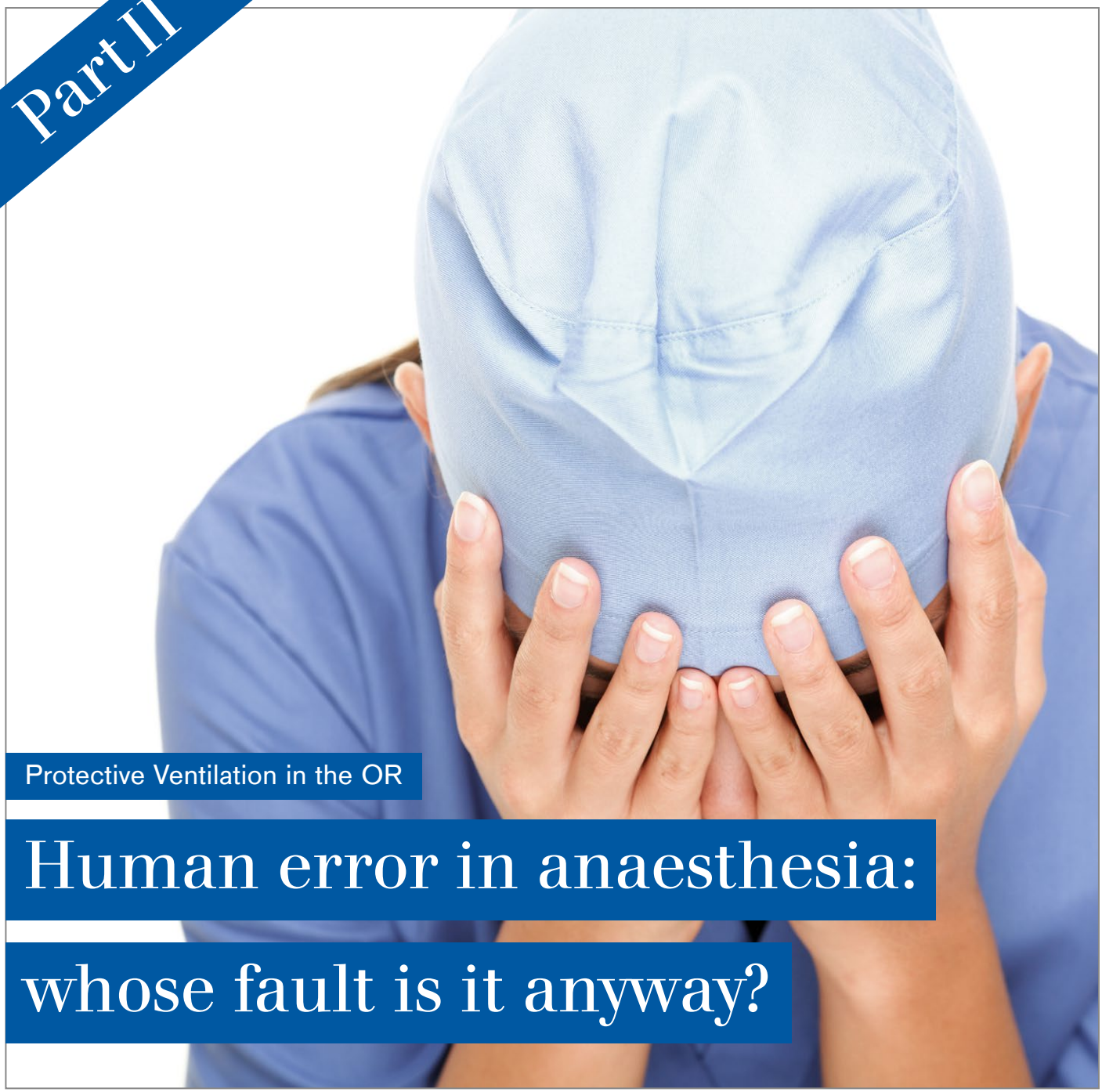
Part II



Protective Ventilation in the OR

Human error in anaesthesia: whose fault is it anyway?

This whitepaper addressing relevant issues regarding human error in anaesthesia has two main aims: One, we want to provide anaesthetists with an extensive overview of the topic, and two, to offer information that could be used as background material for further discussions in hospitals on why it would be important to take a closer look at this matter and how to potentially improve the situation. This is part 2 of the paper. Please click here to download part 1.

Human error in anaesthesia: whose fault is it anyway?

CHAPTER IV: APPROACHES TO IMPROVE THE SITUATION

In this chapter, we will look at how another industry with a high-risk profile manages its safety issues, namely the aviation industry. Often quoted as shining example of how to ensure the best possible safety for all people involved, there is no doubt that certain areas such as its excellent error reporting system may be of benefit in medicine and anaesthesia. Other experts are less convinced, pointing out obvious counterarguments such as the irrefutable fact that patients are individual and unique, while planes clearly are not. The following text will offer an overview of those areas that modern medicine could well use as a template, which areas may not lend themselves to comparison and which approaches physicians themselves think that hospital and governing bodies should now adopt. One thing seems to be clear: Medicine needs to make the shift away from a "blame game" culture to an open culture of reporting mistakes, thereby creating the basis for learning from them and improving outcomes for all people involved – physicians and patients.

What does the aviation industry get right?

Undoubtedly, the aviation industry is hugely successful when it comes to keeping people alive while blasting through the air in a pressurized metal tube at 30,000 feet. In 2016, there were about 163 aviation accidents worldwide (including business jets and military transports), 24 of which resulted in 399 fatalities. The chances of being killed on a single airline flight are about 1 in 29.4 million.[1] By contrast, anaesthesia-related mortality of adults is estimated at 1:250,000.[2]

Obviously, patients are not planes, but are there components of the aviation industry that anaesthesiologists could copy? A quick overview of aviation vs. anaesthesia:

Technical equipment:

- ✈ Aircraft have, to a certain degree, a standardisation of displays. Most procedures are automated with multiple back-up systems in place, and information such as weather conditions is automatically available.
- ✚ Medicine: Relative little standardisation of design across medical equipment, low degree of automation and multiple systems not systematically available.

Safeguards:

- ✈ Aeroplanes have many safeguards in place with a high degree of automatisation and computerised support; there are strictly enforceable rules to exclude adverse effects of fatigue or alcohol on a pilot's performance.
- ✚ In medicine, there is a relative lack of automatisation and computerised support, lack of strictly enforceable rules to exclude adverse effects of fatigue; rules about alcohol seldom explicit or strictly enforced

Simulator training:

- ✈ In aviation not only covers the actual flying, but has also been extended to include teamwork and debriefing.
- ✚ In medicine, simulator training is not yet an integral part of obligatory training.

Crew resource management (how members of a team interact and perceive factors that may influence performance):

- ✈ The aviation industry has crosschecks, read-backs and the so-called "two challenge rule": another team member is allowed to override someone if that person has been challenged twice but has failed to respond appropriately. Simple measures to simplify communication include being on first-name basis, having direct eye contact, using non-judgmental words and putting safety before self-esteem.
- ✚ In most operating rooms, a strict hierarchy prevails, and the communication between surgeons and anaesthesiologists is often less than optimal.

Adverse events:

- Major adverse events (AE) are always investigated by a national body and often featured in the mainstream media. Pilot immunity is often part of the reporting culture, and AE investigation reports are always published.
- In medicine, major AE usually only investigated locally, immunity is not necessarily part of the reporting culture, disciplinary procedures are wide-ranging, AE investigation reports seldom published. In many cases, "whistle-blowers" are badly treated and stigmatised.

Log of errors:

- Is based on a voluntary, confidential, self-reporting scheme in aviation; no negative consequences for the pilot, but support if needed / wanted
- In medicine, it is practically non-existent: reporting errors is often associated with negative consequences for the physician's career, and they are left alone to deal with any fallout.

However, two of the most important factors, say researchers from University College London, London School of Economics and Imperial College London, are the "much more blame-free culture in the case of reporting and owning up to safety incidents", and the spreading of responsibility[3]: In aviation, safety is not just the pilots' job, but "permeates all levels of business", comparing favourably to healthcare, where one could argue safety is still seen as the "priority of some, not the obligation of all." In one particular case a woman, Elaine Bromiley, died during routine surgery. As reported in the video (click here), nurses did not dare to openly voice their concern that something was not going right during anaesthesia in the operating room, but did mention it amongst themselves in the recovery room – a clear case of failed communication.

In medicine, a "belief in the myth of the boundless capacity of medical science" has given rise to the expectation, even demand, of perfection and "hence of an intolerance of morbidity and mortality", states an article in the BMJ.[4] "Physicians learn early in their education that they shoulder the sole responsibility and blame for any mistake." The US-American report mentioned in chapter II does not mince words either: "The culture of medicine creates an expectation of perfection and attributes errors to carelessness or incompetence. Liability concerns discourage the surfacing of errors and communication about how to correct them. The lack of explicit and consistent standards for patient safety (...) lets health care organizations function without some of the basic safety systems in place."[5]

In addition, as the London report on aviation mentions, economic factors and safety seem to be competing demands in healthcare, with "financial pressures and considerations constantly making news headline." Speaking about the NHS (but probably applicable worldwide), the London authors also point to the "persistent feeling of hierarchies and the fear of speaking out", which perpetuate the "cultural limitations" in healthcare.[3]

Keeping the craft innovative

However, there are also critical voices when it comes to seeing the aviation industry as example to follow; one of them is Chris Thompson. In an interview, the senior consultant at the Royal Prince Alfred Hospital in Sydney, Australia, pointed out that, firstly, the aviation industry is "much more authoritarian in its set-up than medicine. In my view, it would be much harder to make a doctor follow a strict checklist than a pilot, as we simply do not have this culture", and the main reason for this is that in stark contrast to planes, all patients are of course different and unique .[6] "As an anaesthesiologist I know what parameters are relevant for which patient, and these are different from case to case – a set checklist is of only limited use here." Dr. Thompson also warns that a too rigid approach could lead to a much more "defensive" type of anaesthesia. "Anaesthesia really is a craft that is handed down from person to person, and change comes mainly by trying out new things, doing things slightly differently. This is how we improve, almost the only way we can improve, because large studies – such as in oncology – are either not possible or simply not conducted. And: What could be good for one patient might not be beneficial for the next." In short: A too rigid approach would stifle innovation.

Instead, Dr. Thompson suggests setting up better communication channels with the surgeons, who are in charge of the follow-up of patients and could give valuable feedback about what patient fared better or worse. Another idea would be to collect data from these surgeons after the operation and analyse what procedures work best.

Approaches to improve the situation

So how could the situation in anaesthesia be improved?[3]

1. Reporting errors

- Countries could consider setting up an independent investigations agency similar to the UK's Air Accidents Investigation Board or the US-American National Transportation Safety Board, suggest the authors of the London study.
- Reports of adverse events (AE) should include i) a factual summary of the key features of the event, ii) analysis of the data (what contributed to the incident) and iii) conclusions and safety recommendation. This last bit is seen as particularly important: In healthcare, "the link from error to learning has often not materialised". By contrast, in the aviation industry, after a major incident its causes are often simulated and become part of training.
- Reports should also include near misses or complications, which are currently often considered to be routine, but which may be just as instructive as real AEs. Causes for not reporting should also be investigated: most commonly these are the fear of consequences and the lack of support offered by the hospital and / or the direct superiors. Other causes include a sense of pride or self-esteem, concerns that "no real beneficial action will follow", lack of confidentiality or lack of time due to high workload.

2. Staff wellbeing

At the same time, it should be ensured that adverse events that seriously affect staff wellbeing receive the same urgency. In the UK for instance, it was proposed to establish an Independent Staff Investigation and Support Service.

3. Using costs to increase awareness

In Australia, the last five years has seen "increasing awareness of the cost of error and complication", says Chris Thompson, and there was a "very strong push by the government to improve that" .[6] Australian hospitals now have clinical excellence commissions, a centralized reporting system for all incidents and they oblige any doctor aware of such an event to report it. Departments are required to have a manager to read all reports and report back, categorise the nature of the incident and start a process for recommendations and their implementation. So while people still "only report mistakes that they can attribute to a systematic contribution", Dr. Thompson sees the increased awareness of errors and the changes overall as "very positive".

4.Checklists

Several studies have investigated the use of checklists in surgery and intensive care, and concluded that checklists make most sense when they are applied during key transition phases in surgery, such as departure from the OR or during staff shift change-over times.[7,8]

5. Training

Anaesthesiologists might benefit from learning the same non-technical skills that pilot have to acquire to better deal with emergency situations: i.e. team working, decision-making, situational awareness, managing stress and coping with fatigue.

6. Crew resource management and sterile cockpit: Some features of crew resource management that could be applied to the operating theatre include peer monitoring, briefings, defining operating procedures and standards, recognising fatigue as a factor in performance, regular 'check rides' in the form of assessment in a simulator and using the principle of a 'sterile cockpit' (a distraction-free environment during complex or critical procedures). Briefings before and after surgery could be particularly helpful, as they could encourage all team members to appraise procedures, and to encourage mutual respect and team bonding.[9]

7. Technical equipment and workplace

- The anaesthetist's workplace is increasingly complex and complicated, some might say overloaded (s. part I of the whitepaper). On the plus side, this equipment (mechanical ventilation, perfusion, monitoring) is also better able to respond to the need for close monitoring and a "fine adaptation" to the patient's needs than ever before, say French authors[10]; and this indicates that the machinery used today is also increasingly reliable and accurate, and sometimes more complex. As a consequence, clinicians need to develop a better understanding of the medical devices they use. This includes being schooled in risk analysis, making sure they "check before use" and undergoing a teaching program including simulation.

- According to the French study, anaesthesiologists need to be aware of the main machine dysfunctions:
  - Monitoring: Screen failure during anaesthesia, failure of one monitoring modality, missing modality, failure to transfer data, unavailable or substandard monitoring
  - Ventilator: sudden failure during anaesthesia, sustained or increasing positive pressure, parts missing
  - Anaesthesia machine: Leak in circuit, failing "cockpit check", vaporiser problems
  - Miscellaneous: Bed/trolley problems, alarm failure.

- Another way in which technical devices may support the decision-making process and help to reduce errors during complex or emergency situation is the ability to visualise trends. Because even though a change in situation might not be immediately recognisable when single values go up or down, a graphic illustration of a trend may alert the anaesthesiologist that some values are clearly going in the wrong direction. In a stressful situation and under pressure to keep an eye on all data, this could prove the decisive support to make the right decision.

8. Timing

A study by authors at the University of Manchester found that the various phases of anaesthesia should also be considered.[11] Thus, types of behaviours vary according to the 'phase' of anaesthesia, and tasks in the induction room (including induction of anaesthesia itself) are the most demanding. Different kinds of measures could help to avoid errors during the various phases: Errors during preoperative planning and perioperative maintenance could be avoided by measures to support information handling and decision-making, while errors during machine checking, induction, and emergence could be reduced by streamlining or automating task steps, or by making changes to the physical design of the work environment.

9. Non-Technical skills

Management, team work, awareness: There is also increasing recognition in anaesthesia regarding the importance of non-technical factors (as well as technical skills and knowledge) to ensure safe practice, writes an anaesthesiologist from Melbourne, Australia.[12] These include task management, team working, situation awareness and decision-making. Accidents, writes Dr. Heard, are rarely the result of one, single unsafe act, but "often the product of many factors, including organizational, situational, task-related and personal." The author therefore advocates a „more modern approach to error" which considers that most errors are the "result of an interaction between the design of activities, procedures and objects, such as equipment, with known patterns of human behaviour." She also stresses the importance of the psychological precursors of an error such as distraction, preoccupation, forgetfulness, fatigue, sleep deprivation and stress – these factors are "often the last links in a chain of events leading to an accident or adverse event".

Multitasking, "distracted doctoring":

Multitasking might be appropriate in some situations, but research has shown that memory is impaired in the presence of too many distractions, potentially leading to errors or poor recall of material presented, with possibly "disastrous consequences", as Canadian researchers noted.[13] According to this study, errors in medication are significantly associated with distractions, and the severity of a medication error increases with the number of interruptions. One (extreme) case was reported in an article titled "Treat, don't tweet", which followed a malpractice case in Texas over the death of a 61-year-old woman after a low-risk cardiac procedure.[14] Here, it was discovered that the anaesthesiologist had been on his iPad throughout the operation, and the surgeon testified that the anaesthesiologist did not even notice the patient's dangerously low blood-oxygen levels until "15 or 20 minutes" after she "turned blue." This would confirm the Canadians' assertion that it is not so much multitasking at hand here but "distracted doctoring".

These authors make it clear that they are not opposed to the use of technology, but do propose a modification of the environment, including strictly enforced "do not disturb signs", for instance on the sites of drug preparation, teaching adequate "e-etiquette" to make sure staff and students understand when and where it is appropriate to use e-technologies and communication devices, and for doctors to become role models in their use of smartphones et al.

Communication: One example of bad communication in aviation for instance is United Airlines flight 173 which crashed in December 1978, recounts Dr. Seemann, anaesthesiologist at the Clinic for Anaesthesiology at the Health and Care Centre in Russelsheim, Germany. "The crash was preceded by a faulty display of the landing gear, which led to the entire cockpit crew being fully occupied with this problem and thus completely losing track of the need to watch the fuel situation. In the end, the plane crashed due to the lack of fuel." This situation, says the German anaesthesiologist, is a perfect example of the importance of "keeping a reliable overview in any exceptional, unusual situation and having a clear distribution of tasks and a good communication within the team" – similar to the Elaine Bromiley case mentioned above, in which anaesthetists seemed to have lost track of the situation and of time ticking.

Social media. Dr. Chris Thompson reports of the case of an anaesthesiologist who, frustrated about a problem with a technical device, took to Facebook et al to vent his concern directly with the company. Other doctors form anonymous groups for much the same purpose. This may be understandable, as the anonymity of the Internet allows complaints that could well go unheeded or be associated with adverse outcomes for the doctor if reported through the usual hospital canals. However, this form of communication is rarely constructive, as technical companies need not just one complaint, but all data and background info to investigate any case of technical faults. It is up to hospitals to provide the correct channels and to allow the unhindered flow of information from anaesthesiologists 'in the field' and the producers of the machines they use, without negative consequences for the reporting anaesthesiologist.

Special focus: perioperative setting

Adverse events and patient harm are frequent in the perioperative period: Adverse events occur in about 30 percent of hospital admissions, are associated with higher mortality, and may be preventable in more than 50 percent, state two anaesthesiologist and authors of a joint Swiss-Austrian study. They report on a review supported by the US Department of Health and Human Services 'Agency for Healthcare Research and Quality', which examined 41 patient safety practices. Ten of these were 'strongly encouraged', and additional 12 practices were 'encouraged' for adoption. A selection is seen in table 1, page 7.[15]

WHAT DO ANAESTHETISTS THINK?

A selection of quotes from letters in response to the BMJ article "Reducing error, improving safety"[16]

"Establish a log of errors similar to the one used in aviation"

"In Sweden, a patient insurance scheme gives financial compensation to injured patients, regardless of medical responsibility or malpractice. Introduced in the 1970s, this has led to more than 100.000 filed claims, allowing the establishment of an extensive database of accidents and errors."

"Get the message across to the public that a good organisation will mean a greater number of errors reported. There is no relationship between reported mishaps and safety or efficacy."

"Introduce a non-punitive systems safety approach, requiring all accidents and near misses to be reported and investigated"

"Increase psychological assessment of doctors and medical students"

"Medical errors should be a subject taught in medical education"

"Crew resource management training should be mandatory in anaesthesia."

Table 1: Safety practices encouraged by the Agency for Healthcare Research and Quality for the prevention of increasing substantial perioperative safety issues

Patient Safety issue	Rate (percentage of hospitalizations at risk)	Encouraged safety practice	Advantages	Problems (all: varying implementation problems)
Clinical issues				
Ventilator-associated pneumonia	10,6%	Bundles: head-of-bed elevation, sedation vacations (holds), oral care with chlorhexidine, and subglottic-suctioning endotracheal tubes (++)	Evidence for effectiveness (evidence): moderate to high (as bundle: synergism)	(Low to) moderate costs
Catheter-associated urinary tract infections	3,7%	Interventions to reduce urinary catheter use: Catheter reminders, stop orders, or nurse-initiated removal protocols (++)	Evidence: moderate to high; low cost	Low risk: premature removal
Healthcare-associated (HAI) in surgery	Specific fields: 10,5%	Hand hygiene (++) Barrier precautions, patient isolation, and routine surveillance (++)	Low evidence for harm, low cost Evidence: moderate	Low strength of evidence for effectiveness [26] Moderate evidence for harm (contact isolation); Moderate-to-high cost
Central catheter-associated mechanical complications	3,5%	Use of real-time ultrasonography for central line placement (++)	Evidence: strong; negligible harm	Moderate cost
System issues				
Adverse events per hospitalization	36,8%	Preoperative checklists and anesthesia checklists (++)	Evidence: high, low cost, negligible harm	Multiple implementation issues
		Rapid-response systems (+)	Evidence: moderate; low harm	Moderate cost
		Use of simulation for patient safety efforts (+)	Evidence: moderate to high	Moderate cost
		Team training (+)	Evidence: moderate; low harm	Impl. moderate to difficult; moderate costs
		Monitoring patient safety problems (e.g., chart reviews; critical incident reporting systemy) (+)	Negligible harm	Evidence low; high cost
		Outcom measurements (+)	Evidence: moderate to high, low harm	Moderate cost

Wacker J., Staender S., The role of the anaesthesiologist in perioperative patient safety, Curr Opin Anaesthesiol 2014;27:649-656. For references please see the original publication.

(++) strongly encouraged; (+) encouraged practice.

Conclusion

At the moment, the blame culture in medicine might still be alive and well, but change is coming, albeit slowly. Ultimately, every hospital has to decide whether it is willing to promote an 'open error culture' or not. If a hospital does decide to allow the open reporting of errors, it follows conclusively that it must then also have a physician's back when he or she does report a mistake, ensuring that errors are used as tools from which to learn, not as stumbling blocks that can seriously damage or even end an anaesthesiologists' career.

As indicated in this final chapter, there are a number of measures available to increase the health and safety of both patients and anaesthesiologists. Some can be implemented on an individual level – e.g. making sure you are up to speed on technical devices, trying to get enough sleep –, while some will be up to the manufacturers of technical devices, who are called upon to make equipment as user-friendly as possible to optimally support the decision-making process, especially in complex or emergency situations. Yet other measures such as organisational changes require the will of stakeholders including hospital administrations and policy makers. And it is up to these stakeholders to make the shift away from a "blame game" culture to an open culture of reporting mistakes and learning from them.

As a better "error culture" ultimately also implies lower costs (by reducing the amount of expensive patient claims), the authors of this Whitepaper are cautiously optimistic regarding these changes: "We hope that in the near future, key opinion leaders and stakeholders will come to realise that installing a blame-free culture of reporting mistakes will in the end benefit all: patients, staff and hospitals", conclude Dr. Albuszies and Dr. Seemann.

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