# Human Factors Education for Healthcare Audiences: Ideas for the Way Forward

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Within the last decade, there has been a growing emphasis on applying human factors principles in the healthcare domain, and although human factors is a well-established scientific discipline, it is still a relatively new concept for the healthcare community. Educating healthcare audiences on the goals, history, and contributions of the human factors discipline may dispel misconceptions; preserve the integrity of this scientific discipline; inform healthcare stakeholders about the value of human factors research; and increase the uptake of human factors principles in the healthcare domain. Panel members will share their views on human factors education for healthcare audiences, including their past experiences, personal successes, and insights on the challenges that remain. Panelists will also engage the audience in an open discussion to generate novel ideas on how to advance the healthcare community's understanding of the human factors discipline.

## INTRODUCTION

The human factors discipline is receiving increased attention in the healthcare community, and many medical training programs are in the process of designing patient safety curricula, representing a unique opportunity for the HFES community. This timely panel session will foster discussion on human factors education in healthcare and how the human factors discipline can effectively engage healthcare audiences and stakeholders. This panel includes a diverse set of professionals representing both traditional human factors and clinical backgrounds; panelists also represent healthcare institutions as well as academic, government, and consulting groups. In this session, panelists will engage the audience in an open discussion and seek to generate novel ideas for human factors education in healthcare, such as the potential role of HFES in healthcare education.

## PANELIST STATEMENTS

### Healthcare and Human Factors: Intersections versus Collaborations

*Militello, Applied Decision Science.* Laura Militello has applied Naturalistic Decision Making models and methods across a range of domains including healthcare over the past 20 years. She has conducted workshops on cognitive task analysis, and cognitive systems engineering for both students and professionals.

*Statement.* Healthcare and human factors have intersected in interesting ways for several decades. For example, nurse researcher Patricia Benner generated a model of expertise (Benner, 1984) that has influenced human factors studies of expertise and decision making for over 25 years. Device manufacturers and software developers have hired human factors consultants to explore issues of usability and user interface design ((Baeck & Militello, Spring 2003); (Lopez, Militello, Arbuckle, & Wolf, 2011). More recently, the healthcare community has turned to human factors to explore strategies for improving patient safety (Gosbee, 2002; Lin, Vicente, & Doyle, 2001). Many of these "intersections" turn out to be a just-in-time exchange of knowledge in the context of a specific problem.

Although positive outcomes have resulted on both sides of these interactions, deeper and continuous collaboration is needed between the healthcare and human factors communities to address the complex challenges ahead as increasing levels of automation and decision support are introduced throughout the healthcare system. Workshops designed by human factors professionals for a healthcare audience should go beyond these simple intersections. Presenting a specific procedure, technique, or toolbox without a larger

perspective and context may encourage organizations to send an individual who will return from the workshop and serve as the resident human factors expert. Effective workshops should focus on communicating a larger perspective, providing theory and context behind the methods, thereby setting the stage for continued collaboration between healthcare and human factors professionals. Promising directions include:

- Presence of full-time human factors professionals in the healthcare setting, such as within the Veteran's Health Administration.
- Workshops that include human factors principles instantiated in real-world examples.
- Workshops with exercises that illustrate the need to acquire practice and experience before applying human factors methods and principles for real-world problems.

As human factors professionals, we have to move beyond "how to" in our workshops, and include a broader perspective to foster continued collaboration.

## Curtailing the Propagation of Human Factors Misinformation

*Saleem, Roudebush VA Medical Center.* Dr. Saleem has spent the majority of his career with the Veterans Health Administration (VHA) and has seen the number of human factors professionals based in the VHA steadily grow over the last 8 years.

*Statement.* The demand and interest for human factors knowledge within the VHA has grown at a faster rate than the number of VHA human factors professionals and available human factors resources. Because of this imbalance, improperly trained individuals sometimes attempt to apply newfound human factors knowledge to redesign healthcare processes and tools without fully understanding human factors and its associated methods.

The literature demonstrates the propagation of misinformation about the science of human factors itself. For example, a recent article in the *Archives of Surgery* describes a "human factors curriculum" for surgical students (Cahan et al., 2010). Remarkably, the human factors curriculum reported in the article had little resemblance to the science of human factors. Rather, the authors were referring to humanistic qualities like empathy, caring, and work/life balance.(J. J. Saleem, Patterson, Russ, & Wears, 2011) This type of misuse of the term "human factors" threatens the integrity of our field. Likewise, a national VHA survey illustrates the lack of understanding of human factors: Chiefs of Staff at 34 of 111 (31%) VHA Medical Centers reported conducting some type of formal human factors or

usability evaluation on computerized clinical reminders and templates during their development (Yano et al., May 2007), yet the number of human factors professionals with the ability to conduct such a formal evaluation within the VHA during the time of the survey was only about half a dozen.

Human factors professionals acquire their skills after years of training and practice; these skills are not easily imparted outside of a formal program of study. Human factors principles, such as usability design heuristics and guidelines of use of color and fonts for visual design, can successfully be passed onto others through short training sessions. However, a majority of human factors methods, such as cognitive task analysis, formal usability testing, summative and formative evaluation techniques, and many ergonomic assessment tools cannot be learned with a short presentation and outside of a formal program of study. Therefore, human factors education in healthcare should address skills that can be effectively imparted through short training programs, while skills that require formal training should be reserved for the human factors professional. For example, one study revealed that while simple ergonomic principles can be easily taught to non-experts in the redesign of their own jobs, ergonomic tools, such as the National Institute of Occupational Safety and Health (NIOSH) lifting equation, cannot be effectively taught to front-line workers (J.J. Saleem, Kleiner, & Nussbaum, 2003). Without this type of distinction, we run the risk that healthcare audiences may apply human factors with insufficient training, resulting in poor design outcomes. In cases where there is a lack of human factors professionals on staff, an organization should consider external resources such as hiring human factors consultants and/or sending employees to formal human factors training programs.

## A Little Knowledge is a Dangerous Thing

*Wears, University of Florida.* Dr. Wears is an active physician who has taken human factors seriously for 17 years. He is currently hoping to be received into the elect by completing his PhD in Industrial Safety at École des Mines de Paris.

*Statement.* It is generally accepted that the field of human factors and ergonomics could contribute substantively to improving quality, safety and efficiency in healthcare. But the development of true collaboration between these two disciplines has been slow, and we should not be surprised that there are occasional misconceptions and even misdirections. This section of the panel outlines opportunities and challenges from the point of view of healthcare domain professionals.

Opportunities for very simple improvements abound. Healthcare devices and workplaces are full of design problems that have long been identified and remedied in other settings, and when failures inevitably occur, health professionals tend to personalize them, interpreting the failures as the operator's fault because they are unable to see the design and usability issues (Norman, 1988). Thus, even raising consciousness regarding human-device issues frequently engages practitioners and makes them want to learn more.

However, there are several difficult challenges to this educational process. First, healthcare professionals are smart, highly motivated, and achievement oriented, and one of the hardest things to do is to teach smart people how to learn (Argyris, 1991). Roger Kneebone (himself a practitioner who invested in formal training at the PhD level) has called this the "magpie syndrome," noting that often health professionals grasp a few ideas quickly, assume they have comprehended the entirety of the field, and rush off to do their own thing without ever developing a deep understanding or recognizing their need for guidance (Kneebone, 2006). We have seen medical publications treat human factors as if it were "humane factors", solely concerned with the affective aspects of work (Cahan et al., 2010), or attempt to assess issues such as cognitive demand in ways that are irrelevant and show no awareness of the body of work in such areas (Chisholm, Weaver, Whenmouth, & Giles, 2011). So, a little knowledge can be a dangerous thing.

In addition, although healthcare, and medicine in particular, has its intellectual origins in the interpretive tradition, the voices that are privileged in healthcare discourses about science are largely positivist. Because human factors as a field often draws on interpretivist views of science (Lipshitz, 2010), many healthcare professionals may view it as unscientific and treat it dismissively. However, there is reason for optimism. Several healthcare professionals have recently completed PhDs in human factors or related fields (not as a career change, *i.e.*, leaving medicine, but as a career enhancement). At least two others are in PhD programs and several are working on a Masters Degree. In addition, a number of human factors professionals now hold full time, 'hard money' positions in healthcare organizations, where they can help the educational effort in both formal and informal ways. Thus, the way forward should be guided by three principles:

1. Continue to do general education to increase the appreciation of what human factors can bring to the table.
2. Expand venues for health professionals who seriously want to become competent in human factors, for example through training programs for students in full-time employment.
3. Gently but firmly critique and guide those magpies who have picked up the shiny object (human factors) and flown off with it, so they can be led from a little knowledge to a greater understanding.

## Where do we Start: It may not be where you think.

*Fairbanks, National Center for Human Factors Engineering in Healthcare.* Dr. Fairbanks is a practicing physician and safety science researcher with a masters degree in human factors engineering, who finds it fascinating to use today's heath IT systems.

*Statement.* An outsider's analysis of the interface design of medical devices and health information technology (IT) systems is likely to lead to the conclusion that there is a need to educate manufacturers about the value of human factors engineering. But is this where we need to focus our efforts? Human factors as a concept is often misunderstood by both front-line healthcare providers and organizational leaders, including quality and safety leaders and risk management leaders. For example, many believe it is synonymous with 'teamwork and communication,' or that 'human factors' should be named as a root cause after an adverse event because the nurse or physician "committed a medical error." In fact, some commercially available adverse event and near miss reporting systems include the category "human factors" as a selection under the "root cause" or "contributing cause" field, which perpetuates a misunderstanding that "the human factor" (as sometimes used in healthcare) means focusing on what individual to blame, completely missing the contribution that true human factors perspectives can have to a safety engineering approach.

Currently, few programs for healthcare providers focus solely on human factors engineering. Two notable exceptions are the Systems Engineering Initiative for Patient Safety (SEIPS) Short Course on Human Factors at the University of Wisconsin Madison's Center for Quality and Productivity Improvement, and Red Forrest Consulting's Human Factors and Medical Device Workshops. Many patient safety fellowship or certification programs also include workshops or lectures lead by human factors professionals.

It is inappropriate to expect that a healthcare leader, such as hospital manager or quality and safety specialist, will be able to apply specific human factors engineering methods of evaluation and design after taking a brief workshop or short course. However, the value of these courses is in developing sensitivity to the impact of poor

(or good) human factors engineering design. This knowledge might lead a senior hospital leader to ask for usability analysis data from a prospective medical device vendor, or to seek a local usability consultant to conduct a comparison evaluation of two health IT systems under consideration for purchase.

There are several potential avenues to exert influence through education. Medical Schools, Residency training programs, and specialty organizations are currently in the process of designing a patient safety curriculum for their learner groups. This presents a unique opportunity for the HFES community to develop a 'human factors engineering module for patient safety curriculums', which these groups could adapt and integrate into their curriculums.

Two other important groups include the medical device industry and the health informatics industry. Graduate and undergraduate programs in biomedical engineering and biomedical informatics often lack human factors training. Organizations, such as the Association for the Advancement of Medical Instrumentation (AAMI) and Red Forrest Consulting, have become more active in educating the medical device industry, and recent regulatory changes in the Food and Drug Administration (FDA) are increasing the visibility of existing human factors engineering programs among device manufactures.  There seems to be somewhat less awareness in the health informatics industry, though there is movement in the right direction. For example, a new theme in the call for papers for the 2011 meeting of the American Medical Informatics Association (AMIA) is called "Interactive Systems" and specifically asks for "contributions that highlight human-computer interaction (HCI) research, compelling designs, or innovative interactive technologies, including those that improve our understanding of the social and human elements of health technologies."

 However, from the outside looking in at health IT vendors, it often appears that the true value of human factors is missed. For example, take a recent recruiting notice from a large national health informatics vendor appearing on a Linked-In human factors group, which that states that as a member of the user interface design team "you will make it elegant, flashy, and fun. Take rough concepts and turn them into works of art. Contribute to visual standards that will have a company-wide influence on future software design."

Studies of these systems in the actual work environment often show that they lack functionality to support the work of the end user, often have antiquated interface designs that violate even the most basic user interface principles, miss opportunities to protect the user from error, and in many cases, actually facilitate use

error (Fairbanks, 2008).  However, incorporating human factors design is an expensive undertaking, and though many (if not most) device companies and health IT vendors are aware of the potential, and even have significant internal human factors expertise, the reality is that their customers (e.g., healthcare providers, hospitals, and other healthcare organizations) do not demand it. In fact, customers seem to be instead demanding increased customizability, which only results in increased complexity of the interface design (Johnson, 2006). Hospital biomedical engineering departments often diagnose device events as "user error," return the device to service, and close the case. Much of this could be avoided with an analysis of the work environment (such as what cognitive systems engineering can offer) to inform design, and an iterative process to inform the design of the user interface. But without a demand for better human factors design, why would manufacturers put the resources into such an expensive undertaking?

Though still small, there is a growing demand for human factors engineering expertise in healthcare. This is a great opportunity for our professional community to drive the education of healthcare stakeholders and decision makers about the value of human factors engineering.  As more and more healthcare stakeholders recognize the value of human factors engineering, there will be increased opportunities for human factors professionals to become involved in the healthcare domain.  To further this goal, human factors experts could consider contacting their local hospital's senior leadership and offer to consult, give a seminar or talk to key groups (such as adverse event review teams), or join healthcare teams as a guest reviewer.

Even though at face level it may appear our efforts would be best spent educating the medical device and health IT industry, it is more likely that they have the knowledge but often choose not to exercise it.  Instead, the human factors engineering community would be best served by focusing our educational efforts on the customers of these industries, the healthcare providers and leaders. If we can create an incentive to manufacturers for good human factors design, the rest will fall into place.

**Lessons from 8 Years of Training Healthcare Professionals**

*Karsh, University of Wisconsin.* Over the last 8 years, Dr. Karsh has trained approximately 300 physicians, nurses, pharmacists, and vendor staff on human factors engineering for patient safety and health information technology design through the University of Wisconsin SEIPS summer short course. He has also

delivered introductory lectures on human factors engineering for healthcare at national medical and pharmacy meetings and many grand rounds.

*Statement:* Keys to effectively educating healthcare audiences about human factors appear to be, first and foremost, having in-depth knowledge and first-hand experiences of the workings of healthcare delivery and challenges faced by clinicians, caregivers, and patients; second, teaching human factors principles through healthcare examples from the real world, and challenging misconceptions directly through audience participation experiences. Challenges encountered include misperceptions that human factors is common sense or is simply aesthetically appealing software, and beliefs that there is no evidence basis for human factors design principles. Successful education strategies will be shared as well as methods to overcome these challenges.

## ACKNOWLEDGEMENTS

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