Health and Social care Ergonomics. Patient Safety in Practice
Sue Hignett, Sara Albolino, Ken Catchpole

This Special Issue on Human Factors in Healthcare was suggested by Prof Sara Albolino, at the IEA Triennial Congress in 2015 (Melbourne, Australia) as current Chair of the International Ergonomics Association (IEA) Technical Group on Healthcare. It provides a collection of papers to illustrate current research which is helping to introduce and implement Ergonomics (Human Factors) theory and practice into healthcare.

A previous special issue of Ergonomics (Edworthy et al, 2006) included a wide range of Human Factors contributions to the area of patient safety, from systems (macro-ergonomics) analyses to specific, relatively contained interactions and interfaces (micro-ergonomics). This special issue, 10 years later, provides a similar range of macro and micro topics as well as discussions about the location of HFE input (upstream/downstream) and a greater consideration of obstacles to the use of HFE in practice (rather than research). We are intentionally using ‘Human Factors’ and ‘Ergonomics’ interchangeably in this editorial to reflect the international use of both terms in healthcare. Some countries such as UK, USA, Australia and New Zealand include both in the name of professional societies/institutes, whilst most non-English speaking countries use ‘Ergonomics’.

In our reflection of the past 10 years, we comment on the progress (or lack) for embedding Human Factors in healthcare practice, technology and changing culture. Our much missed colleague, Professor Bob Wears reflected on this (and other topics) in 2015, suggesting that the lack of progress may be due to ‘medicalization’, where ‘a certain school of thought among health professionals – managed to take it [patient safety] over, displacing other forms of scientific and professional activity, and turning it from a reformist movement to a conventional, business-as-usual activity, ironically with the best of intentions’ (Wears, 2015). This included a lack of engagement with safety scientists (Human Factors professionals) which has resulted in a partial (limited) understanding of the user-system interactions, and the view that safety solutions can be procedurally derived, easily systematized, and permanently ‘hard-wired’ through behavioral change at the point-of-care.

So what has changed since the last Special Issue? Overall, we think there is evidence of more prospective (upstream) use of Ergonomics with applications of the core principles of systems and design (Hignett et al, 2013). Surgical safety is an area that has probably received the most Human Factors research attention and there are 2 papers where systems (and environment) design is seen as the priority to design out the potential for making mistakes in the human-technology-systems interactions. Bellandi et al (2017) continue the discussion of domain-specific tools to analyse interruptions and multi-tasking in surgery. However, rather than developing a new observational tool as Healey, Sevdalis and Vincent (2006), they explored the application of an established Ergonomics observation tool (WOMBAT; developed in Australia) in Italy to classify activities as dimensions, categories and task. As surgical practice develops, there is a need for ergonomics input to consider the systems and technology interface design. Catchpole et al (2017) applied Human Factors methods to robotic surgery to analyse additional workload in 4 operative work phases (pre-robot; docking; surgeon on console; undocking; and finish). Their recommendations include cognitive (communication systems), organisational (supplies availability) and physical (visual interface design).
We are seeing a continued focus on medication management research from 2 papers in 2006 (Hellier, Edworthy, Derbyshire and Costello, 2006; Fogarty and McKeon, 2006) looking at medication labelling (packaging) and the organisational climate for medication administration to 4 papers in 2017 looking at the design of integrated systems (including information technology) across healthcare sectors (Jun et al, 2017; Jahn et al, 2017), and medication adherence in home (informal) care settings (Mickelson et al, 2017; Parand et al, 2017). As with the surgical papers, the use of a systems approach is more evident in 2017 with, for example, Mickelson et al (2017) describing performance shaping factors of the person or team, task, tools and technologies within the organisational, physical, and social context in a Patient Work System Model. In this last decade, in order to promote a better care, safe surgery and medication safety have been set as a priority and a global challenge by the World Health Organisation (WHO, 2009; 2017).

One change since the last special issue is a decrease in research describing the ‘patient safety problem’ (incidents and investigations). In 2006 there were 6 papers discussing ‘the problem’ from error detection, identification and reporting (Nyssen and Blavier, 2006; Kanse, van der Schaaf, Vrijland and Mierlo, 2006; Carayon, Hundt, Alvarado, Springman and Ayoub. 2006), to investigation (Dieckmann, Reddersen, Wehner and Rall, 2006; Catchpole, Giddings, de Leval, Peek, Godden, Utley, Gallivan, Hirst and Dale. 2006) and description (Kostopoulou, 2006). In 2017, two papers discuss ‘the problem’, Parand et al (2017) and Reader et al (2017). Parand et al, (2017) take a prospective (rather than retrospective) approach using 3 well-established ergonomic risk analysis techniques Healthcare Failure Modes and Effect Analysis (HFMEA), Systematic Human Error Reduction and Prediction Analysis (SHERPA) and Systems-Theoretic Accident Model and Processes (STAMP). The second paper (Reader et al, 2017) considers human limitations in decision-making for ICU discharge where mental models are influenced by philosophies on care, past experiences, and perceptions of group and organisational norms. This change in focus perhaps reflects recent commentaries by Kellogg et al (2016) that ‘despite dramatically intensified efforts to increase the safety of the healthcare system, reports have suggested that safety has not improved. The adverse event rate has remained essentially the same, suggesting that our current solutions to the problem are not working’. There is a need for healthcare systems to be designed with an understanding of human capabilities and limitations, and an acceptance that a Human Factors approach will not aim to change people (this is a behaviourist approach); it will aim to change the things (interactions and interfaces) around them. This approach, more focused on understanding daily success stories rather than unsafe events, is consistent with the need for a broader vision of patient safety looking at how clinicians cope successfully with daily variability and turbulence.

There are similarities where research has continued, for example environmental design principles for falls management (Hignett and Masud, 2006) and for infection prevention and control in neonatal care (Trudell, 2017); and workplace stress (and fatigue) linked to safety-related incidents (Elfering, Semmer and Grebner, 2006) with Chang et al (2017) contributing an investigation of cognitive and physical workload to discuss the implications of adjusting to rotating shift patterns. In 2017 we see examples of a systems approach by Steege et al (2017) to consider fatigue risk management systems using elements of the work systems model Systems Engineering Initiative for Patient Safety (SEIPS). They suggest that the healthcare sector is lagging behind other industries in addressing the risks of acute fatigue, recovery and chronic fatigue. The SEIPS model is also used by Heiden et al (2017) to
discuss and propose a new systems model for service provision of Traumatic Brain Injury management as a chronic disease. A systemic and multimodal approach was also used by Albolino et al (2017) with clinicians to co-create and evaluate an adaptation of the WHO Safe Childbirth Checklist (WHO, 2015) aiming to reduce risks related to maternal and neonatal care.

Finally 2 papers (Hignett et al, 2017; Pickup et al, 2017) offer experiences for introducing Human Factors into the UK National Health Service. Pickup et al discusses the apparent dichotomy of trying to apply a systems approach with the operational challenges and priorities for implementation in practice. Their case studies include Human Factors education and environmental design in primary care, and mapping complex pathology processes (blood sampling) in secondary care (similar to Hallock, Alper and Karsh, 2006), with practical illustrations of HFE methods including Work Domain Analysis, Abstraction Hierarchy, Failure Modes and Effects Analysis (FMEA), and the Functional Resonance Analysis Method (FRAM). They conclude by stating that, in their opinion, Human Factors ‘in UK healthcare remains opportunistic ... still in its infancy’. Hignett et al (2016) report on challenges preventing the delivery of effective, high quality and safe health care identified by healthcare staff. Some problems are well known (staff shortages, finance and patient complexity), but others, they suggest, raise questions about healthcare commitment to patient and staff safety. These include Organisational Culture leading to ‘stifling bureaucracy’, Workload resulting in ‘firefighting daily’. A challenge is issued to healthcare providers to ‘think about a Human Factors Integration approach for safety, well-being and performance for all people involved in providing and receiving health care’.

In some respects, progress has been slow over the last 10 years. In comparison to traditional Ergonomics domains, which were largely engineered in the last 150 years to achieve specific goals, the complexity, opacity, variability and conflicting goals of clinical work have created both methodological and organizational challenges for traditional Human Factors approaches. Despite huge developments in technique, application and shared knowledge, we suggest there is a long way to go to truly realize the potential that Human Factors offers for clinical work and patient benefit. As technology is increasingly sought in solutions to many safety and performance problems, opportunities for Ergonomics to improve design and integration have been missed, despite new regulatory interest (FDA, 2016).

From the opposite perspective however, healthcare is rich with need and potential, and there has been considerable progress and much to celebrate. A decade ago, there were few qualified Human Factors practitioners working directly in healthcare, and little recognition of Ergonomics as a discipline or the value it might bring to clinical work and patient outcomes. In 2017 there is much more cross-disciplinary publication and collaboration, and in the UK, Europe and Australia, most clinicians have encountered some aspects of Human Factors, while in the USA Certified Professional Ergonomics (CPE) practitioners are increasingly being employed by hospital systems to work alongside clinicians, safety teams, and quality improvement experts.

There is now supporting evidence for the Human Factors approach through a range of insightful and influential studies that was not extant a decade ago. The science of teamwork and checklists has been especially advanced, with increasing opportunities for refinement and further development, while our knowledge of how to enact and measure meaningful change has been hugely advanced by
the rigorous demands of the evidence base in healthcare. Rather than simply producing or deploying analytical tools, many healthcare Ergonomics practitioners are actively engaged in making change that has immediate and long term benefits. As a consequence, there are increasing opportunities for collaboration, education, practice, funding, and employment.

Our vision for Human Factors in healthcare over the coming decades is that best practice will be common including design, audit, investigation and procurement. We see benefits in qualified practitioners based in healthcare facilities, working alongside clinical and non-clinical professionals to apply the unique Human Factors perspective for the improvement of healthcare delivery, supported by a network to share lessons across facilities and countries. We think that Ergonomics initiatives should be integrated with Quality Improvement and Implementation Science. We also believe that Human Factors principles should be part of the core competencies of all healthcare professionals and embedded in educational curricula. Finally, the value placed on evidence and scientific rigor within healthcare provides the motivation to evaluate analytical techniques and interventional approaches for improvements in healthcare and reduction in costs. None of this will be easy or fast, but the progress in the last decade, exemplified by this special issue, demonstrates that we are already firmly on course.

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Sue Hignett
Professor of Healthcare Ergonomics & Patient Safety, Loughborough University, UK

Sara Albolino
Center for Clinical Risk Management and Patient Safety, Florence, Italy

Ken Catchpole
SmartState Endowed Chair in Clinical Practice and Human Factors, Department of Anesthesia and Perioperative Medicine, Medical University of South Carolina, USA
References
DOI:10.1080/00140139.2017.1377772
DOI:10.1080/00140139.2017.1349934
Dieckmann, P., S. Reddersen, T. Wehner, and M. Rall. 2006. “Prospective memory failures as an unexplored threat to patient safety: results from a pilot study using patient simulators to investigate the missed execution of intentions” Ergonomics 49(5-6): 526-543
Fogarty, G. J. and C. M. McKeon. 2006. “Patient safety during medication administration: The influence of organizational and individual variables on unsafe work practices and medication errors” Ergonomics 49(5-6): 444-456