Human Factors in Healthcare

From the IEHF, bringing projects and people together

IEHF Healthcare Campaign

The Institute of Ergonomics & Human Factors (IEHF), is the professional home for ergonomists and human factors specialists, with its members working across nearly all sectors of industry. There is a growing interest in ergonomics in healthcare and an increasing number of members applying their expertise in this field. In recognition of this, the Institute’s latest campaign is focussed on human factors in healthcare.

The IEHF will be involved in a number of events during 2013 and will organise the healthcare stream at their Ergonomics & Human Factors conference in Cambridge in April. The campaign is also coinciding with the launch of the IEHF’s new website which is being redesigned in order to meet a growing demand for information about ergonomics/human factors and particularly material relating to healthcare.

Understanding why mistakes are made and tackling poor designs or any poor procedures is key to improving patient safety. As this becomes more widely recognised, increasing numbers of professionals are coming together to share expertise and good practice. Their projects and organisations address specific problems such as medical device design, improved procedures for hygiene, patient handling and teamwork in complex surgery. What they have in common is that they are applying human factors and ergonomics principles and expertise to achieve their desired outcomes.

Significant research and innovation is taking place within healthcare human factors and our aim in this campaign is to bring organisations and people together to share examples of good practice, raise awareness of good design and to demonstrate the important contribution of ergonomics and human factors to the quality and safety of healthcare. The campaign will augment the efforts of organisations such as the CHFG which, through its Open Seminar series, is doing invaluable work bringing professionals together and raising awareness of human factors at government policy level.

:: Further details
Professor Peter Buckle, IEHF Past President, Imperial College London
email p.buckle@imperial.ac.uk or Healthcare SIG Coordinator Dr Janet Anderson, Kings College London, email janet.anderson@kcl.ac.uk. Visit www.ergonomics.org.uk.

MATCH

The Multidisciplinary Assessment Centre for Healthcare, MATCH, is a collaboration between four UK universities: Nottingham, Brunel, Birmingham and Ulster, that have been working since 2003 to improve the quality of medical devices produced in the UK.

As part of this project, human factors researchers from Nottingham University are working alongside researchers in psychology, engineering and computer science, as well as a cohort of device manufacturers and health providers to study how human factors methods and approaches can contribute to the development of new medical technology. MATCH has worked with the manufacturers of clinical devices to study how user requirements of patients and healthcare professionals can be collected, understood and incorporated into the development process. They have also investigated the use of verbal protocol methods for understanding the interactions between medical technology and users within a range of clinical environments in order to improve adoption, safety, effectiveness and health outcomes.

Another focus of MATCH has been on the devices that are used by patients to treat, support and monitor health conditions such as Type II diabetes, anaphylaxis and chronic obstructive pulmonary disease. As an example, an evaluation of physiotherapy devices used by adolescents with cystic fibrosis found that these devices are often not used as regularly or correctly as recommended by clinicians. Five human factors issues were identified that should be addressed in order to improve the effectiveness of these devices: engagement, information, confidence, aesthetics and compatibility with lifestyle.

Future MATCH research will focus on home and patient-use devices and will aim to develop improved ways of motivating, encouraging and supporting patients to use these devices correctly, safely and regularly. Collaborators are currently working with the Sickle Cell Society and NHS clinicians and medical psychologists to develop digital technologies and services that will assist people with this condition to monitor and self-manage this condition. In addition, MATCH is also working with health economists and social scientists to develop new techniques that will allow manufacturers to calculate the effects of improved design on the cost-effectiveness of medical devices.

:: Further details
Email Dr Jennifer Martin at Jennifer.martin@nottingham.ac.uk or visit www.match.ac.uk.
The Clinical Human Factors Group (CHFG) is the independent campaign group and charity set up to stimulate dialogue and demonstrate through concrete action how a better understanding of human factors can have a significant impact on safety, quality and productivity in healthcare.

Bringing together a broad coalition of health professionals, service users and human factors specialists, the CHFG is working with the Department of Health, the NHS Commissioning Board and the National Quality Board to influence National Policy.

In 2013, they will launch a new set of human factor resources for NHS Boards which will be freely available for download from a number of websites and will include practical case studies from within and outside the NHS as well as signposting healthcare professionals to human factors guidance.

In addition, Volume 2 of their popular “How to” Guide to Human Factors will be published. Whilst the first How to guide largely focused on giving a broad brush overview of human factors, Part 2 will include more examples and case studies demonstrating the implementation of human factors in healthcare.

Dr Jane Carthey, a human factors and patient safety specialist and author of the How to guide said: “Although our first guide raised awareness of human factors, we recognised that it was only a starting point. Many healthcare organisations have carried out work on implementing human factors since it was published in 2009 and that has created a real demand for more information from the service.

“The new guide will broaden the understanding amongst healthcare teams of the potential ways in which human factors methods can be applied to improve patient safety. It will share practical experience of applying human factors in healthcare, using case studies from different care settings, and signpost healthcare teams to further information and resources to support them to implement human factors in their own organisations,” she added.

The CHFG has also been actively growing their own network through their Open Seminar series and the development of a specialist Advocacy network.

Murray Anderson-Wallace, an Independent Strategic Advisor to the CHFG who is leading this work said: “Our Open Seminar series has been hugely popular. The events are a great opportunity for enthusiasts and experts to share their ideas and practice and learn from one another. Our collaboration with the IEHF has been crucial to the success of the Open Seminar programme, adding real expertise and a deep understanding that has been very much appreciated by all of our supporters.”

Progress in Scotland has also been impressive with collaboration on human factors developing between professional organisations, the Scottish Government and the CHFG.

:: Further details Email Murray Anderson-Wallace at mawallace@awrsc.co.uk or visit www.chfg.org.

Putting usability at the heart of monitor design

System Concepts have provided ergonomics and usability support for several years to an organisation which researches, develops, manufactures and sells cardiac sensor monitors. They worked with a design team of medical personnel and engineers to enhance the effectiveness and efficiency of use for medical staff using a cardiac monitor system. The cardiac sensor monitor offered great advances in non-invasive measurement but the output of data was poor at showing relationships between the different data sets and it was complicated to set up or change the user interface. The device aimed to transform complex, raw physiological data about a patient into useful information for medical staff, clearly displayed at the point of care.

System Concepts’ user-centred design approach starts with understanding the context of use so they carried out an ethnographic study which involved observing medical staff within the intensive care unit. They were able to find out who the users were, how users set up the device with patients, how often they used the device and the features that they used. They found that the real users were intensive care nurses who only needed a couple of key measures but who struggled with the interface which offered too much choice.

Having understood the context of use they also reviewed the user interface and device instructions against usability best practice and recommended improvements to the interface and instructions. When they fed this back to the designers they came up with an improved interface for these users. They then tested the revised interface in their lab with novice users in a simulated working environment and provided further recommendations based on their findings.

The new interface design was perceived by its users as easier to use and new features were described as very helpful. The users also considered that the data from the new interface was safer and more accurate. The design team were pleased and had a more efficient and more effective device.

:: Further details Visit the System Concepts website at www.system-concepts.com/usability.

:: How to guide: Email Dr Jane Carthey at jcarthey@iwhp.com or visit www.chfg.org.

:: How to use for medical staff using a cardiac monitor: Email Dr Jane Carthey at jcarthey@iwhp.com or visit www.chfg.org.


:: CHFG resources available 2013: Visit the System Concepts website at www.system-concepts.com/usability.

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**CHI+MED - making medical devices safer**

If a patient receives the wrong dose of a drug it’s usually the nurse who entered the numbers into the infusion pump that is blamed for the mistake. This is often unjustified. Because human error can never be eliminated (even by training) it is clearly impossible to design a system or pump that is completely error free.

However better design can reduce common errors, for example cash machines now return your card before your cash, and make sure that mistakes are correctly flagged up as errors, allowing them to be addressed.

CHI+MED, Computer-Human Interaction for Medical Devices, is an interdisciplinary research project combining expertise in human factors and computer science which considers interactive medical devices in their socio-technical context. They are aiming to transform the ways in which interactive medical devices are designed, bought and used in ways that both prevents and reduces the consequences of human error. They are working with everyone involved in the lifecycle of infusion pumps, including designers, NHS staff and patients in order to understand the context in which these people use these machines.

Their work has shown that different machines ‘assume’ different things when given wrongly entered numbers. For example, 1.2.3 is a meaningless number but different devices arbitrarily ‘autocorrect’ this to 1.23, 1.3 or even zero — instead of telling the user that a nonsense number was entered. In cases where an error leads to harm, the machine log may well be silent on the true reason for the mistake, shifting the blame onto the unwitting user. Things could be better.

CHI+MED’s research into the number entry systems used to programme pumps suggests that up and down arrows (chevrons) may result in fewer dosing errors than numeric keypads. They have also developed an online game called ‘Save the patients’, where players take on the role of a nurse setting up pumps. This demonstrates the different entry systems and the differences in their use.

Better design can make devices easier to use too and they have created an award-winning short video to demonstrate interaction design concepts in a fun way for use in schools. ‘Microwave racing’ shows four users of different microwaves competing to finish a task first. They also use magic shows in schools to enthuse pupils about computer science careers.

Understanding that human error is unavoidable is important in developing resilience–supporting designs but also in changing the culture of ‘blame and re-train’ that has often been the response to medical errors. ‘Errordiary’ is a Twitter tool they have put together for university students as a way of collecting examples of everyday error to reinforce that error is pervasive and to provide a rich source of material for categorising the different types of errors that can be made.

The CHI+MED project is a six year multi-site research project, taking place at City University, Queen Mary University of London, Swansea University and UCL with the Royal Free and Singleton Hospitals, and is funded by the EPSRC.

:: Further details Email Public Engagement Co-ordinator, Jo Brodie at jo.brodie@ucl.ac.uk or visit www.chi-med.ac.uk.

**Patient-centred approach to wound care**

Ease of use and patient satisfaction were just two of the factors that resulted in the VAC Via™ Negative Pressure Wound Therapy System winning the 2012 Ergonomics Design Award. The KCI entry was one of nine finalists in the 2012 Ergonomics Design Award with products ranging from a bespoke saddle design to an ambidextrous mouse. Judge lead was John Wood whose consultancy CCD Design & Ergonomics Ltd. sponsors the award. The KCI entry was one of nine finalists in the 2012 Ergonomics Design Award with products ranging from a bespoke saddle design to an ambidextrous mouse. Judge lead was John Wood whose consultancy CCD Design & Ergonomics Ltd. sponsors the award. He commented that of the nine products short listed, four of them involved patient safety products, demonstrating how ergonomics/human factors design was becoming increasingly important in healthcare.

:: Further details The closing date for entry to EDA 2013 is 30 November 2012, full details from the IEHF website at www.ergonomics.org.uk. For further information about the VAC Via™ System and other KCI products, see www.kci-medical.co.uk.
Designing out medical error (DOME)

One in ten hospital patients in the UK suffers unintended harm as a result of medical error. A key contributing factor is that clinical processes continue to evolve but the design of much ward-based equipment remains largely unchanged.

The Designing Out Medical Error (DOME) project aimed to better understand and map healthcare processes on surgical wards, establishing an evidence base to design equipment and products which better supports these processes and therefore reduces instances of medical error.

This three-year multidisciplinary project was set up with the aim of reducing medical error by creating a better fit between healthcare processes on surgical wards and the equipment and products that support them. The research team consisted of designers from the Helen Hamlyn Centre for Design at the Royal College of Art, surgeons and psychologists from Imperial College London and Imperial College NHS Trust, operations management expertise from Imperial College Business School as well as human factors specialists.

The team mapped surgical processes with NHS staff and patients, investigated how safety is managed in analogous industries, and used novel research techniques to identify and prioritise the five most error-prone processes on surgical wards. These are hand hygiene, information handover, vital signs monitoring, isolation of infection and medication delivery.

Interventions were designed for each process and tested in a simulated ward environment. These include the CareStation™, an all-in-one unit for the equipment needed for patient care in the bed space (pictured), a communication campaign for hand hygiene, and a new trolley to monitor vital signs that is easier to clean and use. Some of the design interventions are undergoing clinical trials and have been taken forward by manufacturers to production.

The project has won a number of awards and has also been exhibited internationally including at the Hunterian Museum at the Royal College of Surgeons.

:: Further details Email Jonathan West, Helen Hamlyn Centre for Design, Royal College of Art at jonathan.west@rca.ac.uk or visit www.domeproject.org.uk.

Reducing the risk of retained guidewires

After undergoing an operation a patient might be forgiven for being somewhat alarmed on being told that a catheter guidewire had accidentally been left inside their body, that there was a risk of severe harm and that further urgent surgery would be required to remove it from their venous system.

Indicating their rarity, this and similar incidents of retained surgical equipment are called ‘Never Events’ in the NHS, and often bring with them a significant cost to the institution involved, not to mention harm to the patient. Recent incident report figures of guidewire retention suggest that there are around three cases per month in the NHS, although this may be an underestimate.

Following a case of guidewire retention, Addenbrooke’s Hospital in Cambridge recognised the significant part that human factors can play in incident causation.

Seeking a thorough review of the risks, they worked with the Engineering Design Centre at the University of Cambridge to investigate the incident from a human factors systems perspective.

The work investigated a variety of socio-technical factors including the range of users, their training and expectations, the diversity of catheter sets, organisational pressures and cultural influences, and the Trust’s procedures for catheterisation. Various methods were employed to help in the investigations, including two human reliability analysis methods, an audit of procedures using a tool from the Health & Safety Executive, and a review of the guidewire insertion task using usability heuristics.

These were supported by interviews with staff, observations of catheterisation and a questionnaire, to evaluate proposed solutions for their effectiveness and ease of implementation. Thirty seven staff who insert central lines responded.

The project revealed the complexity of the situation, including many risk factors and error-producing conditions. Fourteen candidate solutions were identified to help reduce the risk, ranging from changes to the procedures and training, the purchasing strategy, how surgical waste is disposed of and minor modifications to the design of guidewires. These require consideration of various trade-offs, including infection risk, efficiency of use, unit cost and guidewire retention risk.

A shortlist of solutions for implementation by the Trust is undergoing final review with users although involvement by the NHS Supply Chain, the MHRA and manufacturers would be an added benefit to bring about effective and sustainable design solutions.

Appreciation is given to the staff at Addenbrooke’s Hospital who took part in the project and the Addenbrooke’s Patient Safety Unit for funding it.

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