

PANEL: THE ROLE OF HUMAN FACTORS IN HEALTHCARE – 2020

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What role will human factors professionals play in healthcare 2020? Health systems throughout the world face a number of common pressures, related to demography, epidemiology, science and technology developments, and medical demand. In particular, while developments in technology do not just provide health care with new possibilities for human factors engineering, medical interventions and therapies. They also produce changes in our understanding of sickness and health, the possibilities and needs for managing the systems, for innovation, for standardization, and the political and economic relationships. The health care providers not only have to cope with these technological developments but assure their successful implementation and acceptance. The uncertainties and expectations linked to these innovations face major issues within the research and health care system, such as policies for managing scarcity of resources and changes in the relative frequency of diseases because of factors like ageing, and mobile global population and the like. A panel of both healthcare and human factors experts will discuss the role that human factors will play in healthcare in 2020.

INTRODUCTION

Human factors engineers/engineering (HFE) have made significant inroads into healthcare. HFE is recognized as useful in critiquing medical device design, conducting usability testing, and is credited with aiding remarkable improvements in some areas of patient safety. As will be argued in this paper, HFE also has the opportunity to help to improve quality of care, clinical process efficiency, timelessness and access, reduce cost of care, and enhance the satisfaction of patients and clinicians. Evidenced by the growing number and quality of papers submitted to the Medical Systems and Rehabilitation Technical Group (8 sessions at this HFES – New Orleans, 2004), HFE is helping to reduce human error through, for example, issues such as the design and implementation of computerized tools to reduce “human error,” including such as bar coding, provider entry systems, “smart” IV pumps, and automated alerts for critical lab values. HFE has guided the design of interventions such as “time outs” to reduce wrong site surgeries, quality of working life studies, and the design of “fail-safe” organ transplant systems, and studies on the quality of the work environment.

Despite an increase in the number of human factors professionals working in healthcare, the current role of these professionals is much limited than the potential.

DISCUSSION

In a recent presentation titled “The Medicalization of Patient Safety: Where have the patient safety experts in the

patient safety movement gone?” Wears reported that nearly 20% of speakers at the first Annenberg meeting on patient safety in 1996 were from non-healthcare fields (Wears, 2003). Yet, at the 2nd Second AHRQ Safety Research Conference the following year (2003), only 2 (8%) speakers were from non-healthcare fields. Wears discredits that the decline is due to decreased concerns about patient safety or increased HFE knowledge of healthcare professionals. Rather, other more plausible explanations might be: 1) the tendency for healthcare professionals to seek help only from other healthcare professionals, 2) issues with viewing others’ paradigms as unscientific and 3) conservative choices made by funding bodies in relation to funding “foreign fields.”

The intersection of human factors and healthcare is at a crossroads. What is the future role of human factors in healthcare? Will healthcare continue to pursue “isolationist” research and quality improvement efforts with only the help of a handful of human factors professionals? Or will groundbreaking work generate the support needed to sustain substantive partnerships between human factors and healthcare experts? In 2020, what will be the number of positions, and stature of human factors professionals working in healthcare? Where will they work and what will they do day-to-day? Will they hold leadership positions at the institutions or be relegated to mid-level staff positions? Will human factors professionals work in traditional domains as well as healthcare, or be solely dedicated to healthcare? How will the special demands of healthcare change how (and where) will we train new human factors professionals? What will be the options for “cross-training”? Most importantly,

what, if any, will be the impact of human factors on patient care?

The panelists present their vision of the role of human factors in healthcare in 2020. We need futurists with excellent crystal balls because the role of the HFE in healthcare is hard to predict since healthcare is a not stable domain - it is undergoing massive changes that are expected to continue for many years. In fact, healthcare in 2020 will likely look very different than it does today. The panelists will discuss how these anticipated changes will create opportunities and challenges for the human factors community.

ANTICIPATED TRENDS IN HEALTHCARE

Increased costs and public awareness of patient safety issues

The exit polls from the presidential primary elections indicate that the escalating cost of healthcare is a primary issue for the general public. In addition, the 1999 release of the Institute of Medicine (IOM) report *“To Err is Human: Building a Safer Healthcare System”* (Kohn, Corrigan, & Donaldson, 1999) and the follow up report *“Crossing the Quality Chasm: A New Health System for the 21st Century”* (IOM, 2001) greatly increased public awareness of patient safety issues. It is anticipated that the public response to these two issues will drive monumental shifts in how healthcare is delivered and reimbursed. Already, there is intense pressure to implement new technologies to reduce “human error” such as the electronic medical record, computerized provider order entry, bar coding for patients and medications, robots and automated systems for medication dispensing, and “smart” infusion pumps that identify abnormally high doses. HFE is critical in the design of these technologies, taking into account work processes and reducing unintended consequences following the introduction of the technologies. Also, HFE can play a role internationally – health systems throughout the world face a number of common pressures, related to demography, epidemiology, science and technology developments, and unprecedented demand for medical services. These forces provide a window of opportunity for HFE to help steer the massive changes in healthcare systems in safer, more efficient and easy to use pathways – as well as to help avoid unproductive and dangerous pathways already been tried or failed in other domains.

The changing patient population

According to statistics from the U.S. Census Bureau, the average age of the population is increasing. Additionally, in other countries, the oldest age group (80 and above) is the fastest-growing component of the population. As patients get older, treatment becomes more complex; patients have a greater burden of disease and are on more medications. There are more potential hazards to consider during procedures and therapies. As the complexity and risks of providing care increase, the benefits accrued from better-designed systems from a human factors perspective also increase.

Patients and their families will increasingly be asked to assume more responsibility for their own care. Thus, we already see patients asked to manage complex computer-controlled devices such as insulin infusion pumps (for diabetes), continuous positive airway pressure devices (for sleep apnea), etc. Elderly and ill patients have more difficulty caring for themselves and managing the care technologies imposed on them. For instance, in an effort to reduce costs, many health plans are dispensing larger strength pills and pill cutters to patients. A patient taking 10 mg of a drug every 12 hours may receive a prescription for 20 mg pills and instructions to cut each 20 mg pill in half and take a half a pill every morning and evening. However, data show that elderly patients often forget to cut the pills, or have trouble doing so.

Increase in home healthcare and “distant provider” settings

The average length of stay in the traditional inpatient setting has been shortened and is expected to continue to shorten. More procedures are conducted on an outpatient basis and there is an increase in patient care being provided in the home environment. In addition, there will be increased use of web-based patient-provider interactions, telemedicine, and remote surgeries via robots and other devices. Human factors expertise in automated alert systems for the home, web and telecommunication design, and remote operation of devices can be leveraged in these settings.

Medical advances

Medical advances such as developments in genetic diagnostics do not just provide health care with new possibilities for medical interventions and therapies. They also change our understanding of sickness and health, the possibilities and needs for managing the system, for innovation, for standardization and the political and economic relationships, and provide new opportunities for contributions by HFE professionals. Health care providers have to cope with these technological developments and assure their implementation and acceptance. The uncertainties and expectations linked to these innovations meet major issues within the research and healthcare system, such as policies for managing scarcity of resources, changes in the relative frequency of diseases because of aging, global mobility and the like.

Bioterrorism and disease surveillance

As diseases spread more quickly due to globalization and as concerns about the potential for bioterrorism rise, including the recurrence of diseases such as tuberculosis, polio, and parasitic diseases once thought “conquered”, there will be an opportunities for HFE with expertise in emergency management, data mining, data overload, and automated alerting systems to contribute.

Expert decision support systems

It is already difficult for the average clinician to keep current with medical knowledge, even within specialties, due to advances and new studies. As there is a shift from using specialist to generalist physicians under cost and other constraints, and from using highly trained personnel to less trained personnel in nursing home and home healthcare settings, there is going to be an increased need for user-friendly expert decision support systems and greater artificial intelligence in medical devices and systems. Also, computer-based and other types of training can play a role in accelerating learning curves.

Increase in the use of wireless devices

There will be an explosive increase in the use of wireless devices by healthcare professionals and by the general public. Although wireless devices currently create electromagnetic interference with powered wheelchairs, apnea detectors, hearing aids, infusion pumps, cardiac telemetry, cardiac pacemakers, and ventilators, it is expected that technological solutions, such as reducing power transmission levels and interference management, will enable these devices to be used in healthcare settings before 2020. As these devices proliferate, design challenges and opportunities will arise from the distributed nature of easily accessible information and software. For example, if a user controls a number of infusion pumps on multiple patients via a single device, how is the interface designed to enable proper mapping to patients? Similarly, if two healthcare professionals “compare notes” on a patient can wireless devices support this interaction, by sharing information and standardizing information display to enable comparison? It is not expected that a single wireless technology or device will meet all the design goals and address all the issues presented by users. Human factors engineers should be involved in every design project that includes wireless technology and the associated decisions that must be made to identify the most appropriate technologies for that application and human device-use model.

New technologies

By the year 2020, it is expected that technologies currently being researched will be moving from research to development. For example, nanotechnology research will create opportunities for “nanomedicine,” the monitoring, repair, construction and control of human biological systems at the molecular level, using engineered nanodevices and nanostructures. While there will be opportunities for input into the design and evaluation of these types of systems, will HFE be able to play a role in framing issues relating to coverage of investigational devices and related routine clinical trial design and costs? Although improved in recent years, the current level of federal oversight of the human user interface of medical devices is insufficient to prevent the marketing of devices with poor usability, leading to serious patient harm. How can HFE be involved in discussions with the FDA on improvements in new technology evaluation and approval?

How might HFE play a role in the Centers for Medicare and Medicaid Services’ evaluation and reimbursement schemes for using new care technologies? Also, more treatments will be “minimally invasive” whereby the clinician may be distantly removed from the point of “contact” or the treatment with the patient; therefore possibly having indirect information on the status of therapy. This applies to therapies as disparate as genetic manipulations via viral carriers and telerobotic surgery. This too will demand careful human factors design and evaluation.

SUMMARY

Healthcare in 2020 will be shaped by a complex set of converging forces that are anticipated to cause monumental shifts in how healthcare is provided and delivered. Human factors engineering has the knowledge, methods, and personnel available to help steer healthcare in more efficient and easy-to-use direction. And, hopefully patients will no longer need to fear a significant chance of incurring an unintended consequence of receiving care.

PANEL ABSTRACTS

Critical Care Command and Control

Gary Klein, Ph.D., Klein Associates, Inc., and James Fackler, M.D., Cerner Critical Care

Intensive Care Units mirror pressures facing general medical care: lower error tolerance, increasing patient loads, nursing shortages, critical care physician shortages, need to identify subtle patient trends to prevent decompensations, and needs to occasionally, instantly, flex capacity to respond to 2 or 3 patients who decompensate simultaneously. Several opportunities are converging to address these problems: an increasing sophistication in electronic data gathering, analysis and presentation, a growing acceptance of “provider extenders,” and an appreciation of formal decision support analyses. We believe these problems and opportunities intersect in a way that re-conceptualizes the ICU. The concept of a critical care Command Post will emerge, enabling intensivists to use information technology to simultaneously monitor all the patients in the ICU. The ICU Command Post will allow intensivists to gauge overall pressure on the ICU, prioritize patients, direct interventions, diagnose problems, and prevent crises both on site and from a distant location.

The Role of Human Factors and Future Healthcare

Matthew B. Weinger, M.D.

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Predictions of the future of healthcare suggest that human factors must play a central role if we are to yield the benefits of advancing medical technology at a reasonable societal cost. While acute care processes will become more complex and involve sicker patients, most patient care will actually occur in low acuity settings, especially the home and at work. Substantial care will be provided remotely (via the web, and with telepresence and robotics), and will incorporate expert systems. Automation, decision support, and

collaboration facilitation will be ubiquitous in medical devices and processes that will incorporate complex molecular and nanotechnologies. Care teams will be truly multidisciplinary, with patients and their families playing a key role in care decisions. Most healthcare technology users will be less educated and trained. Continuous quality improvement will be based on the collection and analysis of fine-grain real-time patient care data (including video) about routine and non-routine care.

The Future of Human Factors Engineering and Healthcare

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Human factors engineering has made significant inroads into healthcare. We are recognized as useful in critiquing medical device design, conducting usability testing, and improving patient safety in anesthesiology. Although our methods and knowledge base are still considered foreign, we have begun to address burning issues, such as how introducing new "informatics" technologies effects work processes. In the future, we will expand our practice into new hospital settings such as outpatient clinics and home healthcare, the pharmacy, and the laboratory. We shall broaden our focus from devices or technology into more teamwork and organizational issues. We shall move earlier into design processes, such as by conducting cognitive task analyses to help identify user requirements in advance of finalizing a design, and create career tracks through sustainable funding mechanisms for people with wider ranges of human factors and medical experience.

Cassandra: The Sequel

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Beginning in 1997 I presented the Cassandra Project. It included a set of predictions regarding the future of patient safety work in the U.S. The predictions have been confirmed by experience. In an extension of this project, we can anticipate a variety of issues that are likely to arise over the next decade. Current efforts to engage information technology more intimately into work processes are expected to eliminate error, increase delivery efficiency, and improve care quality while reducing its cost. Simultaneously, new reporting systems are intended to capture those few errors that manage to sneak through the web of protective software. Although everything may go as planned, it is possible that there will a few problems along the way. This presentation will describe some of those potential problems and offer suggestions on ways to avoid them. Significantly, implementing the suggestions would require rethinking the planned system designs.

Human factors engineering and patient safety: Views from Hospital CEO's

Pascale Carayon, Ph.D.

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From the viewpoint of many hospital CEO's, the main contribution of human factors engineering to patient safety relates to the 'technical' aspects of patient safety. When it comes to leading healthcare organizations to the 'next step of patient safety', hospital CEO's emphasize the importance of skills and competencies such as leadership, communication, an understanding of organizational (safety) culture, courage, and accountability. Hospital CEO's need to be 'sensitized' to human factors engineering, but not necessarily 'skilled and competent' in human factors engineering. Competency in human factors engineering needs to be spread throughout the hospital. For example, the competency in human factors engineering can reside in the quality department in order to achieve process improvements that consider human capabilities and limitations. Competency in human factors engineering also needs to reside in the departments in charge of purchasing and implementing technologies, tools and equipment and various forms of information and communication technology.

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Healthcare in 2020 will be shaped by a complex set of converging forces that are anticipated to cause monumental shifts in how healthcare is provided and delivered. Human factors engineering has the knowledge, methods, and personnel available to help steer healthcare in more efficient and easy-to-use direction. Hopefully, patients will no longer need to fear a significant chance of incurring an unintended consequence of receiving care.

REFERENCES

- Committee on the Quality of Health Care in America (2001), *Crossing the Quality Chasm: a New Health System for the 21st Century*, Institute of Medicine. National Academy Press: Washington D.C.
- Kohn LT, Corrigan JM, and Donaldson MS. (1999), *To Err is Human: Building a Safer Health System*. Institute of Medicine. National Academy Press: Washington, D.C.
- Wears, R. (2003), Presentation at the 2nd AHRQ Patient National Summit on Patient Safety Research in Arlington, VA.