Keeping patients safe in hospital

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Intravenous drip. Credit: Toshiyuki Imai

Healthcare is a complex beast and too often problems arise that can put patients' health – and in some cases, lives – at risk. A collaboration between the Cambridge Centre for Health Services Research and the Department of Engineering hopes to get to the bottom of what's going wrong – and to offer new ways of solving the problems.

In November 2004, Mary McClinton was admitted to Virginia Mason Medical Center in Seattle, USA, to receive treatment for a brain aneurysm, a potentially serious swelling in a blood vessel. What followed

was a tragedy, made worse by the fact that it was entirely preventable.

McClinton was mistakenly injected with the antiseptic chlorhexidine. It happened, the hospital says, because of "confusion over the three identical stainless steel bowls in the procedure room containing clear liquids—chlorhexidine, contrast dye and saline solution". Doctors tried amputating one of her legs to save her life, but the damage to her organs was too great: McClinton died 19 days later.

Nine years on, an almost identical accident occurred at Doncaster Royal Infirmary in the UK. Here, the patient, 'Gina', survived, but only after having her leg amputated.

Professor Mary Dixon-Woods is one of Cambridge's newest recruits, and she is on a mission: to improve patient safety in the National Health Service and in healthcare worldwide. She has recently taken up the role as RAND Professor of Health Services Research, having moved here from the University of Leicester.

It is, she admits, going to be a challenge. Many different policies and approaches have been tried to date, but few with widespread success, and often with unintended consequences.

Financial incentives are widely used in the NHS and in the USA, but recent evidence suggests that they have little effect. "There's a danger that they tend to encourage effort substitution – what people often refer to as 'teaching to the test'," explains Dixon-Woods. In other words, people focus on the areas that are being incentivised, but neglect other areas. "It's not even necessarily conscious neglect. People have only a limited amount of time, so it's inevitable they focus on areas that are measured and rewarded: it's an economy of attention as much as anything else."

In 2013, Dixon-Woods and colleagues published a study, funded by the Wellcome Trust, evaluating the use of surgical checklists introduced in hospitals to reduce complications and deaths during surgery. The checklists have become the most widely used patient safety intervention in the world and are recommended by the World Health Organization. Yet, the evidence shows that checklists may have little impact, and her research found that in some situations – particularly in low-income countries – they might even make things worse.

"The checklists sometimes introduced new risks. Nurses would use the lists as a box-ticking exercise rather than as a true reflection of events – they would tick the box to say the patient had had their antibiotics when there were no antibiotics in the hospital, for example." They also reinforced the hierarchies – nurses had to try to get surgeons to do certain tasks, but the surgeons used it as an opportunity to display their power and refuse.

Problems are compounded by a lack of standardisation. Dixon-Woods and her team spend time in hospitals to try to understand which systems are in place and how they are used. Not only does she find differences in approaches between hospitals, but also between units and even between shifts. "Standardisation and harmonisation are two of the most urgent issues we have to tackle. Imagine if you have to learn each new system wherever you go or even whenever a new senior doctor is on the ward. This introduces massive risk."

Even when an institution manages to make genuine improvements in patient safety, too often these interventions cannot be replicated elsewhere or scaled up, leading to the curse of "worked once", as she describes it.

One place that has managed to break this pattern is Northern Ireland, which has overcome the problem of poor labelling of lines such as

intravenous lines and urinary catheters. A sick patient may have several different lines attached to them; these were not labelled in any consistent way – if at all – so a nurse might use the wrong line or leave a line in place too long, risking infection. Over 18 months, the health service in Northern Ireland came up with a solution. Soon, whether you are in a hospital, a nursing home or a hospice, every line will be labelled the same way.

"I'm interested in how they managed to achieve that and what we can learn that can be used in the next place that wants to standardise their lines."

Dixon-Woods compares the issue of patient safety to that of climate change, in the sense that it is a "problem of many hands", with many actors, each making a contribution towards the outcome, and where it is difficult to identify who has responsibility for solving the problem. "Many patient safety issues arise at the level of the system as a whole, but policies treat patient safety as an issue for each individual organisation."

Nowhere is this more apparent than the issue of 'alarm fatigue'. Each bed in an intensive care unit typically generates 160 alarms per day, caused by machinery that is not integrated. "You have to assemble all the kit around an intensive care bed manually," she explains. "It doesn't come built as one like an aircraft cockpit. This is not a problem a hospital can solve alone. It needs to be solved at the sector level."

Dixon-Woods has turned to Professor John Clarkson in Cambridge's Engineering Design Centre to help. Clarkson has been interested in patient safety for over a decade; in 2004, his team published a report for the Chief Medical Officer entitled 'Design for patient safety – a system-wide design-led approach to tackling patient safety in the NHS'.

"Fundamentally, my work is about asking how can we make it better and what could possibly go wrong," explains Clarkson. It is not, he says, just about technology, but about the system and the people within the system. When he trains healthcare professionals, he avoids using words like 'risk', which mean different things in medicine and engineering, and instead asks questions to get them thinking about the system.

"We need to look through the eyes of the healthcare providers to see the challenges and to understand where tools and techniques we use in engineering may be of value. I have no doubt that if you were to put a hundred engineers into Addenbrooke's [Hospital], you could help transform its care."

There is a difficulty, he concedes: "There's no formal language of design in healthcare. Do we understand what the need is? Do we understand what the requirements are? Can we think of a range of concepts we might use and then design a solution and test it before we put it in place? We seldom see this in healthcare, and that's partly driven by culture and lack of training, but partly by lack of time."

Dixon-Woods agrees that healthcare can learn much from how engineers approach problems. "Medical science tends to prioritise trials and particular types of evidence, whereas engineering does rapid tests. Randomised controlled trials do have a vital role, but on their own they're not the whole solution. There has to be a way of getting our two sides talking."

Only then, she says, will we be able to prevent further tragedies such as the death of Mary McClinton.

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