

Disclaimer:

Except for movies, it is rare to start anything with a disclaimer. It must be appreciated that many of these articles are a decade and more old. On the contrary, climate science has progressed by leaps and bounds over the last few years. Things which were ambiguous in the early 2000s are no longer so. It is a fact our planet is heating up at an unprecedented rate and will continue to do so for the next few decades. Contribution of VAs and our speciality, though small, have to be viewed against that context. (In other words **anaesthesia practice makes a measurable contribution to global warming**) And so too the interpretation of the knowledge in the below mentioned articles.

Campbell M, Pierce JMT. Atmospheric science, anaesthesia and the environment. *BJA education* 15 (4): 173–179 (2015)

This article explains the structure of the atmosphere and the role played by greenhouse gases in atmospheric warming. It explains definitions of commonly used terminology with respect to climate change for eg. Radiative efficiency, GWP etc. It introduces the role of VAs in atmospheric pollution besides explaining terms such as TIVA, low flow anaesthesia and “reduce, reuse, recycle” mantra for lowering impact of anaesthesia on climate.

Shine KP. Climate effect of inhaled anaesthetics. *Br J Anaesth.* 2010 Dec;105(6):731-3. doi: 10.1093/bja/aeq313. Erratum in: *Br J Anaesth.* 2011 Feb;106(2):288

One of the earlier articles with a focus on climate impact of VAs, it starts with the basics of a “climate friendly” gas and explains terms like atmospheric lifetime and radiative efficiency. It describes the basics of GWP and GTP—what the terms mean, how is it calculated and how it should be interpreted—and their relation to the Kyoto Protocol.

Varughese S, Ahmed R. Environmental and Occupational Considerations of Anesthesia: A Narrative Review and Update. *Anesth Analg.* 2021 Oct 1;133(4):826-835

This articles gives the difference between ozone depletion gases and greenhouse gases. Additionally readers will get to know about the atmospheric lifetimes of each VA and the detailed description of GWP. How much distance is covered in

a car if an anaesthetist uses Sevoflurane for an hour—this “simple perspective” is detailed here. This perspective is necessary to bring home the “pollution impact” of VAs in terms of how a normal person thinks. Why impact of N<sub>2</sub>O on climate is high and how to minimise the ramifications of VAs as per NIOSH are other items of interest.

Sherman J, Le C, Lamers V, Eckelman M. Life cycle greenhouse gas emissions of anesthetic drugs. *Anesth Analg*. 2012 May;114(5):1086-90

Again this highlights the high adverse impact of Desflurane on the environment. To arrive at this conclusion the authors use a cradle-to-grave approach encompassing resource extraction, drug manufacturing, transport to health care facilities, drug delivery to the patient, and disposal or emission to the environment of all four VAs. Use of electricity to run anaesthesia machines and life cycle assessment of plastics used were analysed. It also gave a thumbs-up to TIVA with GHG impact of propofol being at least 4 orders of magnitude lesser than desflurane.

Devlin-Hegedus JA, McGain F, Harris RD, Sherman JD. Action guidance for addressing pollution from inhalational anaesthetics. *Anaesthesia*. 2022 Sep;77(9):1023-1029

One of the more recent articles, it questions the routine use of desflurane only on the basis of a shorter time to extubation, addresses N<sub>2</sub>O central piping leaks and supports the use of TIVA. In a very realistic assessment, the article says “TIVA may be associated with increased procurement costs, limiting its utility in low- and middle-income countries, where the use of inhalational anaesthetics with low FGF is important”. Devlin-Hegedus et al also shares a few success stories with regard to curtailment of use of VAs from Australia/ New Zealand and UK; it brings into focus the medical education and crowdsourcing platform CODA and their work on improving sustainability in healthcare.

White SM, Shelton CL. Abandoning inhalational anaesthesia. *Anaesthesia*. 2020 Apr;75(4):451-454

An intuitive article, it details the amount of CO<sub>2</sub> added to the atmosphere by one bottle of desflurane/ isoflurane/ sevoflurane and the amount added by an

anaesthetist over a lifetime of work. This article is in sync with today's climate science, looks to the future and proposes "it is 'too late to mitigate': the profession of anaesthesia must consider specifically abandoning the use of inhalational anaesthetic agents by 2030". It also suggests "the continued pre-eminence of inhalational anaesthesia within the orthodoxy of our profession occurs not due to any clinical superiority but due to a clinical tradition and an educational model that makes such acceptance almost inevitable". In other words we should learn ourselves and teach the next generations of anaesthetists the science of TIVA for induction and maintenance of anaesthesia.

### WFSA statement

The World Federation of Societies of Anaesthesiologists gave 7 consensus principles for environmentally sustainable anaesthesia arrived at by a Delphi process involving anaesthesiologists from around the world, from low-income to high-income countries. Recognising the paucity of such guidelines for low and middle-income countries, WFSA came up with detailed guidance which could be implemented in the maximum number of countries. It has rightly pointed out that "Anaesthesia practice makes a measurable contribution to global warming", the impact of VAs on the climate will continue to rise as more countries become developed and healthcare settings consume a lot of natural resources especially the perioperative setups.

Apart from the focus on VAs, the statement encourages anaesthetists to adopt environmentally sustainable principles with regard to anaesthesia administration (green anaesthesia) and align their practise to the triple bottom line of environmental (planet), social (people) and financial (profit) accountability. It encourages anaesthesia practitioners to make themselves aware on the topic and teach the same to our future generations.