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The art of medicine
Trial and error

Two decades ago, the estimation that a jumbo jet's worth of Americans were tumbling out of the skies every single day due to our medical errors grabbed headlines and jumpstarted the modern patient safety movement. *To Err is Human*—the seminal report on medical error from the Institute of Medicine, now the US National Academy of Medicine—detonated like a bomb. Ever since then, the medical world has been scrambling to find ways to decrease medical error and improve patient safety. Hospital systems have been redesigned. Electronic medical record systems have been installed nearly universally. Checklists are ubiquitous. And every committee, document, and process now has the word "quality" mandatorily embedded somewhere within.

One of the most far-reaching developments has been the use of simulation training. While we've always used some modicum of simulation training in medicine (remember those Resusci Anne dolls for learning cardiopulmonary resuscitation and mouth-to-mouth resuscitation?), the breadth and sophistication of simulation have exploded in the 20 years since the publication of *To Err is Human*. It is now integral to nearly every aspect of medical education.

As part of my research for the book *When We Do Harm: A Doctor Confronts Medical Error*, I spent time observing simulation sessions. They were remarkable in their intricacy and relevance, offering simulations for obtaining consent, for giving bad news, for doing procedures, and for middle-of-the-night clinical decompensation. The simulated patients were short of breath. Their significant others were anxious and demanding. Team members were pressuring. Blood pressures skyrocketed. Urine outputs ground to a halt.

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As I observed these sessions, I thought back to my own training, and how desperately I had yearned for some sort of safe zone for my first tentative medical steps. I longed for a trial run to test out my doctoring, but alas, there was only the vérité of the hospital ward and the living, breathing patients who populated it.

One evening on call, well before a medical diploma had made contact with my eager palm, one of our patients needed a central line. He had run out of usable peripheral veins, but still required several more days of intravenous antibiotics, so a central line was in order. My supervising resident decided that there was no time like the present for a newbie to learn.

In the sprawling Veterans Affairs (VA) Hospital where I was doing my rotation, the patients were largely tolerant of trainee doctors, although this was probably because trainees were pretty much the only medical personnel they ever saw.

And so that's how I found myself aiming a dismayingly mammoth needle at the jugular vein of a Vietnam veteran who was respiring patiently under a cornflower-blue surgical drape. Palpating my way up the patient's neck to the point of entry, I glanced up at my resident with one last, fraught, "Are you sure?" look. He reassured me with what seemed to be the universal answer to any medical student concern: "This is a teaching hospital."

I'll never know what the patient thought about all this, or if he truly understood just how verdant my greenhorn status was. (The Krebs cycle was still in my working memory, if that gives you any hint.) But forward I ploughed, literally.

Sweating bullets, I aimed the tip of the needle lateral to the carotid pulse, whispered a prayer to whichever deity was on call that night, and sank the needle deep into the terra incognita of my patient's neck.

The tidepools of perspiration on my scrubs were mushrooming, but my resident was as cool as a cucumber, calmly walking me through the steps. "Don't cause an air embolus", he said casually, as I began to thread in the guidewire, something that seemed far too metallic to be slithering into my patient. "And don't let go of your end of the wire", he added, almost offhandedly.

Witnessing a foreign object—one dispatched from my own, medically uncallused hands—sink ever deeper into the impossible depths of a real live human being was becoming more than I could bear. I just wanted this to be over.

I began threading the snake-like catheter over the guidewire into the seemingly endless internal jugular

vein. "Oh, and just make sure you don't hit the right atrium", my resident added, stifling a yawn. His preternatural calm was unnerving. My own blood pressure was dipping low enough to require dobutamine, but I don't think his pulse nudged north of 60.

We were finally coming close to the end, and my resident began cleaning up our supplies. He seemed reasonably satisfied with my performance, and so I cautiously exhaled a few millilitres of pent-up breath. "Just push in the saline flushes and we'll be done", he said, with a quick glance at his watch. And then my fear officially polymerised into true panic. Flushes? What was he talking about?

That was the only time I saw a crease prick up on his otherwise unlined forehead: his idiot medical student hadn't prepared saline flushes to prevent this newly placed central line from clotting off. But he recovered in an instant and strode off to the nurses' station. I wasn't exactly sure how much I'd screwed things up, so I didn't say a word to the patient lying motionless under the drape. Nor did he say a word to me.

In a flash, my resident was back, gripping three saline-filled syringes that he promptly dispatched into the three ports of the central line. The day was saved, as was my skin.

What I remember from that day was that after the procedure I collapsed in a heap in the call room, my autonomic nerves jangling, riling up every physiological system in my body. What I don't remember from that day is how the patient responded to the ordeal, whether it was as traumatic for him as it was for me, or whether it was just another day at the VA.

And so went all of my medical training. All of my firsts—first paracentesis, first arterial line, first lumbar puncture, first bone-marrow biopsy, first nasogastric tube, first pelvic exam, first end-of-life discussion, and first diagnosis of cancer—all were done on real people. All under the omnibus rationale of dwelling in a teaching hospital.

When I look back at this now, I'm frankly horrified at what was considered a routine approach to training—placing sharp objects and critical conversations in the hands of medical fetuses and letting them loose on living, breathing patients.

From the modern-day lens of patient safety, this trial-and-error method of teaching contains a little too much, well, error. As a physician and educator—and occasional patient—I'm deeply heartened by the increasing sophistication of simulation technology. Our trainees should do all their initial bumbling on inanimate objects and computer-simulated scenarios. They should practise the high-stakes conversations with trained actors in risk-free settings. Maybe it's not quite as good as the real thing, but it's close enough. And I'm sure that most patients would be in hearty agreement.

It's certainly possible that our patients back then—as they hopefully also do now—benefited from the heavier dose of energy, enthusiasm, and academic verve that a teaching hospital can generate compared with a non-teaching hospital. But when it came to being guinea pigs on the steeper portion of our learning curves, there's no doubt that our patients endured additional—and frankly unnecessary—misery. (Surely no patients suffered more in the history of medicine than the first three upon whose radial arteries I strove to draw an arterial blood gas).

Perhaps during the coronavirus disease 2019 pandemic, health professionals can be forgiven for improvising. The public is generally understanding that in a crisis like this we need to graduate our medical students early, pull our vaccine nurses over to inpatient duty, recruit our dermatologists to assist with peritoneal dialysis, turn our orthopaedic surgeons into medical interns, task our urologists with delicate family conversations, convert our endoscopy suites into intensive care units. There will be missteps with this jerry-rigging, no doubt, but in times of critical need the benefits usually outweigh the harms.

Under regular circumstances, however, the practice of medicine needn't entail actual practising on our patients. Trial and error isn't an appropriate diagnostic or therapeutic strategy.

So bravo to simulation technology. It is a critical step for ensuring that those jumbo jets stay safely tucked in the sky where they should be. Jab away, medical students, at plasticine jugular veins. Go to town with the faux joints for arthrocentesis. Suture to your hearts' content on synthetic abdomens. Ramble all you want with actors in simulated renal failure. Experiment lavishly during cardiac resuscitations on interactive apps.

But when you do get to the real thing, however, remember to peek under the drape. Those are real people under there. Their concerns are not simulated. Their fears are not fabricated. The worries they are experiencing are not mocked up for an actor's prepared clinical encounter.

While they might, in fact, be debuting in their role as patients, they do not have the luxury of a warm-up or rehearsal. Yes, they might be improvising, but it's not remotely role-play for them. They will be looking directly at you and will not desire a simulation of any sort.

They'll need the real thing.

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