

SAOA PRESIDENT'S ESSAY MEDAL

Antifragile orthopaedic surgeons: a reflection on the training experience

RG Venter

MBChB(Stell), MMed Orth (Stell), FC Orth (SA)
Consultant Orthopaedic Surgeon, Division of Orthopaedic Surgery, Department of Surgical Sciences,
Faculty of Medicine and Health Sciences, Stellenbosch University

Corresponding author: Dr Rudolph G Venter, Division of Orthopaedic Surgery, Clinical Building, 4th floor,
Tygerberg Campus, Cape Town, 7505, South Africa; tel: 021 938 9266; email: rgventer@sun.ac.za



I'm a newly qualified orthopaedic surgeon. It was the hardest thing I have ever done.

This essay is a reflection on the things I learnt doing it.

I could say that I 'burnt out' during my surgical training. But that expression has been used to describe such a range of symptoms, from someone merely feeling depressed, to being the cause of a colleague's suicide, that it has lost most of its meaning.

In May 2019 the World Health Organization (WHO) clarified the term, and it has its own ICD-11 code now: 'QD85'. It's not a disorder as such, but one of the 'factors influencing health status or contact with health services', specifically related to one's work environment.¹

And besides, I honestly don't feel that the term accurately describes what happened to me.

Shortly before the CMSA intermediate examinations, I was not doing very well. After working in the orthopaedic trauma firms, being on call more than once a week, regularly working more than 90 hours per week, and burning the midnight oil on the days that I was at home, I moved over to the surgical ICU for a few months. Which I found to be a very stressful environment. My attention span was shrinking, my ability to concentrate was getting less by the day and it was making me more and more anxious. And depressed. Besides, I hadn't seen periosteum for weeks.

I had started reading a book about a year before, called *Antifragile* by Nassim Nicolas Taleb² who is something of a modern-day philosopher, mostly doing research on probability and randomness. As orthopaedic surgeons we are well aware of Wolff's law^{3,4} that describes how function dictates the structure of bone, and Taleb had noticed that this principle – that some systems gain from disorder and stress – is found all around us, but no one has come up with a word for it. There is *fragile*, to describe something that doesn't like changes in the environment (like a wineglass at an orthopaedic congress) and *robust*, that describes something that doesn't care for changes in the environment (like a 30-year-old Bristow elevator in the 'major-ortho' tray), but nothing that describes something that actually *gets better* in the face of repetitive stress, like bone. The actual opposite of fragile. Thus, he came up with the word 'antifragile'. I told myself that I was antifragile. Just absorb the stress, and you'll come out stronger on the other side. It had been my mantra all through my surgical training: operate as much as you can, study as much as you can, it's temporary. But I was failing. Why was I failing?

The 'impostor phenomenon', or now more commonly known as 'impostor syndrome', is a term coined in 1978 by Dr Pauline Clance.⁵ It describes a frame of mind in which one constantly doubts their accomplishments and competencies, despite ample evidence that they are qualified, and have a fear that they are eventually going to be caught out as a fraud. Health professionals are especially affected. We have an ingrained 'duty to care'. We are naturally hard working and perfectionistic personalities, and

above all, we are working in an environment where high levels of responsibility and high levels of uncertainty collide. Our patients and colleagues don't need doctors who doubt themselves. And yet I do. I just hope no one finds out.

And then something curious happened. I found myself in yet another situation where I was berating myself for not coping and not being good enough, when I had a thought: what if something is happening to me?

I started asking for help. I even managed to convince a neurologist to do an MRI of my brain. I found myself sitting in a psychiatrist's office, feeling embarrassed, but then he helped me formulate a thought that had been brewing in the back of my mind: I have injured my brain at work. Luckily, I happened on a psychiatrist who is also a researcher, and thinks like I do.

There has been a lot of research about the effects of sleep deprivation and chronic stress on the brain. The first article I read about this was a 2001 study^{6,7} looking at chronically jet-lagged flight attendants over five years. It was a small sample, but it suggested that chronically raised cortisol levels and altered melatonin profiles made their temporal lobes and hippocampi atrophy, making them score worse on computerised cognition tests. More recently, in a 2018 paper⁸ the researchers describe using functional MRI and wearable sleep-tracking devices to investigate how acute sleep deprivation alters the grey matter volume (GMV) in the brain, explaining the real effect of impaired cognition and memory impairments after periods of sleep deprivation. Mercifully, they also showed how brains recover normal volume after periods of 'sleep recovery'. My brain wasn't shrunk forever.

Sitting at home one evening, scrolling through the MRI slices of my own brain, I realised that it was an organ. An injured part of my body. I was like a training athlete that has torn a hamstring. Honestly, for a moment I thought that I was the first to come up with the idea of viewing surgeons as athletes, but there has been much written about it. Dr Edward Verrier is an American cardiothoracic surgeon who transcribed a lecture for the *Journal of American College of Surgeons* in 2017.⁹ It's a recollection of his training days and how his love for sports has informed his decisions as a surgical programme director over the years.

Both athletes and surgeons are attracted to the field because they have talent. Both realise quickly that it's going to take more than talent to succeed. Both have to rely on physical dexterity and improvisation, and both have to manage a team of people to have a good outcome. Both need regular, deliberate exercise to reach and maintain peak performance: they are *antifragile*. But athletes have coaches.

I have a friend that has been very involved in training, and doing research on, elite level cyclists. Discussing this idea with him, he mentioned that most of a coach's job, at that level of performance, is to make sure that training is effective, and that there is enough time for recovery between sessions to ensure that the performance

peaks actually go up with time. They constantly have to hold the athletes back. Explaining how difficult it can be to monitor athletes, he mentioned something called the 'breakfast test'. Imagine a cycling team on tour, staying at a hotel. Now imagine the coach going down to the dining hall really early, before any of the cyclists have come down for their breakfast. Then he observes them as they descend on breakfast, unaware that they are being watched. Athlete A might always look hung-over at this time of the morning, but athlete B is usually bright and on top of things, but today they look equally groggy. It's a complex process of interpreting trends and seeing warning signs that are specific to the individuals. As healthcare professionals we are expected to manage our own rest and recovery, and honestly, who better than doctors? But, somewhere along the line, I wasn't being objective about myself and my performance anymore, I couldn't see my performance dropping. That is something coaches do – they observe independently and objectively to see trends that the athletes do not.

Atul Gawande is an endocrine surgeon, writer and researcher, and I can recommend reading any of his work. In 2011 he wrote an essay about reaching a plateau in his surgical career, and enlisting an old mentor, already retired, to come and coach him in the operating room.¹⁰ It's a brilliant read, and explores his own hesitations and concerns about 'being caught out' when one of the cases doesn't go as planned. Maybe the antidote for impostor syndrome is letting the coach into the room.

The way we train surgeons hasn't changed in decades, as Verrier discusses in his lecture mentioned above,⁹ but the environment in which we train them has changed; there is a much higher burden of disease, with limited staff and resources. And so have the trainees changed, now typically older, because the programmes are more competitive, and some have already started families. But most importantly, in my opinion, we are not monitoring them.

When we plan a construct for fracture fixation we have to make sure that it will withstand the loads and create the optimal biomechanical environment for fracture healing. To make these decisions we need to understand the mechanical properties of the components we are working with. Young's modulus, or the modulus of elasticity, is a way to describe how different materials respond to load, specifically, the relationship between stress over strain:

$$E = \frac{\sigma}{\epsilon}$$

Stress (σ) is equal to force applied to an amount of surface area but it does not describe how the material in question *responds* to the stress, just *how much* stress.

Strain (ϵ), on the other hand, describes how an object is *deformed* when stress is applied.

$$\epsilon = \frac{\Delta L}{L}$$

Here, the starting length of the object (L) increases as the object is stretched. More difference in length (ΔL) means more strain (ϵ).

The implication here is that 10 cm of stretching will generate much more strain for an object that is 100 cm long, as opposed to one that is only 10 cm long to begin with.

I'm sure you can see where I am going with this.

First (and forgive me if I am taking the analogy too far), when we build systems with humans, we typically don't consider how much stress and strain the individuals can tolerate, and we leave the monitoring up to the humans that make up the system. At worst, we blame them for the 'construct' failing.

Secondly, consider that an individual can tolerate varying amounts of stress, depending on how many 'reserves' (L) an individual has.

With a new appreciation that even the most antifragile thing can fracture, I approached my situation as an occupational injury, treating acute symptoms and resting, followed by rehabilitation and reconditioning. And now, like an athlete with an old injury, I

am more aware of myself in times of stress, and careful to actually rest when it's time to recover. Something unexpected that came from using this different terminology, was that others around me started talking too, as if the stigma had been lifted, and I became much more aware of how much strain the people around me were experiencing. I see myself as a near-miss in a way, and this is the part of the essay where I think of the friends and colleagues who didn't make it through the programme and the one who didn't make it at all.¹¹

To go back to Taleb's book, he goes on to describe ways to measure the antifragility of abstract systems like economic markets. It is a bit too abstract to try and measure an individual's ability to bounce back after stress, but I believe that it is something we can learn, and coach each other in. Not just for registrar training, but for *living* as an orthopaedic surgeon, and surviving all the stresses life will throw at us, while maintaining high levels of expertise and competency.

I was very happy to learn about the peer-reviewing processes that the SAOA is instituting, and it is a sign that our profession is making healthy decisions about its future, making itself antifragile, and ready for the stress and strain to come.

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