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EDITORIAL

Climate change – "How did it get so late so soon?"

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I do not believe that Theodor Geisel (Dr Seuss) was referring to climate change when he wrote:

"How did it get so late so soon?
It's night before
it's afternoon…." *1950*

"Suddenly" man-made climate change is impacting our world, and the understanding that everyone's carbon footprint needs to drastically decrease, is a constant topic. In 1989, nitrous oxide (N_2O) was the first anaesthetic gas implicated in the "greenhouse gas (GHG) effect and ozone depletion". Halogenated hydrocarbon vapours (halothane, enflurane and isoflurane) were also mentioned at that time, but thought to be too short-acting to be significant.[1] However, in 2010 a landmark article by cosmologist Sulbaek Anderson et al. published in the *British Journal of Anaesthesia* (BJA), equated anaesthetic vapours to Global Warming Potentials (GWP).[2] GWPs are a measure of carbon dioxide's (CO_2) 100-year radiative forcing (climate forcing) effect in the troposphere, which contributes to its GHG warming effect (see Table I). Table I is a composite of two recent, back-to-back and very conflicting articles written by leading cosmologists and published in *Anaesthesia.*[3,4]

Nielsen and Sulbaek Anderson stick by their original 2010 theory that desflurane has a very large GWP and is driving climate change.[4] But Slingo and Slingo dispute this by saying that the GWP of anaesthetic vapours are negligible as vapour half-lives are too short and the atmospheric concentrations too low to cause significant radiative forcing effects.[3]

Climatology is clearly a complex subject and rash decisions to force routine practice changes in the name of protecting the environment, should always be carefully considered.[6,7] Notwithstanding, this conversation and debate must be ongoing. And therefore, it is hardly surprising to see research articles on climate change and anaesthesia in two consecutive SAJAA editions. Both articles follow international trends by reporting on survey questionnaires – one by Giuricich et al.,[8] who surveyed doctors at the University of the Witwatersrand academic anaesthetic departments, and the other by Vorster et al. who did a national survey of the South African Society of Anaesthesiologist (SASA) members. Surveys such as these provide a dual role: a) Assessment of anaesthetists' knowledge of the environmental impact of offending drugs. b) Promotion of awareness of environmental issues.

The results of both these surveys were not surprising in the context that environmental problems reportedly caused by anaesthetists seemed to be only amplified in the very recent past. The Giuricich study found that only 14,9% of respondents in an academic department in Johannesburg, had adequate knowledge regarding the provision of environmentally friendly anaesthesia. The Vorster study concurred as 73,5% of respondents stated that volatile anaesthesia without N_2O was their technique of choice, but many respondents still used volatiles and N_2O. Sevoflurane was the vapour of choice in both studies, but desflurane in the Vorster study was the second choice. In both studies, non-compliance with international and SASA recommendations was evident. For instance: breathing systems were changed more than once a week, supraglottic

Table I: Summary of factors that contribute to GHG effect[3,4]

	Atmospheric lifetime (yrs)	(Effective) radiative forcing (Wm^{-2})	Global Warming Potential (GWP) 100 yrs	Concentration in atmosphere Parts/billion (ppb)
Carbon dioxide	100+	2.16	1	420,000,000
Desflurane	14,1	0.00017	2530	0,37
Sevoflurane	1,4	0.00003	140	0,16
Nitrous oxide	123	0.21	273	336,000
Isoflurane	3,5	0,00006	536	0,11
PVC	Recycling 1 kg PVC by incineration causes the production of 7.83 kg CO_2e			

Table adapted from current articles by Slingo and Slingo, and Nielsen and Sulbaek Anderson.[3,4]
PVC = Polyvinyl chloride, CO_2e = Carbon dioxide equivalents.[5]

airways were not reused, and the persistent use of desflurane and N_2O appeared ubiquitous in the Vorster study.

Clearly, more education for anaesthetists, ancillary staff and hospital administrators is required and should encourage better standards of practice. However, it is important to remember that the speciality of anaesthesia did not evolve as a gentle environmentally friendly practice. Proponents for banning the use of volatile anaesthesia have realised that regional/neuraxial techniques cannot be done for every patient. And copious amounts of administrated intravenous drugs used for total intravenous anaesthesia (TIVA) will be excreted into sewers, and therefore cannot be deemed to be totally innocuous to the environment. A drug such as propofol, for example, is poorly biodegradable in water and may be toxic to aquatic life.[9] The encouragement of single use equipment was amplified in the 1990s during the acquired immunodeficiency syndrome (AIDS) epidemic and the resurgence of prions in the United Kingdom (UK). Our escalating reliance on single use plastic or polyvinyl chloride (PVC) generates copious amounts of waste and, when incinerated, generates significant amounts of CO_{2e} (see Table I). Even if strict recycling were enforced, the separation of infectious and clean waste, would be an onerous task.

Traditionally, operating theatres were situated in the "centre" of the hospital, requiring humidification, ventilation and air conditioning (HVAC) to convert these dark and dank spaces into areas compliant with modern practice. The energy consumption and GHG emission in theatres has been shown to be three to six times higher than the rest of the hospital[10] and 20% of hospital waste is generated in this area.[11] These issues are generally beyond the control of the anaesthetist.

Finally, as Confucius said: "It does not matter how slowly you go so long as you do not stop." Anaesthetists must continue to pursue improved practices for a softer environmental impact. After GHG emissions, plastic waste seems to be our biggest challenge. Therefore, petitioning hospital administrators for prefilled syringes sourced from the manufacturer, as well as the reuse of some equipment should be encouraged. But manipulations like using ultra-low fresh gas flows (FGF) of < 0,5 L/min, waste anaesthetic gas (WAG) trapping devices and choice of more sustainable vapours and gas should be a priority. We have the intelligence and cognition to understand the environmental catastrophe of our making, and in this instance, collectively, we may just be able to reverse the trend.

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