven Health System. Can you explain more about your role in this area and how it relates to the design process?

Jessica: Several years ago, our team was brought in to do orientation for staff on a new unit for a hospital in Yale New Haven Health System. I encouraged the group we were working with to start by taking a step back to really understand how people were going to function in the new environment, and to look at how the work would translate in the space. Leadership quickly saw the value of this approach, and we got their buy-in to look at other projects from a design-forward approach. This allowed us to sit at the design table from the beginning for other units and to bring in users during the design process. We also did some observation of users’ key actions so we could understand their needs. Since then, we have worked on other projects, helping to make sure designs incorporate a Human Factors Ergonomics approach.

Do most people in the healthcare field today really know what a Human Factors Ergonomics approach is? Can you explain the concept for our readers?

Jessica: When I tell people I have a PhD in Human Factors, I often get blank looks. Some of them don’t know what it means. Other medical professionals do know about Human Factors, but they are not necessarily thinking about it from a design point of view.

Human Factors Ergonomics is focused on how humans work in built systems. It can be anything from how they interact as a team, to how they interact with the room around them, to the interaction with the equipment itself, the placement of the equipment, the design, and really all aspects of the system.

Stephanie: It’s worth noting that even people who are aware of HFE often don’t recognize how comprehensive the field is. They may think about how they
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Interact with an infusion pump in a very narrow interpretation instead of thinking more broadly about working with that infusion pump in a physical space and interacting with people, technology, and teams. All of those elements are part of the equation.

When people talk about Human Factors being the mistakes people make, how do you help them understand a systems approach?

Jessica: I take a systems perspective. Human Factors Ergonomics is absolutely how you design the full system—it is not just design of the components of the system, but how they interact. By incorporating workers and patients throughout the design process and bringing in users to walk through their tasks, we are able to test whether all of the elements will support their efforts. We do this by observing existing units to see how they operate and by doing cognitive walkthroughs using mock-ups of the design plans to see how people will really operate in the space. This way, we can identify any areas that potentially need to be changed.

The key, particularly in design, is doing cognitive walkthroughs with staff early in the process. This provides tremendous information that can direct the design and can help avoid making mistakes and having to change them later. Whenever possible, we try to shadow staff in existing units to get some insights. Sometimes we have a service that is new, so we don’t have the opportunity to observe. But when we can, it makes the process richer.

Can you give any additional examples of using HFE in real projects?

Jessica: We recently helped with a new hybrid OR for advanced heart and vascular procedures within an existing surgical area of Bridgeport Hospital (one of the facilities in the Yale New Haven Health System). It is important to develop relationships with key groups. This project brought together a few teams that were already familiar with our work from previous projects, as well as new teams. It is not uncommon to encounter some resistance or questioning of our involvement when we work with new teams. Everyone quickly realized we were there to be helpful, and as a result, we got real buy-in from the teams.
Stephanie: Keep in mind that there is a lot of regulatory planning that goes into preparing for a unit move. That still goes on with Human Factors Ergonomics, but we try to make things feel more relevant. For example, we recently worked on a new Neonatal Intensive Care Unit (NICU). Initially, the unit had four open rooms full of isolettes where the nurses would just turn to ask the person standing next to them for help. The new NICU encompassed two separate floors, most with single patient rooms and some couplet rooms, so the mother and baby could stay together when possible. It was very complex, with a complete change of the physical layout and a corresponding change in how care is delivered.

The new NICU had new communication control panels. The nurses went through a few eight-hour training sessions on these panels several months before the unit opened. Since these monitors were incredibly important, we incorporated their use into our training, allowing the staff to refresh their skills prior to delivering actual patient care.

Another example is with a bariatric unit we worked on. We brought in the lifts and lift operators so we could see how the lifts operated as part of the staff’s day-to-day work.

To guide our efforts on all of our projects, we establish a current process map to capture our current state and a desired future map to illustrate the new process or desired changes.

Establishing a current process map and a desired future map sounds a lot like a Lean process. Can you elaborate on the differences of a Human Factors Ergonomics approach that is person based? How is that different?

Jessica: We take a similar approach to Lean, but our goal is looking at system interactions: Who is the personnel, how do they move in and out of the space, and how do they communicate? In fact, communication was a big issue for the OR catheterization project we mentioned. We were looking at the intersection of space and how the team worked and communicated within that space. It’s still process mapping, but looking at system interactions.
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**Stephanie:** A goal for both Lean methodologies and Human Factors Ergonomics is to optimize efficiency for patients and staff. HFE can also support a Lean methodology in terms of daily operations. But with HFE, it can be difficult to track financial savings because the savings are often in cost avoidance (financial or physical).

For instance, for the hybrid OR, we realized that our initial plan to locate the control room in a separate area was not necessary. To change that control room after it was built would have cost $60,000. But by figuring this out ahead of time, it is a cost avoided rather than money directly saved. If you avoid a safety event, how much does that save you?

**From the HFE point of view, how do you help people imagine new workflows? What are the best ways to uncover unintended consequences?**

**Jessica:** We use mock-ups of design plans for new units so we can walk staff through the space. Once you start walking people through the different scenarios, they start to understand a lot more.

**Stephanie:** One of the beauties of a physical walkthrough is that once people get in and start to experience it, they really start to envision what it will be like. They can see that if the machine is placed over there, they won’t be able to reach it from where they need to stand.

We’ve worked closely with architects and contractors with actual construction plans to make mock-ups out of hollow coreboard and metal studs to put up a physical representation of the design plans. Then, working with nurses or physicians, we build a patient case and walk them through it. The idea is to guide people through the steps of their work. We are not giving them the answers. The cognitive walkthrough teases out the pieces of the event and guides them through the process and interactions.

For the OR catheterization project, we went through simulated cases—bringing patients in, caring for patients in the mocked-up space—and really saw how their process plays out in the new space and what needed to change. For instance, if the team is performing a closed (minimally invasive) procedure and there is a complication that requires them to convert to traditional surgery V
(commonly called an open procedure), we discovered that we needed to modify the drive path of the equipment so it would get out of the way faster.

In another case, we reviewed the process for accessing medications in the storage room. We taped out the room with blue tape to mark equipment and furniture and guided participants through the events, asking them to describe their process.

The power of the cognitive walkthrough is that even without equipment in front of them, there are things that became clear. For instance, when pulling out a drawer, it became clear there wasn’t enough room. The cognitive walkthrough slows down the process so challenges can be identified and addressed.

What would you suggest to other organizations thinking about using HFE? What are some of the most basic HFE methods that can be used to optimize healthcare facility design?

Jessica: Organizations can start by finding a Human Factors systems professional to guide their efforts and to break the complex process down into manageable pieces. For instance, divide up the process into distinct phases (planning, design, construction, pre-opening). The methods we use at each phase are based on the goals and constraints of that phase—so, for example, in design we will utilize mock-up spaces to answer design questions. In pre-opening we will bring staff into the completed space to understand any changes in work process as well as to test for safety. At each phase, it’s important to consider the key elements for successful patient care, such as teamwork, patient satisfaction, and preparing people to translate their work. Tackling all of this is a huge undertaking and requires a full professional interdisciplinary team. The architects have to embrace the concept of having people help from a Human Factors standpoint, and you need to have leadership buy-in.

Initially, we did not start all of this at once. We started by figuring out how the new team would work in a new space and how they would care for and interact with patients. Not all projects involve construction, but for those that do, the HFE professionals need to be involved earlier to identify necessary changes while there is still time to make modifications.
**Stephanie:** At Yale New Haven Health, we started smaller and the program has grown. We also work very hard to meet tight deadlines before units open. If the leadership says you can have 24 hours for the space, you need to be willing to get in there and do whatever work you can get done in that short timeframe. We try incredibly hard to be as flexible as possible and work within the constraints, no matter how challenging they are.

**How do you think the HFE approach facilitates improvements to the patient and staff experience?**

**Jessica:** HFE involves staff in the design process and gives them an opportunity to have some input and control. It’s rewarding for them when they see someone in the design process really considering how they work and doing their best to support that work through design.

Similarly, patient advisor participation allows us to gather their perspectives and incorporate them into the design.

We have done a lot with the Patient Family Advisory Council through Yale New Haven, and they have been fabulous standing in as patients and families even in the mock-up stage for the bariatrics unit.

**Stephanie:** We also try to optimize the space for patient safety and comfort. For instance, we spent a lot of time on one unit talking about where the visitor/patient chair should go. Patients prefer it be near the window so they can look outside. However, some nurses resisted that idea because the location makes it more difficult for them to get to the patient. But really giving the patient that voice in the process makes a big difference. Therefore, we try to educate staff on the importance of including the patient’s viewpoints when it comes to making decisions.

This really goes a long way toward changing the culture. It puts the patients at the center of the experience, which is where they should be.