

Ditching desflurane – four steps to success

With the goal of net zero emissions by 2050 and the increasing recognition of the importance of sustainability in healthcare, anaesthetists in Western Australia have significantly reduced desflurane use in public hospitals.

THE HEALTHCARE SECTOR is responsible for seven per cent of CO₂ emissions nationally¹. With the planet facing a climate change crisis, and the Australian government finally committing to achieving net zero CO₂ emissions by 2050, it is time for those working in the healthcare sector to do their bit.

Volatile anaesthetic agents are environmental pollutants. Of these, desflurane is the agent with greatest global warming potential, due to its ability to retain heat and its longevity in the earth's atmosphere². One 240mL bottle of desflurane is equivalent to 895kg of CO₂ emissions (this equates to driving a Volkswagen Golf for 5900 kilometres³).

The good news is we have excellent alternatives with a much lower carbon cost.

Sevoflurane, MAC for MAC, is 50-60 times less harmful than desflurane⁴. Total intravenous anaesthesia (TIVA) with propofol

has approximately 1:10000 of the environmental cost^{5,6}, and the advantages of smoother emergence and less postoperative nausea and vomiting. Furthermore, experience has demonstrated no compromise to either patient safety or list turnover, across all patient cohorts.

Anaesthetists in Western Australia have recognised that reducing the use of desflurane is one of the "lowest hanging fruits" to target in order to mitigate the global warming impact of their practice. In recent years, they have achieved remarkable success. As illustrated in the graphs below, the total usage of desflurane across all public metropolitan and country hospitals in Western Australia has fallen from a monthly average of 162 bottles in January 2018 to just six bottles in January 2022. This has resulted in a staggering reduction of 110,000kg of CO₂ equivalents per month, as well as saving the health service \$A40,000 a month.

MONTHLY TOTAL OF CO₂E (KG) PRODUCED BY WA HEALTH FROM DESFLURANE AND SEVOFLURANE



Left: Chris Mitchell with the Desflurane vaporisers taken out of the theatre in store room. Above: Article co-author Dr Laura Wisniewski.

The lessons to be learned from this remarkable reduction of desflurane use may be distilled into four key steps to success:

1. Measure the current volatile and propofol use in your department as a baseline. Start a simple database to track your department's progress. This is easy to do using pharmacy purchase data as it bypasses the complexity of determining individual theatre usage (and pharmacy staff are generally keen to help when they are presented with the potential financial savings).
2. It is critical to raise awareness, empower and educate people who are willing to champion the cause in their department. Most anaesthetists are willing to change their behaviour and practice when presented with clear evidence and scientific reasoning. Those who have had reservations regarding the change have often been surprised to see that, in practice, their concerns were unfounded. There are a number of existing organisations (for example, TRA2SH <https://www.tra2sh.org/>) which can assist in providing information and resources to support the phasing out of desflurane.
3. Sequentially institute physical changes to reduce the usage and availability of desflurane. For anaesthesia machines with end tidal control, set a default low-fresh gas flow (for example, 0.55l/min on the GE Aisys machine). After educating the department and anaesthetic assistants, start storing the desflurane cassette in the anaesthetic trolley (rather than installing in the machine). This physical reminder to desflurane users that the department was trying to decrease usage assisted in a significant change. The next step is removing the desflurane from theatre and storing it in theatre pharmacy. This balance between availability, but inconveniently so, results in many of the "devout" users exploring the acceptability of alternative agents. The final step is to remove desflurane from the hospital. This has occurred at different times in various hospitals, depending on the leadership style of the head of department. In some instances, it has been by simple autocratic removal, in others, it was put to the consultant group vote.
4. Ongoing cycles of monitoring and education are vital in order to effect the required change. In parallel, aim to gradually ramp-up barriers to accessing desflurane. It must be recognised that change will not be immediate. The Green Theatres Network, as well as the TRA2SH group, have both been involved across WA in raising awareness and providing ongoing education.

It is relevant to note that public sector reductions have been easier to achieve than private – however, as many consultants work across both sectors, the flow-on effects mean there has also been significant change in the private sector. Two private hospitals have now ceased using desflurane altogether, and the three largest private metropolitan hospitals have moved storage of desflurane out of theatre to the theatre pharmacy. Of the remaining hospitals, those using the cassette system have moved desflurane to the anaesthetic trolley.

So – how to initiate the change in your institution? Become the local champion, and start by obtaining the cost/usage figures from your friendly theatre pharmacist. Follow the four-step process we have outlined. With persistence, and a little help from your colleagues, the results will follow.

Dr Laura Wisniewski
Registrar, Department of Anaesthesia, Pain and Perioperative Medicine, Fiona Stanley Hospital

Dr Chris Mitchell, FANZCA
Consultant Anaesthetist, Sir Charles Gairdner Hospital

References

1. Arunima Malik, Manfred Lenzen, Scott McAlister, Forbes McGain. The carbon footprint of Australian health care, The Lancet Planetary Health, Volume 2, Issue 1, 2018, Pages e27–e35, ISSN 2542-5196, [https://doi.org/10.1016/S2542-5196\(17\)30180-8](https://doi.org/10.1016/S2542-5196(17)30180-8). (<https://www.sciencedirect.com/science/article/pii/S2542519617301808>) Accessed 02/10/2022/
2. Sulbaek Andersen MP, Nielsen OJ, Wallington TJ, Karpichev B, Sander SP. Assessing the impact on global climate from general anaesthetic gases. *Anesth Analg* 2012; 114: 1081–5
3. Self J. Calculating the carbon dioxide equivalent produced by vaporising a bottle of desflurane. Correspondence: *Anaesthesia* 2019, 74, 1473–1483. <https://associationofanaesthetists-publications.online.libraray.wiley.com/doi/pdfdirect/10.1111/anae.14802> Accessed 08.02.2022.
4. Pierce T. Anaesthetic gases calculator. <https://anaesthetists.org/Home/Resources-publications/Environment/Guide-to-green-anaesthesia/Anaesthetic-gases-calculator> (accessed 09/02/2022).
5. Sherman J, Le C, Lamers V, Eckelman M. Life cycle greenhouse gas emissions of anaesthetic drugs. *Anesth Analg*. 2012 May;114(5):1086-90. doi: 10.1213/ANE.0b013e31824f6940. Epub 2012 Apr 4. PMID: 22492186.
6. Sulbaek Andersen MP, Sander SP, Neilsen OJ, Wagner DS, Sanford TJ, Wallington TJ. Inhalational anaesthetics and climate change. *Br J Anaesth* 2010; 105: 760–6
7. <https://www.tra2sh.org/refuse-desflurane>. Accessed 09.02.2022.