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EDITORIAL I

Improving teamwork in anaesthesia and critical care: many lessons still to learn

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The idea that anaesthesia needs to mimic other high-stakes industries may have been oversimplified and overdone. However, aviation (as the most cited example) still provides too many lessons to be ignored. Like aviation, evidence from acute care medicine increasingly shows that inadequate teamwork (and the related topic of inadequate communication) is one of our most common reasons for preventable error.[1–6] Aviation prioritized the 'science of reducing complexity' and the 'science of team performance'.[5] So should we. Similarly, medical training should promote 'team-dexterity' (and 'verbal dexterity'),[2] not just capacious brains and nimble hands.[1 6 7] Like aviation, it is time to encourage more 'we' and less 'me'.[6]

After the 1935 crash of the B17-bomber, it was lamented that 'the modern plane is just too much for one man to fly'.[5] Similarly, the modern patient is too much for one clinician to manage. The modern intensive care unit patient has been estimated to require upwards of 180 steps per-patient per-day.[5] Regardless of the exact number, this complexity outstrips even the most capable individual. It also means that without effective teamwork, safe patient care may be illusive.[6] It is not enough to demand that we work as a team. We need to practice and perfect the team structure.[8] After all, 'a team of experts is not always an expert team'.[6]

Creating effective teams

During a 1960s obscenity trial, Justice Stewart famously quipped that while he could not define pornography, he 'knew it when he saw it'.[9] Similarly, good teamwork is probably easier to recognize than define. Teamwork usually means 'cooperative efforts to achieve a common goal'.[6] Accordingly, team skills include communication, compensatory behaviour, mutual monitoring, and giving and receiving feedback.[6] Teamwork is also more than just subordinates doing what the leader says. It is about maximizing the mental and physical problem-solving capabilities, such that the sum exceeds its parts.[6] Returning to aviation, fewer planes crash when the co-pilot is flying.[10] This is probably because the senior pilot is unafraid to speak up, and the subordinate is actively engaged.[10] In short, a team (albeit small) is formed that is better able to tackle a crisis.

For teams to succeed, task demands (rescuing the patient) and social demands (running the team) have to run in parallel.[6 11] A key strategy is the 'shared mental model' (a common understanding, with everyone 'on the same page').[6] This helps form a task-focused (as opposed to an ego-focused) team. It also helps to prioritize duties, manage information, establish roles, stabilize emotions, and build confidence.[6] If time allows then leaders invite members to suggest mental models ('what do you think?, what should we do?'). After all, diverse inputs can create a better mental model.[6 11] However, under time-pressure, the leader has to rapidly establish a reasonable model that others will support ('I believe its haemorrhagic shock . . . please do the following').[2]

The greater the overlap in mental models the more likely that team members will predict, coordinate, and adapt.[6] Teams with similar mental models also move quicker through the phases common to most crises: denial, deliberation, then deliberate action.[11] The mental model must also be regularly updated ('the patient is now intubated, our next priority is . . .'). The mental model must also be re-examined as new knowledge

presents ('he now has an abnormal heart rhythm: priorities have changed').[6] Task assignment is usually specified by profession (e.g. anaesthetists intubate and surgeons operate).[6] Therefore, this rarely needs including in the mental model. However, if there is the potential for confusion (i.e. both anaesthetist and surgeon could insert central lines), then good leaders will be explicit ('Dr Smith, you'll intubate; Dr Jones you'll do lines'). Similarly, a strong mental model encourages a proactive approach ('call the blood bank, we'll need them to okay products ahead of time'). Expressed in aviation terms, good leaders are able to 'fly ahead' of the plane.[6]

Like aviation, teamwork is everyone's responsibility, and not just the leader's. However, team members will not fully engage unless they feel 'safe' to do so.[6] This means that we cannot create the teams we want unless we create the culture we need.[7 10 12] Culture is also difficult to define. However, it generally includes the group's collective beliefs, customs, and habits.[6] Culture can be so powerful as to override training, and even distort ideas of right and wrong.[12] Fortunately, anaesthesia has a laudable culture that puts the patient first. However, like the western culture it mirrors, it typically prioritizes an individual's agenda over the team's cohesion.[6] Our prevailing culture also equates success with an individual's skill (and failure with an individual's shortcomings).[6] Therefore, quality-care has been historically linked to how the solo-practitioner performs, and remedies focused on individual competence. Unlike aviation, our medical culture has also been slow to accept human fallibility.

The irrationality of man and his (or her) blind spots is tough for many to accept.[5 10 12] After all, how can a species that travelled to the moon (or routinely performs complex surgery) be so 'handicapped'?[10 12] However, humans have evolved as social beings so are susceptible to social pressures.[6 11 12] Similarly, we resort to behaviours that worked for most of our evolutionary past, especially during crises.[11 13] Good leaders know to leverage the best of our primitive behaviours, and mitigate its shortcomings. For example, leaders can capitalize on our propensity to obedience (especially to a loud voice) during a crisis. However, leaders also realize that excessive dominance threatens the team's larger cognitive capacity.[11]

Once a majority of team-members have formed an opinion, they usually maintain it despite contrary information.[6] This is probably an innate defence to reduce social isolation and 'cognitive dissonance' (the discomfort humans have with simultaneously holding contradictory ideas).[12] Regardless, this is why good leaders routinely challenge assumptions ('please check the endotracheal tube's position'). Similarly, 'group think' means that teams tend to follow majority opinions over rational arguments ('if we all agree then we can't be wrong').[6 11 12] Accordingly, team leaders need to guard against premature closure ('I need that EKG before we assume this is sepsis'). Teams can also amplify individual behaviour for good and bad.[11 12] For example, groups tend towards greater risk if an individual's tendency is to be risky, and towards more caution if individuals are risk averse.[6] In short, team behaviour can (and must) be managed. Fortunately, these skills can be taught, and like it or not, aviation still leads the way.

The basics of teamwork

Aviation research shows that in a crisis, 10% will lead, 10% will freeze, and 80% will neither lead nor freeze, but can be led.[13] Therefore, hierarchy is still an important strategy to combat confusion and complexity.[6 11 12] However, for every strength we gain, we must mitigate a potential weakness (the so-called 'Janus Head').[7] Aviation crashes are commonly the result of subordinates not speaking up—even with their own lives at stake![5 10] In contrast, without hierarchy, diffusion of responsibility can occur.[6] Some tasks, typically the easiest, will be addressed by several people even when one would suffice. Other tasks, typically the most complex, remain undone.[6] It is tempting for leaders to scream out blunt instructions (and, when all else fails, this is justified). However, especially when working with other highly skilled individuals, we achieve more in the long run with a calmer, more credible, approach.[6]

Team leadership needs to be earned. In return, leaders are empowered to be decisive, and, when necessary, to override others.[6 11] Surgeons and physicians are expected to lead *a priori* and therefore time should not be wasted negotiating this.[6] However, the highest functioning teams are also dexterous enough to modify their structure, hierarchy, and communication norms to individual problems.[5 6 10 11] Good leaders create a culture that focuses on 'what' is right not 'who' is right.[3 4] In this way, the right team leadership style also promotes a culture of safety.[8]

As outlined, effective leaders alternate the focus between task-completion and team-coordination.[6] This reduces fixation errors and prevents overtaxing any individual. Relationship conflicts are rarely resolved during an emergency (this is why de-brief is necessary). In contrast, task-related conflicts must be dealt with promptly.[6] Inexperienced teams can still function well, but typically need more direction.[6] This means more 'command-and-control'.[6 11] However, as teams mature so should their structure. Leaders can then promote a culture where members volunteer relevant information, verbalize contingencies, and apportion responsibility (so-called 'explicit coordination').[6]

Communication is how meaning is made common.[2 6] Therefore, mature teams also voice relevant concerns and ask critical questions. This 'cross-monitoring', or 'mutual-monitoring', results in a flattening of the team's authority gradient.[6] As teams mature further, they can anticipate each other's needs, and perform with less noise (i.e. more 'implicit coordination').[6] The more routine the task, and the more familiar the team members, the less that 'explicit coordination' is required. As a result, silence can be a sign that an immature team does not know what to do . . . or that a mature team knows exactly what to do.

By remaining open to the best insights from other professions, we start to understand healthcare as a complex social system.[8] We also understand why it takes regular practice to coordinate individuals with varied training, abilities, attitudes, behaviours, and styles.[7 8] Coupled with diagnostic complexity, and pressure to act despite limited time and information, medical error figures begin to make more sense.[6 7] Perhaps the complexity of the task ahead is also a little clearer.

Declaration of interest

None declared.

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EDITORIAL II

Retrograde cerebral venous gas embolism: are we missing too many cases?

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Air embolism is a well-known adverse event of medical therapy. The epidemiology, pathophysiology, and management is well understood and described.[1] Cerebral gas/air embolism (CGE) on the other hand is thought to be uncommon and the average anaesthetist/intensivist currently may see only a few or none in a life time. The common error is to misdiagnose it as a thrombotic or thrombo-embolic stroke.[2] It may arise in a patient who has survived a significant systemic air/gas embolism event, with or without a need for cardiopulmonary resuscitation (CPR). It may however be more subtle or even unnoticed in an unconscious or anaesthetized patient or in situations where slow entrainment of small amounts of air takes place over a period of time. Reviewing the literature has raised a significant patient safety issue due to missed or delayed diagnoses, but also an interesting new understanding of the mechanism in some cases.[3]

Hyperbaric physicians generally have a higher index of suspicion because of training in decompression-related accidents and the occasional referral of iatrogenic CGE for hyperbaric oxygen therapy (HBO). Looking at the hyperbaric medicine literature, a significant discrepancy is seen between the number of iatrogenic CGE cases referred for HBO in the UK and France or Australia.

In the UK, only five cases were treated with HBO in the last 10 yr according to British Hyperbaric Association (BHA) treatment database (J. Sayer, personal communication, 2013). A further seven cases were referred and discussed but not accepted for treatment because they had mainly too advanced damage to benefit from HBO. In Sydney, eight cases were treated over 10 yr[4] and the total for Australia was 39 cases reported over 10 yr.[5] In Marseille, 86 cases were treated in a 20 yr period[6] and in Paris 125 cases in 10 yr (Fig. 1).[7] When asked about the high incidence in France, the explanation was given of a high-profile case that was initially missed, with a bad outcome, which soon focused the attention of French Clinicians (D. Annane, personal communication, 2013).

One of the reasons for a lower rate of reporting in the UK could be lack of belief in hyperbaric therapy. However, several retrospective series show good outcome if referred early, and 6–7 h seem to be the target.[7 8] However, there are case reports of dramatic improvement, if not full recovery, up to 60 h after onset.[9 10]