- [Rhona] Thank you very much for the invitation to come here to sunny Chicago, to have the opportunity to talk to you about some of the work we've been doing in Scotland with nurses and with other kinds of professionals. What I'm going to do is give you a little bit of the background to that work, tell you how we developed some of the tools that we are now trying to test in various professional groups and maybe at the end start to think about what might be the role of the regulatory bodies, such as your own in making this kind of change in the competence profile and what we regard as critical skills for nurses and other professionals working in safety critical domains.

As you can probably hear, like your new CEO, I come from Scotland. I hope you can understand my accent for the next 50 minutes or so. What I'm going to do is tell you about some of the work we've been doing in Scotland with nurses and other kinds of professionals. What I'm going to do is give you a little bit of the background to that work, tell you how we developed some of the tools that we are now trying to test in various professional groups and maybe at the end start to think about what might be the role of the regulatory bodies, such as your own in making this kind of change in the competence profile and what we regard as critical skills for nurses and other professionals working in safety critical domains.

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This was a family doctor, a general practitioner, as we call them, who was not only busy treating his patients, he was busy murdering his patients. And they don't know for sure how many he poisoned but it seems to have been somewhere in the region of 215. Once this all came to light, I'm not going to go into that story, there was clearly a huge public interest and an inquiry began.

A woman judge took the role of leading this inquiry and I think possibly went a little beyond her original remit and started to raise some really significant questions about competence assessment of our medical professionals, particularly our doctors. In her report, she said that the health care profession, this is in the UK, should be considering approaches taken in industry to maintain and assure professional standards of job performance to meet regulatory standards. This is clearly exactly what your area of work and responsibility is.

I have been working with industry, as mentioned. I have worked mainly in high risk industries. Aberdeen, where I come from, is the home UK North Sea Oil industry, so I'm used to working in those kinds of offshore installations, power plants, those kinds of settings where safety is clearly an paramount
for obvious reasons. But, in recent years, in the last 15 years maybe, I've began to work much more in health care, which is clearly another safety critical profession.

I was given the task by the Department of Health in England to write a little report looking at what do other high risk industries do in the United Kingdom, in terms of competence assessment for key professionals. I chose three high risk industries that I have worked with: civil aviation, nuclear power, and the offshore oil and gas industry.

The little report that I wrote is available on our group's website. What I did was some interviews. Obviously, I needed to talk to the regulators about what they were looking for, how they set and maintained standards, and I also had to talk to people from the operating side; from the industry side. What I was asking about was well, let's agree a particular target group to focus on and, for that group of professionals, what's the legislation, what's the role of the regulator?

In many cases, these individuals, like pilots, have got licenses, so how do the licenses get checked, who does the checks, how often does that happen, how do you establish standards of competence, what systems do you have in place for competence assurance, and are there any other mechanisms?

Just very briefly, because it gives a bit of a wider context to what I'm going to talk about in relation to nurses, I'm just going to say a little bit about each of these domains. For civil aviation, as you probably know, you have the FAA here in this country, while in the UK we have, the CAA does the same job. In aviation, there's very well established systems that have been around for 70 to 80 years now. The pilots have licenses, they are checked regularly, they often have a six month check as well.

This is what's key for my presentation. They don't only assess the pilot's flying skills, in terms of can they work their equipment. They also assess their non-technical skills and they know what these skills are and they know how to assess them. Those people who are doing the training and assessment, they too are trained and qualified to make the assessments, not just to the technical flying skills, but also of these non-technical skills. For the regulator, this is very important because you need to understand the big picture here, the whole system, which I'm sure you understand better than I do, but of the fact the trainers and assessors must also themselves be trained and be deemed competent and have their own competence checked on a regular basis. I find that that's not always appreciated elsewhere.

Nuclear power industry. They have people working their controls in the systems. They're called duly authorized persons. They have standards of competence and the relevant point here, two yearly assessments going into the simulator. My point, underlined is that they're not just checking their technical skills; they're also checking their non-technical skills.

The offshore oil industry, you may be less familiar with, although you've got a big industry here. They are slightly different and I looked at one particular group, the managers who are in charge of these rigs and platforms. They have certain skills, such as emergency response checked very formally, but in the bigger oil companies, they have probably six monthly appraisals looking at their performance.

The oil industry has been fairly slow to bring in non-technical skills. We tried to interest them in this after the Piper Alpha accident in the North Sea that killed 167 men one night when the platform exploded. There wasn't an enormous interest in bringing in non-technical skills. However, five years ago,
the Deepwater Horizon drilling rig had a blow out, killed 11 men and spilled oil all over the Gulf of Mexico, costing the oil company, BP, billions of dollars, costing other companies a lot of money, causing the regulator to have to revise its procedures and hey, presto, there's suddenly a whole lot of interest in the drilling industry in non-technical skills because, I think, partly because when we start to get to the investigations of these big events, the lawyers and the investigators are now beginning to ask different kinds of questions around organizational culture, non-technical skills, etc. We can see this coming in, in a much bigger way, particularly in the drilling industry.

So you work in industry. What's this got to do with health care? High risk industries clearly have specific kinds of organizational cultures. They've got very strong management hierarchies. There's risk consequences for the workers themselves, so they're going to kill or injure themselves if they get things wrong. The target group is much smaller than health care and they rely on a lot of standard operating procedures, standard technical ways of doing things, which is not always applicable in healthcare.

It doesn't translate. The fact that they look at non-technical skills, though, I think, does translate. So the general principle is that they've got independent regulator, they have regular conformity checks, and they're not a default to positive. So you don't just get your license approved if you've done nothing obviously wrong in the last year or two.

They actually do a positive check. They have standards of competency of assessors and they look at these non-technical skills. They use simulators, etc. They also, I think in the better companies where they've got safety management systems, they link their competence assurance procedures to their other safety systems. I think that is quite an important point, that these things are integrated.

If you want to focus on non-technical skills, can I ask how many people are familiar with this term or use it in their practice? One or two. One of them is from Scotland.

Okay. So I'm going to just explain the background here. These skills are formally trained and assessed in aviation and nuclear and they're coming in in the oil industry, in shipping and other sectors.

Obviously, to train and assess these, you're going to have to identify what they and I'll come to that point, but, essentially, these are thinking skills, cognitive skills like: decision making, situational awareness, which is picking up information in the world around you when you're doing a task, making a mental model an understanding of what's going on here, and then using that understanding to anticipate what might happen in the next few minutes, in the next few hours.

There's also social skills, team skills like leadership, team coordination, and there's some skills around managing stress and fatigue. In other sectors, they have systems now that have identified the main skills and they have tools for observers to watch a practitioner doing their job and then to make a rating of these non-technical skills. This system, for example, one of the European systems for pilots is called NOTSS.

The rest of the talk is about how we've been working on designing and trying to implement these kinds of systems for anesthesiologists, for surgeons. There's some London groups looking at emergency physicians. We've also developed some tools for scope nurses, instrument nurses, OR nurses. I don't
quite know what you call them here and anesthetic nurses. Now they are not nurse anesthetics because we don't have nurse anesthetics in the UK. They are nurses who assist the anesthesiologist. So they're like scrub nurses for anesthetists.

This is, fundamentally, my model here. My whole talk now is looking really at worker behavior, which consists of people's technical skills and then these non-technical skills which complement them. But sometimes I fear that I'm going to be accused of taking kind off blame-the-worker for everything that goes wrong. This slide is important because what I'm saying here is that I understand that people working, particularly in the kind of environment you work in, are very affected by the conditions in their organization. So what kind of culture is there? What's normal? Is everybody taking risks? Is anybody following the rules? Do people speak up if there's an issue? That's all to do with normal behavior and to do with the culture.

There's a whole set of things to do with work conditions. Are you working under pressure? Are people tired? Do you have the right equipment? There's all that stuff, powerfully affects people's behavior and I am acknowledging that now, but that's a different talk to start talking about that. What kind of culture there is will affect whether people who learn new technical skills and new non-technical skills or training courses actually implement them because cultures can be quite toxic in organizations.

Again that's maybe a bit of another point. So job performance, at the end of the day, does the patient get safe and efficient care is a function of all these factors. Now I'm really going to concentrate just on this one factor, the non-technical skills part. The background now, I'm going to switch to aviation and you may be familiar with these accidents. This is why another industry recognized the importance of non-technical skills. And the key accident in Europe and, really, worldwide is the Tenerife crash in 1977.

Tenerife is one of the Spanish islands off the African coast out in the Atlantic, big holiday destination for Europe and there was a dreadful accident there, in 1977, where two jumbo jets, two Boeing 747s, one operated by Pan Am, the other operated by KLM, crashed on the runway, killing 583 people. The conditions were far from ideal. There had been a bomb scare on another island; a lot of extra aircraft had been diverted into Tenerife, so it was very busy. The crews were all waiting to get their turn to take off, the visibility was poor, so there were a whole lot of conditions here made this much more likely to happen, but the Pan Am plane was on the runway, trying to find its exit. I think it missed its taxiway; it was trying to find its taxiway. On the KLM plane, the Dutch plane, which is sitting on the runway at the top, just ready to take off, there appears to possibly be having been some misunderstanding around the clearance. The co-pilot, it appears from the voice transcript, did not really think they had been cleared for takeoff and was kind of hesitantly, not querying in an obvious way but kind of saying, "Hmm, we are at take off," and the captain said yes and pulled the throttles. The KLM plane then hurtled down the runway and the Pan Am plane was still on the runway and they hit each other. Dreadful accident, but the planes hadn't even taken off into the air. This is nothing to do with technical flying skills. When they analyzed the accident, how can this happen? They see and hear there's issues here to do with maybe the lack of assertiveness, the co-pilot maybe could have spoken up more forcefully, maybe a communication issue that wasn't resolved. The captain maybe wasn't listening properly to co-pilot. Their situational awareness was clearly diminished as to whether—anyway there was a whole pile of things in there.

In the United States, there were three accidents round about the same time, in the 1970s. I can't remember which airline it was, but that were similar. There were obvious technical causes and yet they
were full of this non-technical stuff. So the airlines at this point, the American airlines brought in quite early work, NASA were involved in this, to identify what were these non-technical skills because clearly this was going to have to be fixed in some way and to start training these and emphasizing the use of these skills.

Then it takes a number of years before this comes in. Already KLM, rather obviously, some other airlines have got this training in place but not everybody has. Here we see the role of the regulator. So, in England, the regulator is kind of interested in this, encouraging airlines to do it, but not everybody is doing it.

Then there was another accident in Kegworth, middle of England, plane on a domestic flight. One of the engines goes on fire and the pilots shut down the other engine, they shut down the good engine. People in the back, including the cabin crew, may have realized but then cabin crews don't necessarily speak up the pilots in the middle of an event. So there's another maybe assertiveness issue and the plane is, predictably now, got no engines and crashes.

I have talked with CAA regulators and one them who was in post at the time told me they couldn't wait for the data. They couldn't wait for any more research studies about does this stuff work. These are accidents where such powerful demonstrations that failures in this non-technical skills, because that's what came out of this one as well, were contributing to these dreadful accidents.

That the non-technical skills training, what they call crew resource management was going to have to be mandated and it was going to have to come in and everybody who is going to be operating passenger carrying planes was going to have to train their pilots. I think that's been interesting, seeing the powerful role of a regulator here in starting to make something happen. These same regulators in the UK were quite early on in making sure the pilots had their skills formally checked, their non-technical skills had to checked, as well as their technical skills.

In a sense, this is what we need to think about, this is the framework. We've got now some kind of problem, we see these accidents. We can see many accidents in health care with human error, things going wrong. What has to happen then is that somebody needs to analyze the accident, that's what we saw in these aviation studies. When you're doing that analysis, it enables you to identify what really are these skills that should have been there or pilots had but they didn't use them at that time and what were the conditions affecting whether they used those skills or not. Then, on the basis of that, you design the training and you evaluate the training. So that's a very nice closing the loop model about how you should address these behavioral problems when you start to look at incident and accident investigation.

What I see happening in industry and I see happening sometimes in health care is this. So we have a bit of a problem on patients' safety. One in ten patients going to hospitals in the UK have some kind of adverse event and 50% of these are probably preventable. So we have a huge patient safety problem and I'm aware you have one here in this country as well.

What I see people saying, "Oh, it's something to do with teamwork and communication. So we must buy in some team training or get some airline pilots or we'll get somebody who can fix us with a training course on some of these team training, human factors stuff and then we'll bring that in." Then, quite often, it doesn't really work very well and I would say well why it would, because you never took the time to identify, for those particular professionals, what were the skills and conditions that they needed to do their job.
It's just not a question of taking the Tipex, you know that white paint stuff when you make typing errors? Taking the Tipex and tipexing out flight deck and writing in ward or operating theater and then taking a bunch of stuff. Of course there are things that translate industry to industry. Humans are very similar across these jobs.

People say health care is so complex and I say mmm nuclear power plants and flying jumbo jets is quite complex as well. Clearly, there are differences and they're very significant differences when you're dealing with patients and patients who need treatment. But actually, the humans, the workers, the managers, their heads are you might say wired up the same kind of way, whether they are pilots, surgeons or oil drillers or whatever. The same kinds of things affect their behavior. What we've been trying to do is not just take that easy red arrow and to follow the model from aviation and go down the other route by doing the task analysis and trying to work out what the scales should be. How do you do this? Well there's plenty of professionals know how to do this: psychologists, HR professionals, some trainers.

We will do what's called task analysis. So you'd watch people at work, get observational data, you talk to people. People who do the job are the very best people for telling you what kind of skills are important, what kinds of behaviors make a difference. You can do that with surveys, you can have confidential incident reporting systems, where people talk about near misses and they say what actually happened that day or what they did do or didn't do or nearly did and, of course, you can go to the incidents. This is a patient getting the wrong drug, patient getting the wrong treatment, etc. and analyze what happened in that particular event.

But the one thing that they've got in aviation, which I don't think you have in most of your work places, is that they've got the cockpit voice recorder. So this is taking a two hour loop of the conversation on the flight deck and so we know exactly what the pilots were talking about in the run up to that event.

You'll see from recent incidents; the Germanwings crash, how very useful that cockpit voice recorder was in revealing what probably happened that day and how anxious they are to get hold of the cockpit voice recorder from the Malaysian Airlines missing plane because that tell, probably pretty well, what happened in that event.

So the cockpit voice recorders provide absolutely invaluable data for the psychologists and the pilots. Often, the transcripts can be found on the web.

They make chilling reading, I have to say. This is one from the Air France crash, where pilots lost control of the plane between Rio and Paris and the whole plane was lost in the Atlantic.

But what they found in the Atlantic some time later, they got the black box and the cockpit voice recorders in there. The whole conversation about who was on the flight deck, who wasn't and what was the build up as the pilots are struggling and they're working as hard as they can to keep control of that plane, but are actually doing some of the wrong things.

So my question might be this morning, if there's a clinical black box in your clinical area, if you're still in a clinical position, or you can think if a clinical area, a ward, a clinic operating room that you've
worked in. And we just imagine that we have the voice feed from that recorder, from your workplace coming into this auditorium. There would be people just talking normally about what they're doing in their job or we have an event or an error and we can hear the few minutes before that happens.

You know what kinds of things might we hear health care workers? What kinds of things would nurses be saying? Well, I don't know. You would know that better than I do. I can only guess, but I think they would be saying because if we look at the transcripts from voice recordings from other industries, particularly aviation, we hear kind of normal stuff, sometimes, in the run up to a plane crash or some other event.

You know it could be things like, I'm just guessing, hear people saying, "We don't need to follow the procedure. My way is much quicker." Little misunderstandings, "Did she say four? Will I check? No, it probably was, let's just carry on."

Assumptions under Penal Law of Accidents, nobody follows that procedure. It might be a terrible procedure, we don't know but clearly management probably thinks that the procedures is being used.

People who are very experienced are not immune to making the odd mistake. Time pressure. Maybe a little bit of rushing to get things done. Then, of course, there's the whys after the event, stuff that we sometimes see. We can just guess but these kinds of data would be really, really useful in terms of understanding. We want to know about situational awareness and how that gets lost. We want to know about how people are making decisions. We want to know about how they're communicating and working as a team and how is the leader behaving. All this kind of data would be really valuable. However, we don't have that in health care, so we have to use other things, as I'll explain.

So this term, non-technical skills, which is kind of a bit of kind of European goobledy-gook, came from the European civil aviation sector and there's a definition there. They're also called crew resource management skills. That's exactly the same thing.

The main skills that I've mentioned are listed here. The images of a book we wrote because practitioners we started to work with said I don't have time to read 12 psychology books, could we just have one book just explaining what these stuff is, which is what that book covers.

So as I've mentioned, I'll not go through this again, in aviation in particular, there's a good model there, but what's important is they keep updating this. So they didn't just design their non-technical skills training in the 1970s. Aircraft have changed enormously in 30 - 40 years. They keep reviewing. So the European Aviation Safety Authority, in the last year, you can read about this on the web, have been reviewing their CRM training for pilots.

That's regulators leading the reviews of what CRM skills, non-technical skills, should be taught. They have a two, three days classroom training and its recurrent training, so the pilots get retrained in non-technical skills on a regular basis. They get these skills assessed formally in a number of countries. I know about some of these because was lucky enough to be part of a European project with pilots and psychologists, where we were asked by the European regulator, which was the JAA at the time. This was a bit like this organization. It was responsible for a number of European countries regulations and
this was the overarching body. We were asked to come up with a Pan-European system that airlines could use to rate their pilots' non-technical skills.

They wanted this because the big airlines, the big flight carriers: British Airways, KLM, Air France, they already had stuff in place, they already their own psychologists, but the smaller operators, the charter firms, the eastern European countries that had just come into Europe, far less resourced and they wanted a tool that they could use and that's where I learned, working with these people, all of whom were more experienced than I was, how we could go about developing a taxonomy of non-technical skills that could then be turned into a rating tool.

The question is the work then that we've been doing more recently, is any of these relevant for health care? The area that I've been working in is the operating room. This is because, as the simulators came into medicine about 15 years ago, particularly the anesthesiologists began to develop very good simulation facilities and we began early on to work with, people call them anesthetists in Scotland.

We began to work with these doctors who said, "You know, when we have people in the simulator and we give them these exercises, we're really good at debriefing their technical skills. We can say wrong tube, wrong drug. That's not the pressure.

Do it this way, but we're not so good at debriefing the other aspects of their performance." So, we can say things like, "Mmm, there's something not quite right about the way you're doing that or working with the team or something," but we don't have a common vocabulary, we don't have any tool to do this." They had heard of the work we'd been involved in with pilots and they said can we start to develop the same kind of thing for our professionals? So that's how I got into working in health care in this area.

It's only recently people have begun to look at non-technical skills in areas like the operating room. We can see, as that work starts to emerge, and these are usually psychologists working alongside surgeons, or scrub nurses or anesthetists, but we're starting now to see papers coming into the literature, where either we see the relationship being picked up with failures in communication, teamwork, decision making and adverse outcomes, complications, deaths, mortality, injuries whatever and also some nice studies, Edmondson's at Harvard are looking at where you see good behavior.

This is a study of good leadership behaviors in surgeons with the teams. These are cardiac surgery teams learning a new technique quicker when the leader has good leadership skills, nothing to do with the technical skills.

So if you look at the dates in these papers, these are all in the last 15 years. Prior to that, there's almost nothing in the surgical literature about this kind of behavior. There's a little bit in the nursing literature but not very much and certainly not for the theater nurses. Our definition for staff in the OR is exactly the same. It's cognitive and social skills complementing their technical skills and contributing to safe and efficient task performance. The less errors, the less things going wrong, the faster the task will get done and more efficiently.

The first of the studies that we did was from anesthesiologists. The work's published in various journals. For each profession that we worked with, we devised a set of skills. We identified what we were, we designed a rating tool, and then we produced a little booklet which explains how to use this or how to
start using this. These little booklets are available from our group, they're either on the website or you have to send an email to get them.

The one for anesthesiologists is there. We have been working more recently with surgeons. The papers are in some of the surgical journals.

Again there's a tool, a little booklet and the surgeons, in fact, maybe because we worked with one of the Royal Colleges of Surgeons, the Royal College of Surgeons of Edinburgh were involved right from the start, the surgeons have really taken this to heart and have really started to implement this. So the Australian surgeons, their college put some of our non-technical skills into their performance standards. We've had surgeons in developing countries using these. We have requests globally for people wanting to try this tool.

My understanding, from one of my former colleagues who's now working with the Harvard surgeons, is that the American College of Surgery is interested in the non-technical skills component of surgical training and may be starting soon to do something about that. So we're seeing interest in other domains. Because the surgeons are particularly interested, we've just edited a book for surgeons.

It's not out yet, it's just about to come out, which takes the non-technical skills for surgeons and explains. The chapters are all co-written between surgeons and psychologists. This is surgeons who are familiar with this kind of work. They're not all British surgeons, some are Americans, some are Australian, but they discuss in these chapters what it's like for a surgeon and what are the relevant aspects of decision making or situational awareness or leadership while they are operating. This stuff is all about while they are on task operating. It's not about what they do in the wards or the clinics.

Anyway, to get back to the main subject here, which is nurses, after we'd done the surgical tool, we then began to work with some government funding in Scotland on a tool for scrub nurses, but it is called "scrub practitioners list of intraoperative non-technical skills," because it's not just nurses who do this role. In some cases, their operating department practitioners who are not actually nurses.

So we have to be careful with the terminology here, which is why we say scrub practitioners which covers both professional groups. I don't know what they're called here, instrument nurses maybe. They're the nurses who scrub in with the surgeons and they have large trays of noisy instruments, which they have to hand to the surgeon during their procedure.

We're trying to understand then they're to identify what are the non-technical skills that a scrub nurse needs. Do any people here work or have worked in the operating room with surgeons? Are there any former scrub nurses here? One or two, good. I'll not go through all this, but we did I said is important you do the task analysis in your work out. So there's no point just taking the surgeon's tool and writing nurse instead of surgeon. We did the work from the start. Doing a literature survey, doing observations, doing interviews to identify, to spend time with experienced nurses, identifying what the skills were.

Then, from that, we start to design a taxonomy, which is just like organizing into hierarchy the main categories and elements. Of course, we don't know that because we're psychologists. Again, we work with panels of nurses to do that.

Then we get a prototype rating tool and we have to start the evaluations.
I'm just going to say a little bit about these steps. The task analysis included a review of the literature which is published in one of the nursing journals, observations took place, watching scrub nurse in the operating theater and then we did a series of interviews.

Of course, the role of the scrub nurse is very much linked to surgeon with whom that nurse is working. So we also interviewed surgeons about what they thought about scrub nurse's behaviors, which behaviors were desirable, which behaviors were less desirable etc. Surgeons have strong views on scrub nurses.

They're not quite as strong as the views that scrub nurses have on surgeons, which is another matter. So just to give you a flavor, just to let you see the kind of data we would be collecting and analyzing, here's just some quotations from the nurses. This is a nurse saying, "You just know when something is going wrong. It's just you can physically see that something's happened, but sometimes you can't see. You can just recognize the surgeon's body language or see them clenching their jaw and, from that, knowing that things aren't going well."

The nurses talked about subtle cues that they use to determine what was happening in the procedure. The surgeons don't always say what's happening, either because they're preoccupied or because they don't want to say, but the nurses use their own methods.

They have all this tacit knowledge about how to do things and much of this is not written down in nursing journals or nursing textbooks. It's in the heads of experienced nurses and it walks out the organization when these nurses are retired. They pass this on in tea rooms, in sluices, in other places.

To their trainees they say, "When he does this, you must always do that, " whatever or, "Here is my best tip for this one," but this is all very, very important knowledge about what makes things work, what makes things go smoothly.

This is another one, a nurse talking, "When they, " i.e.surgeons, "ask for something and you give them what you think it is that they needed and it's not the thing they said but you know it's actually what they want." We wrote a paper using a phrase that an anesthesiologist gave us because he says they cardiac anesthesist, they stand and watch what goes on. This guy said, "The best scrub nurses think ahead of the surgeon."

I thought it was a great phrase. Good scrub nurses need a high level of technical skills, which I don't think's always emphasized or understood, but they really need high level cognitive skills and situation awareness for scrub nurses is huge. Picking up these cues, making sense of what's happening, and remaining ahead of the game, ahead of the surgeon, ahead of the operation. I mean, the very best scrub nurses are picking up instruments and kind of subtlety putting it into the visual field of the surgeon, who may not necessarily always know that's what he or she needed, but then they just take it. That's lovely and it all works very smoothly when that happens.

The surgeons have nominal epahis sometimes. There's a surgeon asking, give me the buzzy thing because he's got quite a big brain and it processes information pretty well, but it is overloaded with the
tasks and he can't remember the word, but, hopefully, the nurse knows, gives him some buzzy thing and he's quite happy with that.

That's right.

The surgeons then admit this. So this is a surgeon independently saying, "I'm really concentrating really hard," this is all about when they're operating, "I forget names of instruments I use every day." This is another surgeon saying, "A lot of what you need arrives in your hand without you actually asking for. It's almost like telepathy." Another surgeon told us, "It's like choreography. It's like a ballet, a good day in theater because everybody is in the right place at the right time doing the right thing and then it all goes really smoothly."

This is another surgeon saying,

"The scrub nurses need to have the ability to be focused on the procedure and not be distracted by what else is going on." They like them being in the same kind of mental space as they are, but actually the experienced scrub nurses tell us, "I'm listening all the time to what's happening behind my head. I'm listening to the count; I'm listening to something else. I may have to look forward but I can listen behind me because I may need to know what else is happening to do my job well."

So we take these transcripts, hours and hours of them and some poor researcher goes through them, identifying the little bits of this that are relevant to particular skills and picking them out. Then we take this back to the nurses and try to organize them into a taxonomy. At this point, we had a kind of an emerging skill set. The big categories were communication, teamwork and situational awareness. There wasn't so much leadership and decision making. It's not to say scrub nurses don't do that, but it's not a big part of their job. The big decisions are being taken by the surgeon. The interviews revealed some other stuff. We're not trying to capture everything, we're just trying to get the main, important categories. What we then did, in terms of developing a framework is we used experienced nurses. So we gave them these great lists of behaviors and skills and they help us pull this together.

We need behaviors that are observable because this is going to be used as a tool for nurses to watch other nurses and then give them feedback on their performance. So we have to be clear that the behavior can be seen. We can't see what happens in people's heads, we can't see thinking. I can't see what you're thinking right, now which is probably useful, but we can infer what people are thinking by watching their behavior. And we have guidelines and it has to be simple. It's got to be something that they can use in their operating room or a simulator. So it can't be some huge research instrument. It has to be something that's practical.

This is the framework that emerged that the nurses told us, these are the main categories from the data you've got and from our experience. So there are three main categories and each category subdivides into a number of elements, as we would call it, and each element has examples of poor behavior or not-so-good behavior and good behavior. This is what the taxonomy consists of then, this information. This is the whole set of categories, with each element and we define these and explain what they are. As I said, there are some examples, all given by nurses, about what does this look like. So if the nurse is coordinating well while scrubbed in, what does that look like? If they're not acting assertively, what does that look like?
Then, on the basis of that, we designed our rating form that nurses could use to watch other scrub nurses and give them an assessment. The rating scale, I don't know if you can see it very well, it's a four point scale and we took the same wording that the pilots use, so it's all about endangering patient's safety. That's why we're interested in these behaviors, not just because they're nice to have and they make it a more pleasant day. Because these behaviors, as we know from the accidents and the adverse events, sometimes things go wrong because these behaviors were not as good as they should have been.

And these are normal behaviors. They're not some mysterious thing that we've dreamed up as psychologists. They're really just what the best people do all the time, what the rest of us do in a good day. Some people are not so good at doing regularly and consistently and may need some help or encouragement to produce more of those behaviors at the right time. So it's no more mysterious than that. The last stage we did then is we've got this tool but we don't know if nurses can use it. So we have to do a piece of work testing out whether nurses can make ratings with the tool. We then recorded in the simulator, with real practitioners, not actors, but practitioners who were good enough to give up their time to do this.

To act out, with instructions, but then they do it in their own words, a particular scenario that will show the scrub nurse, in a normal task situation, engaging in a number of behaviors that will be shown to other scrub nurses and they will use the tool to try and make a judgment of that nurse's teamwork, that nurse's situational awareness, etc.

And so we ran seven full-day sessions in Scottish teaching hospitals with 34 experienced scrub practitioners, nurses and ODPs. We had to give them a little bit of human factors, training and an introduction to non-technical skills. So one day to do this and the evaluation is simply not long enough but it's all the time. These are busy people and the hospitals were good to release them for a day to do this, but this is not enough training. You have to look at the data in the context that this is a very unfamiliar tool to these nurses, using a very unfamiliar tool. So we explained the SPLINTS taxonomy, how to use it, etc., and then we showed them a number of these scenarios and they made ratings. Some of them were more clear cut, some of them were more ambiguous. So we're looking to see can they identify the behaviors and how consistent are the nurses at rating the behaviors. These are data across seven scenarios, looking at the element level and there are some highlighted there.

This is the inter-rater agreement is not always very high. You know, the nurses would rate things understandably differently. The more ambiguous the scenario is, the more the ratings will vary.

This was our just first test and our conclusion was that the ratings were good enough and we had feedback from these nurses as well, that the tool was certainly worth taking on to further stages of testing and development. Of course, you need high inter-rater reliability to make the tool valid and reliable for feedback and assessment, but the assessors need to be properly trained and calibrated in order to do that.

This was very much our first pass. This is published in one of the nursing journals. The rating weren't good, the inter-rater reliability ratings, but they were mostly at an acceptable level. We got better agreement at the category i.e. situational awareness rather than breaking it down into the components.
Some scenarios were different but the nurses were generally very positive about the system and the nurses themselves said I would need training. I like this tool. I think it has potential, we could use this, but we would training in order to work with this.

The papers are published in "International Journal of Nursing," "Journal of Advanced Nursing," and "Evaluation in Clinical Practice." So there's been lots of interest. I have been elsewhere talking about SPLINTS. There's a website with the SPLINTS tool on it or you email asking for it. So we're getting quite a lot of emails and from different countries with nurses interested in this and they are not all theater nurses. They are not all OR nurses. Sometimes they're coming from other areas of nursing, saying can I have a look at this because this might be relevant to my area of practice.

And what these tools offer is a common language, a terminology. So the word situational awareness may be new for but as long as the nurses all understand what that means in their context, then that becomes a valuable way for discussing this core aspect of cognition.

This can assist in training because you can use the framework as the basis of training, assessment and it can be for looking at ongoing development or training needs. These tools are not ready yet for formal assessment until more people are trained and we have more data about how the tool can be used. We see some works starting to emerge in the journals on these tools.

This is the new one. Interestingly, this one was designed by an anesthesiologist who did a PHD with me, so he's a consultant anesthetist in Scotland. He said,

"We're so dependent on these anesthetic nurses that we work with. I think, while there's already been a tool made for the anesthesiologist, we should do one also for the nurses." So he's published his doctoral work and that his tool has just been released and there's a website for this as well.

To bring this to some conclusion, I think one of the things we need to think about if we're going to down this route is when do we start to teach this? My argument would be we should be teaching this from the beginning. Somebody looked at that image I have and said nobody knows what that L thing means on the back of the surgeon or on the back of the practitioner. This is because in the U.K., learner drivers have to put two plates on their car with L sign showing that they're a learner. So that's what the L means.

The point is, I think if we would really like to change the culture in health care to a safer, maybe a more efficient culture, we have to look at behavior, but we have to look at this really early on because people think that what they get taught at nursing school, at medical school, at physiotherapy school, what you get taught in the early years is the important stuff. So if it's not taught right from the beginning, then people will think it's some kind of add-on or optional thing.

We are seeing the medical schools starting to bring in, certainly in Scotland, starting to bring in patient's safety, human factors, human error and, in some medical schools are already teaching, right from first year, a little bit on non-technical skills, so that the medical students can see how this fits in with all the technical stuff they're learning. Then when they get to the post-graduate stage, then there's customized material available for a particular specialties, like anesthesia.
I think the same should apply in nursing. I think, certainly in the U. K., it's variable how much of this training they get in the nursing schools. There's been some survey work where people say, "Oh we teach all that stuff on patient safety but mostly teach it very explicitly," and you call it that.

The students don't always realize that's what it is that they're being taught. And the use of simulators, which now I'm seeing ward simulators coming in the nursing schools. So once you start using simulators and you're watching behavior and giving feedback, then this kind of tool I think probably has a role to play. We've written a number of, I mentioned one, two, there's another unedited volume, so there are some books around that are on this topic. This is my last slide. I think there are a number of professional issues here. The point I've made about teaching it from the beginning. Pilots do not even get their first license unless they pass an exam on human performance limitations. It looks at fatigue, it looks at human memory, and it looks at all the things that can affect my performance. These are really baby pilots. They're nowhere near the airlines at this stage, but yet that whole profession realizes that human performance is affected by a whole set of things and pilots need to know, from the beginning, that they're not going to be superheroes and they, like every other human, is going to be affected and that they have to think about their non-technical skills as well as their technical skills as well. I think that's a really good model.

The points I mentioned before, if we're going to train this stuff, then the trainers should know what they're doing. Maybe we want to have the trainers qualified in some way to do this and I'm often asked about multidisciplinary training, saying we do multidiscipline team training. I think that's great, but my view on the non-technical skills is I think they should be taught just as you teach the technical skills, single discipline. I actually think the non-technical skills should be taught, to start with, on a single discipline basis. I say this because I've been involved in both. So I think when you do multidiscipline training and I want to teach situational awareness and I want to explain the psychology behind that and I want to look at the behaviors, if I'm working with nurses, I want to use just nursing examples because if I got a mixed group, I know the surgeons are going to switch off when it's not their profession and the nurses will do the same when we take stuff that's not completely relevant to the job they do.

I think if you really want to get this across and get it embedded, I think before you do the multidisciplinary team training stuff, you should do single discipline non-technical skills, so people know what these concepts are and how those psychological factors are going to affect their behavior. It's a big issue here which is absolutely your world about competence assessment, who's doing the assessment, and I've mentioned some parallels from aviation. Then there's the whole final piece about what's the roles of the regulators here. The regulators are the people with the power and we have learned, I think, from the example of where we worked with a surgical college, which is similar kind of influences. It's only then, if you work with one of these powerful professional groups that things really start to change because senior people in the profession know what this about, they have the mechanisms, and they have the levers to make things happen. So that's my review of non-technical skills. I think it will be relevant for all aspects of your world and not just for the OR nurses, but that remains to be seen. Thank you very much for your attention.