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EDITORIAL

Ever made a mistake? The role of aviation-style error management in healthcare

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Abstract

Human error is inevitable in all walks of life. It generally has little effect, unless you work in a safety-critical industry. Aviation and healthcare are two such industries although they have very different approaches to managing error. They also have very different outcomes regarding mortality/morbidity related to error. This paper discusses how aviation achieves these results and how they could be transferred to healthcare.

Aviation has a three-stage approach to managing error. First, we have a "Just Culture" which means we can own up to genuine mistakes without fear of disciplinary action or sanctions as long as we cooperate with investigating how the error occurred. It is not a "No-Blame" culture; we are still expected to take responsibility for our actions. Second, we investigate each event to find why the error occurred. We usually identify a "tripwire" which led to the individual making the error. We assess whether we can re-engineer the system to remove the tripwire and, if possible, add a safety net to reduce the chance of recurrence. Third, we train staff in error management as part of both initial training and recurrent training. Aviation globally is now focussing on introducing evidence-based training to better meet the needs of the crew and make most effective use of expensive training time.

These principles are relevant and transferable to healthcare and could potentially be equally successful there. Success, however, relies on a change in culture by both staff and patients. Error needs to be accepted as inevitable in healthcare, as it is in aviation, and that the outcome is determined by how it is managed. We need to focus on "what went wrong" as opposed to "who went wrong" and accept that attributing blame and demanding retribution is not a sustainable approach.

Keywords: *error management; healthcare; evidence-based training; human factors; aviation*

Ever made a mistake? Yes, me too … all the time! The problem is that when you work in a safety-critical industry such as healthcare or aviation, mistakes are very expensive in terms of lives lost, harm to both patients and staff, and ultimately financially. A 2007 UK study published by Professor Trevor Sheldon in the BMJ affiliated *Quality and Safety in Health Care*[1] (and borne out in similar studies in many countries before and since) showed unintended harm rates of approximately 10% of all hospital admissions. Mortality rates are disputed but can be estimated to be over 1000 per week in the UK alone. No one, however, questions the magnitude of the problem. So, what to do?

Perhaps turn to other industries to see how they deal with error? Aviation is one of the leaders in this field after 40 years of development and improvement following several high-profile accidents in the 1970s, culminating with the Tenerife disaster in 1977. My 2018 article explores the possibility that the Bawa-Garba case and the General Medical Council's handling of it could become healthcare's Tenerife moment, precipitating cultural change due to the unsustainability of the current model.[2] Aviation acknowledges that "human factors" are the over-riding issue in most adverse events and has a three-stage approach to the problem.

First, and crucially, aviation accepts that error is inevitable, no matter how good we are and no matter how hard we work. We operate a "Just Culture" system in which we can put our hands up and admit an error in the knowledge we will not be disciplined (unless it was grossly negligent or deliberate; it is

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not a "Get Out of Jail Free" card). This open reporting system is the foundation on which the rest of the Safety Management System is built. It is mandated at a global level by the International Civil Aviation Organization (ICAO) Annex 13, implemented at a European level by EU Regulation 376/2014 and implemented at a practical level by national authorities approving an airline's Safety Management System into which staff submit their reports. Healthcare appears to accept this approach in principle as demonstrated by the 2016 report by the Care Quality Commission;[3] however, in the absence of a unified, efficient reporting system that provides legal protection for staff in the same way aviation does, it will struggle to have a meaningful impact.

Second, we adapt and refine our systems in light of what we find from analysing the information we gather by our reporting procedures. Put simply, we look at how each error arose and try to find the "tripwire" the crew member fell over and replace it with a "safety net", reducing the chance of a repeat and adding a failsafe in case it does happen again. An example would be keeping vials of concentrated potassium chloride in a different cupboard to vials of saline, and adding a red label to the potassium chloride, to avoid inadvertent boluses of potassium causing cardiac arrest. Very simple, very cheap, but very effective.

Third, we need to train staff to think like pilots. We use an Error Management Framework called Crew Resource Management (CRM), which gives staff a structured approach to issues such as situational awareness and decision making. This system is often misunderstood in healthcare as team training. Although this is a component of CRM, it greatly undersells its usefulness. We use it in conjunction with our culture and systems thinking to complete a comprehensive error management training package.

The crux of CRM involves a broad view of who the "crew" are and being aware of the "resources" available. In a healthcare environment, the crew includes the patient and their family who have probably spent more time reading about their particular ailment than you, so can provide useful information and specifically on how it affects them given that it will probably exist with other co-morbidities. In addition, resources extend well beyond your own knowledge, however extensive that might be. In aviation, we are not expected to know everything, but we are expected to know where to look for it. We are encouraged to go into the manuals while trying to resolve an issue and to contact staff on the ground for input if necessary. Our long-haul fleets even have a satellite telephone on the flight deck to facilitate this.

Critics of the approach often cite patients as being more complex than aeroplanes. This is of course true, patients are infinitely more complex, but it misses the fundamental point. As an airline captain, flying the aeroplane is one component of my role, but my main function is to manage a rapidly changing, complex, high stakes environment and to use all the resources including staff (and passengers if necessary) at my disposal to ensure the safety of the flight. Very few critics of our Error Management Framework's relevance to healthcare have actually sat in the flight deck during a flight to witness what is involved in the operation; those that have accepted the invitation (and been approved by the company) leave armed with ideas they translate to their own workplace to the benefit of both staff and patients alike. In short, they leave thinking like a pilot – anticipating where plans may go awry and preparing plan B (and plan C and maybe plan D) for when they do. Communication and situational awareness are two of our most valuable tools and are very transferable to healthcare.

How do we decide what to train? Aer Lingus is at the forefront of a worldwide drive by the ICAO in conjunction with the International Air Transport Association (IATA) and the International Federation of Airline Pilots Associations (IFALPA) to introduce evidence-based training (EBT).[4] Previously, we had a set pattern for our 6-monthly simulator checks involving engine failures/fires on take-off, single engine approaches with and without automatics, non-precision approaches, etc. Our comprehensive error reporting system is showing that many of the issues that cause problems are outside this important but relatively narrow band of procedures. In order to make better use of scarce training time (scarce due to the cost of the simulators and cost of taking staff out of service for training), we are now checking some routine procedures less often and instead using the time to train issues that are being shown internationally to be problematic. An example is loss of control at altitude. Pilots manually fly take offs and are encouraged to manually fly approach and landing phases of flight but use the automatics at other times to free up capacity for monitoring, trouble-shooting and anticipating problems. If the automatics drop out at high altitude due to an unforeseen failure, pilot reaction has often been found to be less than optimal due to lack of familiarity with this condition; aeroplanes handle very differently at high altitudes and speeds than they do on approach to landing. The last few years have seen airlines train for this uncommon but critical scenario after several flights crashed, e.g. Air France AF446 and others. We also now train how to recover the aircraft having got into extreme situations, an example of our Avoid, Trap, Mitigate mindset, setting out multiple safety nets in the event of earlier ones failing to arrest the error. It would be impractical and potentially dangerous to do this in

a real aircraft so incorporating it into our regular simulator training is a more pragmatic solution.

Simulation has been used at many levels in aviation for generations and continues to be expanded. The first time I ever operated an Airbus A330, I had over 300 hundred passengers with me! The training had been carried out totally in a simulator in Toulouse. This is only possible when using a high-fidelity, full-motion simulator that is regularly certified by the national aviation authority (in the same manner as our planes). We use a stationary mock-up of our A320 cabin for training and checking crew in emergency procedures in as realistic an environment as possible. We use dry ice to simulate a cabin filled with smoke to check we can all don protective breathing equipment and find our way through the cabin and find/use emergency exit doors while effectively blind. We have an inflated escape slide attached to the mock-up in order to practise actually evacuating passengers and then using the slide ourselves. The A330 slide is attached to a platform in a different corner of the training area because it is much bigger and higher. We also have a specially designed fire-fighting unit made from a shipping container, which has mock-ups of galley areas, ovens, toilets, seats, overhead storage bins, etc., all of which we can set on fire to train fire-fighting techniques on an annual basis. We even have door simulators to train how to arm/disarm an aircraft door, how to open it in an armed emergency condition without getting pulled out of the cabin and to ensure crew have the physical strength necessary to open it fully if the emergency assist aids fail. All scenarios are assessed from both a practical outcome viewpoint and from a human factors non-technical angle. If the non-technical skills are below standard, the candidate fails and is retrained, regardless of the outcome of the scenario. All skills are rigorously graded according to pre-specified standards. Results are being sent back to the training department in real time by iPad and incorporated into a database, which is then used to identify crew strengths/weaknesses to determine subsequent training module content.

While operating aircraft on normal, daily operations, we brief each critical phase of flight, discussing what we expect to do, confirming that the computers are programmed to reflect this and discuss what we plan to do if we have a failure, e.g. an engine fire on take-off. How do we intend to get the aeroplane into a safe condition away from the ground, mountains, etc. and where do we intend to land it taking into account our weight (usually over 20 tons heavier than our intended landing weight because we have not burnt the fuel off), whether or not the departure airport has a long enough runway to accommodate this weight, if the weather is suitable for a one-engine landing, etc. and, if not, where do we plan to go instead? All these issues need to meet specific legal requirements as well as practical ones. All this needs to be "simulated" in our heads before we proceed in order to ensure we have viable options and that all crew members have a shared mental model, i.e. that we are all "singing from the same hymn sheet" when it all goes wrong. We also use "touch drills" whereby we put our hand on the appropriate control (without actually moving it) while verbalising what we plan to do in order to develop muscle memory.

Simulation in healthcare has developed greatly in recent years. Training can involve anything from fully immersive high-fidelity simulation with remote interaction by instructors to relatively simple briefing-type scenarios where clinical staff verbalise what they plan to do and discuss alternative options in the event of things not progressing as planned (plan B). More comprehensive reporting globally as in aviation would enable staff to see where problems are occurring (if it is happening in your unit, then the chances are it is happening in mine too, whether or not I am aware of it) enabling us to train realistic scenarios pertinent to our real-world environment, making better use of training time and leading to improved outcomes for patients, staff and management alike. This simulated environment could eventually be taken to its logical conclusion in an immersive virtual reality video game similar to flight simulator games. I have neighbours who tell me about having "flown their A320 into Heathrow" the previous night; you may soon have them telling you about the "lung transplant" they performed! On a serious note, this could expedite training for students, surgeons and others more efficiently in this era of European Working Time Directive restrictions. It would also enable periodic checking to ensure that skills are still "up to speed" similar to the 6-monthly check system for pilots.

The cost of error in healthcare, both in terms of patients harmed and the financial penalties incurred in terms of compensation, legal fees and extra treatment costs is unsustainable. NHS Resolution, which handles secondary care claims for the NHS, paid out £2.23bn in 2017/2018, over £0.5bn of which was legal fees.[5] This does not include extra costs such as extra bed nights, medications, procedures, etc. The industry needs to acknowledge the inevitability of such error and develop a plan to manage it. This will need a change of culture to one that accepts the fallibility of our staff. This culture needs to be accepted not only by staff but by management and, importantly, by patients and their families. Studies from the USA among others show a remarkably positive reaction from patients harmed as long as the error is quickly acknowledged, apologised for and remedied.[6,7] Litigation costs are thought to have reduced, although it has been

difficult to prove this definitively. Mediation is now being used in the NHS as an alternative to litigation but still represents only 2% of incidents handled (J. Vernon, Mediating Claims in the NHS, conference presentation at Better Resolution of Clinical Disputes, London, UK, 2017, unpublished). These cases are being settled in months rather than years, at about 10% of the cost and with better outcomes for all involved. Entering into mediation still allows the option of subsequent litigation but admissions of error, apologies, etc. submitted to the mediation hearing are ring fenced and not admissible in the prosecution case, thus ensuring the staff-member's rights are not compromised.

Aviation has faced similar problems to healthcare. By letting us share what we have learnt, we can hopefully enable healthcare to transform much faster than we did. Our error management system is transferable to the healthcare environment if tailored to the unique needs of that industry. Simulation will play an increasing part in this new approach to managing error by streamlining training and checking without risking patients as has been unavoidable up until now. Preliminary research in the USA suggests reduction in adverse events in the range of 40–70%; that is maybe 500 lives per week saved in the UK alone. When did you last see a medication or procedure achieve that sort of improvement in mortality rates?

Conflict of interest

The author is the Managing Director of Frameworkhealth Ltd, a company that provides aviation-style error management training to the health service.

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