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Improving Healthcare

The Role of the Human Factors Specialist

What is human factors? How would you explain to a hospital director why they should hire human factors specialists?

Human Factors (HF) is the study of how people interact physically and psychologically with their environment—this includes the products, tools, procedures and processes they interact with. HF professionals use insights about human limitations, cognitive biases and social interactions to inform the design of clinical environments, procedures and medical devices. We also inform the selection and implementation strategy for products to purchase and use in clinical environments. HF engineering in healthcare aims to improve patient safety, minimise use errors and reduce training time associated with electronic systems, medical devices and compliance with procedures. For example, in some cases clinicians resist adoption of electronic health records (EHRs), leading to documentation workarounds or missing critical patient information. Traditionally, when we look into the reasons for this behaviour the finger has been pointed at the people at the sharp end; and the solution has been to require more vigilance. But the truth is that there are a number of factors beyond individuals, which are systemic factors that contribute to these kinds of problems and to patient safety incidents. HF experts are trained to identify systemic factors and to develop solutions and risk mitigations that address the root causes of such problems. An HF expert would go into the clinical environment to identify the barriers to adoption or compliance through the collection of objective data. With EHRs, the patient care documentation or medication ordering may require too many steps in a sequence that is not intuitive; or the EHR may not be well interfaced with other electronic systems, creating the need for additional data entry into multiple systems. Users may decide that documenting on paper is much faster and easier for them and their busy schedules, than having to go through many steps and trying to think about the order of steps that is not intuitive to them. If we think of hand hygiene compliance, soap and hand sanitizer dispensers may be positioned inconsistently in different rooms in a hospital, which could result in preventing clinicians from properly performing hand hygiene. An HF expert would identify such barriers to effective and efficient work, and then help the hospital develop mitigating solutions that improve such systems issues, rather than ask individuals to be more vigilant. Asking individuals to be more vigilant is essentially asking them to compensate for deficiencies in the system. However, the inherent risks in the system remain.

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How does Healthcare Human Factors work with University Health Network in Toronto?

Our team is embedded within the University Health Network (UHN) and we work with all the affiliated hospitals on improving patient care and safety. Human Factors is part of incident investigations, process and quality improvement, as well as staff and leadership training. Additionally, one unique area of work we do is support for procurement decisions of safety-critical equipment, such as infusion pumps, EHRs, patient monitors, ventilators, etc. The decision to purchase technology is a huge investment, and hospitals buy only once every ten to fifteen years. The decision traditionally has been based on cost and functionality. We worked with UHN to change that model by including HF as part of the decision-making processes. We, HF specialists at UHN, evaluate the contender products in a way that provides objective data acquired through simulations with UHN staff—those people who will ultimately care for our patients with the technology. We engage all the stakeholders, and in a simulated environment test the shortlisted products to identify any use-related and safety issues relevant to how the technology will be implemented in our organisation. It often happens that the vendor provides a nice demonstration and impresses everyone to think they sell a great piece of equipment. Then, when we do the user evaluation and ask clinicians to perform essential tasks with that equipment, we find that they commit a lot of safety-critical errors that are facilitated by the design of the technology. The objective evaluation data provides the evidence to inform the purchasing decision. The data directly informs the negotiations with vendors about customisations that are required if we purchase a specific piece of technology. It also informs the implementation strategy. After we purchase equipment, the insights about the shortcomings of this piece of technology help us design procedures and mitigations around those known shortcomings.

For the user testing simulations, we focus on the interaction with the devices while we maintain high fidelity of the clinical environment. If we are testing a ventilator, we would bring in a nurse or respiratory therapist and have them perform a basic patient setup and programme the breathing protocol. Actors would play other patients asking for help on the next beds, and a confederate nurse would interrupt the simulation participant in the middle of the programming task. If in real life there is a chance that while you are programming this ventilator, somebody is going to interrupt you, then you have to test the scenario of an interruption, engaging in a conversation, and then having to go back to the task that you left in the middle of programming. Whatever this ventilator has to offer in terms of interface,

we would evaluate how effective it is to support that interruption, because it happens in real life.

We have also evaluated shortlisted medical devices or EHR systems where there was no clear winner; all of the products would perform equally poorly in terms of usability and use-safety. The hospitals would come to the conclusion that the existing technology is not significantly better than what they already use on the patient floors. In these cases the hospitals may decide to defer the purchase until the next generation of this type of technology is developed to hopefully address use-related issues.

We also engage in incident investigations. We help analyse what happened and identify the contributing factors, while ensuring that we look at the whole system. Then we facilitate a process to design risk mitigations that will remove the identified risks. This is a process of iterative design either through simulation or within the actual clinical environment. Additionally, we look at how we can improve incident reporting and help with process improvement, looking for barriers and latent safety factors.

Finally, we also have an educational role, and have been providing training to frontline staff and leadership on the basics of HF for a decade now. By educating staff at the sharp end about human factors, we don't expect them to change the system, but to change the way they view their environment. The next time a nurse or a physician is faced with having to make a decision based on incomplete patient information, they would question why they are in this situation, and ask if something can be improved in the process or environment. The HF education serves to change people's perspective on their environment and help them recognise systemic issues. They would employ critical thinking and identify issues. They would then engage us to confirm and refine the focus on the factors that contributed to the issue, so that we can help them improve the process and design mitigations.

How can human factors specialists help in the very complex intensive care unit environment?

Addressing complexity is at the heart of HF work. An HF expert would identify HF and systemic issues in an ICU and develop mitigations. These could be organisational, process, team, environment, technology or cognitive issues. HF experts could start with a contextual enquiry, including observations, stakeholder interviews and focus groups, to identify the issues and their root causes. Usually when you go into an ICU or other clinical environments, people have a sense of what the problems are, but not necessarily what the root causes are. Once these are identified, HF experts would develop solutions and risk mitigations that will be iteratively tested with the clinicians and other stakeholders to make sure that they work for them, in their environment and in their specific process. The testing of the solutions would be conducted either in a high-fidelity simulation environment or in the actual clinical

setting, and the HF expert will refine the solutions until a positive effect is confirmed.

HF professionals can help improve patient safety, workflow, processes, procedures, tools or the physical environment such that people can use these most effectively; for example: designing user-friendly order sets, procedures around the use of such order sets, effective paper and electronic forms, as well as the selection and implementation of medical devices (such as infusion pumps, patient monitors or ventilators), personal protective equipment, etc.

HF experts can also inform the improvement of non-technical aspects within an ICU such as communication and teamwork issues. In the last few years, these have been major contributing factors to adverse events. ICUs are starting to appreciate the importance of investing in improving team members' soft non-technical skills so that the ICU environment can become more effective, efficient and safer.

How can human factors alleviate staff issues such as fatigue and burnout?

With fatigue, we would follow a similar process to that described above, to identify what is causing the fatigue. We know a lot about the effects of fatigue as a human limitation. When someone comes to us and says that they are experiencing staff fatigue in their unit and it's affecting the quality of care, as HF experts we wouldn't look at the symptoms of the behaviour, but we would identify what is causing the fatigue: Are staff moving around the unit too much? Is the current layout of the unit the problem? Is the way things are organised the problem? Are there very long shifts or too much clutter in the unit? Sometimes physical clutter or noise levels in an environment create high cognitive load in an already demanding setting like the ICU. We need to determine the root causes and appropriate solutions to address them. The goal of HF is to design an environment that takes into account human limitations—to do that, HF experts identify and mitigate systemic issues within the environment in which humans are interacting, functioning and working.

With regards to burnout, we need to go a step further and design the user/human experience. This is the process of enhancing people's satisfaction by improving usability, ease of use, the pleasure that they experience through interaction with their environment. This goes beyond addressing the human limitations and is more on the emotional, experiential side—producing a positive experience triggered by interaction with the technology that people use, the processes they follow, the teams that they participate in. Part of this is a design and engineering challenge, but it also involves the organisational culture.

How can human factors specialists reconcile the different viewpoints in healthcare to bring the best results?

HF experts are very careful to separate opinions and preferences of stakeholders from objective data. HF uses a rigorous investigation and design methodology to acquire objective data and engage all relevant stakeholders. We find that people's preferences and opinions don't always reflect how they perform. For example, when we evaluated the ease of use and safety of several infusion pumps, we engaged purchasing decision makers, technology manufacturers, IT managers, clinicians, administrative staff and pharmacists in the evaluation. We found that everyone really liked the one pump (Pump A). But when we looked at how people performed the basic safety critical tasks we gave them, we found that people actually committed the most serious safety errors with that pump (Pump A). It was not a safe design, but it appealed to the users because it was similar to what they were currently using; but they did not realise they had committed those errors while using it. During the debrief sessions, when we revealed the errors that they had committed, stakeholders appreciated the risk that this pump introduced and supported the purchase of the other contender product (Pump B).

You have worked on effective clinical tool design with the emergency department at UHN (Taneva and Chagpar 2013). Please explain the process.

We worked on a decision support tool for diagnosis of community-acquired pneumonia. We did a heuristic evaluation to identify basic usability issues, such as if there was too much information and clutter. We also looked at how the information is organised—if it was logical and if it allowed easy scanning. We went into the emergency departments of three different hospitals, and did observations and interviews with end-users to identify the critical information sets and decision points they used from all the information presented in the tool. That way we found out what information was really important to them and what helped them make a decision to diagnose community-acquired pneumonia. We were able to reduce the content to only what is critical for the decision-making. We reduced the clutter and kept only the high-priority information that directly helps make the diagnosis. Then, I worked with a visual designer to redesign how the content is presented. We reduced a five-page information sheet to one page and a half, where the most important information was on page one. We validated the designs with the end-users and the tool is now used throughout the Greater Toronto area.

This issue of ICU Management & Practice has a cover story on personalised medicine. What are the lessons from systems thinking for precision and personalised medicine?

The clinical environment is very complex right now. The amount of information and communication has become a major contributory factor to adverse events, people dying. Precision medicine is about to exponentially increase the amount of information and communication related to patient care. If we continue to focus on the sharp end and ask people to be vigilant, it's not going to get better. We need to recognise that safe, reliable systems and processes should be our focus in order to be ready to brave the challenges of introducing precision medicine. Then we will have a chance to be successful. Precision medicine is a very exciting field, but we have to make sure that as a culture and as an organisation we are mature enough to approach it in the right way. We need to think in systems terms and be mindful of human limitations. With this approach we can reduce the frequency and the consequences of errors when we introduce precision medicine. ■

Reference

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