Designing out medical error – the DOME project

Patient safety is a big issue in healthcare. Although the assumption is that people go into hospital to get better the reality is that this is sometime not the case. All kinds of errors and mistakes can – and unfortunately do – happen and as a result there is growing concern about patient safety. To put this in perspective, findings from the UK, US, Australia, New Zealand and Denmark all suggest that approximately ten per cent of patients admitted to hospital may suffer some kind of adverse outcome, about half of which is preventable with current standards of treatment (Vincent, 2006).

The cost of this is not just measurable in human terms – it also has significant economic impact, both in the direct costs of fixing the mistakes and also in the litigation and other associated costs. For example, in 2007 – 2008, the UK’s National Health Service (NHS) Litigation Authority paid £633 million in settlement of clinical negligence but this omits many of the costs relating to avoidable harm. The UK’s National Patient Safety Agency (NPSA) calculates that unsafe care costs individual healthcare Trusts between £88,000 and £400,000 per year, and that medication errors cost a total of £774 million per annum.

Not surprisingly patient safety now has a high priority on most healthcare systems – and it opens a significant innovation challenge. What new approaches – new technologies, new ways of working, new products, etc. could help deal with this challenge? Much progress has been made in understanding the problem and particularly recognizing that there is no single big cause but rather a series of small errors which often compound themselves into accidents and unforeseen negative outcomes.

For example around half of the errors (and often those with the most serious outcomes) occur in surgery; indeed, the World Health Organization estimates that each year, half a million deaths related to surgery could be prevented. A significant impact has taken place through the adoption of a systematic error-checking process base don experience in the airline industry – the pilot’s checklist. Whilst attending to a systematic list of factors may seem at first to be beneath the skills and experience of highly qualified surgeons and related clinical staff, the reality is that the introduction of checklists has had a marked impact on safety.
This illustrates an important direction for innovation in patient safety – learning from other industries. The problem of safety is not confined to the medical world and there are many other situations – like the aircraft cockpit – where analogous activities take place and where potential transfer of innovative solutions could be made.

This formed the basis of the DOME – Designing Out Medical Error project which ran from 2008-2011.

A video describing the project and illustrating some of the innovative solutions can be found here:

http://vimeo.com/30450511

DOME focused on ward-level issues rather than those in the operating theatre and involved mapping processes with NHS staff and patients, investigating how safety is managed in analogous industries, and using novel research techniques to identify and prioritize the five most error-prone processes on surgical wards. These were:

- hand hygiene,
- information handover,
- vital signs monitoring,
- isolation of infection and
- medication delivery

At first sight these might seem hospital specific but closer inspection reveals similarities with other sectors. For example the information handover problem is typical of any business in which there is multi-shift working and failure to communicate important information can lead to problems.

The hospital related issues were analyzed and abstracted to general statements of problems – such as information flow and communication.

The industries form which learning was sought included:

- Construction
- Chemicals
- Automotive component assembly
- Oil and gas exploration

Several innovation tools were used (all of which are described in more detail in the Toolkit on the Portal); these included:
• Process mapping
• Ethnography
• Fishbone (cause and effect) diagrams
• Design methods
• FMEA Failure Modes Effects Analysis

As one of the design researchers, Jonny west, explained, "It's not like an airplane falling out of sky or a nuclear power plant exploding—there's no one big thing ........the process is different for each patient, so the process can go wrong in unique ways, which makes it very hard to tackle in terms of design."

The DOME researchers began by shadowing medical workers inside patient rooms. After dozens of hours of observation, they identified high-risk health care processes and analyzed them for critical points of failure. From there they crafted design briefs and enhanced them during focus groups with various experts. The end result was a suite of prototypes meant for real-world testing.

During patient observations, the DOME team noticed practitioners often had to hunt for hand sanitizer, gloves, and aprons. Many had to carry around bins to dispose of needles. Medication cabinets were often blocked or located far from the bedside. And there wasn't always an easy place to scribble notes into a patient chart. Each of these problems is fraught with the potential for a preventable medical error.

The CareCentre serves all these needs in a single, free-standing station that can be situated at the foot of any patient's bed—complete with hand gel, gloves and aprons, drug locker, waste and needle bins, chart surface, and storage slot. West and colleagues put the device through a week-long randomized trial on surgical wards. Compared to wards with standard equipment, those with the CareCentre had better hand hygiene, fresh glove and apron use, and old glove and apron disposal.

Interventions were designed for each process and tested in a simulated ward environment. These include the CareStation(TM), 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.