Submitted: 17 June, 2025 Accepted: 29 July, 2025 Published: 08 September, 2025 DOI:10.22514/sv.2025.122

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Signa Vitae

EDITORIAL

Should inhalation anesthetics with large global warming potentials be banned?

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Abstract

Climate change is one of the most important environmental challenges of our time. Many anesthesiologists believe that inhalation anesthetics such as desflurane with its large global warming potential is a principal environmental problem of their profession and feel it is a moral imperative to eliminate its use from their own practices and to advocate for its universal prohibition. Others argue that clinical autonomy should be preserved whenever possible. Calculations based on widely accepted principles of atmospheric science present a possible resolution to this controversy. Even if desflurane were used for all of the more than 313 million surgical procedures performed each year and into the indefinite future, its effect on climate would be lost in the natural variation of global average temperature. Moreover, cessation of utilization would result in the rapid reversal of desflurane's effects.

Keywords

Climate change; Global warming; Global warming potential; Anesthetics; Desflurane

1. Introduction

Advances in pharmacology have given anesthesiologists an ever-widening array of chemical tools. These now include the so-called F-gases, a prominent example being desflurane, a fluorinated methyl ethyl ether ($C_3H_2F_6O$). Recently, considerable attention has been paid to the global climate change effects associated with the use of inhaled anesthetics [1]; every one of the fourteen articles published in this package mentions desflurane.

Desflurane is a specialty anesthetic agent. It is used in a few percent of the more than 313 million surgeries performed worldwide each year [2–4]. Some anesthesiologists find that certain sub-populations of patients benefit from the use of desflurane. These include morbidly obese [5], older and frail, pediatric, and neuro-compromised patients [6]. Some practitioners may wish to avoid the use of total intravenous anesthetic (TIVA) agents, which have been found to be associated with pollution of water sources [7]. Other anesthesiologists have found desflurane use to be unnecessary [8] or not worth its greater expense relative to other anesthetics. A session of the Euroanaesthesia 2025 conference was devoted to a debate exploring the clinical versus climate considerations surrounding the use of desflurane [9]. This editorial explores this controversy from a physical science perspective.

2. The misuse of global warming potential

Desflurane is a powerful greenhouse gas. If scored by its twenty-year global warming potential (GWP-20), it is 7020 times more powerful than carbon dioxide. As a result of this fact alone, the United Kingdom National Health Service has sharply limited the use of desflurane, "with use allowed only in exceptional clinical circumstances" [10]. Several Canadian provinces have taken similar measures [11], and as of January 2026 the use of desflurane will be strongly discouraged in the European Union [12]. Currently, there are heated debates over whether desflurane bans should be extended on the basis of its GWP, or rolled back to allow anesthesiologists to use their own judgment in balancing individual patient welfare against broader concerns about climate change.

Although GWP is widely cited in non-specialist literature (including the anesthesiology literature), in policy circles, and in the mass media, it is viewed with skepticism in the climate science community [13–16].

3. Temperature: a meaningful measure of climate change

According to Article 2 of the Paris Agreement [17], the internationally accepted standard for the measure of climate change is "the increase in the global average temperature". This makes sense. Whereas the originator of the GWP concept, Keith Shine, points to "the lack of specificity in what aspect of climate change GWP actually represents" [18], temperature

has a direct connection with the palpable effects of climate change, such as the melting of glaciers and polar ice caps, and sea level rise. Moreover, the change in temperature with time is the key input into calculations of the economic damages connected with climate change [19]. The proper method to assess the climate hazard attending the use of desflurane is by computing the effect of its use, at global scale, on global average temperature.

Because carbon dioxide has an atmospheric lifetime exceeding hundreds of thousands of years [20], its emissions linger in the atmosphere, contributing to long-term warming. In contrast, a pulse of desflurane almost completely disappears from the atmosphere in about sixty years. Even if desflurane were used indefinitely in all the 313 million surgical procedures per year (the worldwide annual total as of 2012) [4], its effect on global average temperature would never exceed 0.002 °C [21], much smaller than the natural variation of temperature due to variations of solar insolation and volcanic activity [22]. Moreover, once the use of desflurane is discontinued, its effect on temperature is fully reversible, unlike carbon dioxide [21]. Therefore, GWP is a misleading metric when quantifying the climate effects of short-lived climate forcers such as desflurane. Calculations of global average temperature, as per the Paris Agreement, are far superior methods of weighing the influence of greenhouse gases on climate. Those calculations show that the effect of desflurane emissions on climate "will be lost within the natural variability of the climate system" [16, 23].

4. Weighing moral choices

It is becoming increasingly apparent that climate change is a danger to the earth and its inhabitants. Climate change is an inherently difficult problem to solve, requiring collective action on a global scale and continuity of purpose in the face of inherently slow change. Anesthesiologists, as a group, are motivated to benefit humanity and therefore want to contribute to the solution. The greenhouse gas effects of inhalant anesthetics stand out as a climate factor within their control, and within this group, desflurane is the most potent warming agent. It is not surprising that desflurane has been a subject of interest to professional societies and civic-minded individuals [9].

For those anesthesiologists who have not found desflurane to be useful in their practices, there is no conflict. No one has been required or even requested to use desflurane, which is, after all, a high cost option. The declining use of desflurane over the last decade [3] might suggest an increasingly precise definition of situations in which desflurane is superior to other, less climate-active anesthetics.

Like any fine craft, the practice of medicine at its best is sometimes a matter of individual preference and experience. For all physicians, reduction of risk to the patient is paramount. In this landscape, regulators must act with great caution and humility. When weighed against the value of patient risk-reduction, not every conceivable method of climate change mitigation is an appropriate candidate for regulation. Some mitigation measures are simply too insignificant to risk the welfare of even a small sub-population of patients.

5. Conclusions

Global Warming Potential has been a useful tool in the administration of diplomatic agreements such as the Kyoto Protocol and the Paris Agreement, but it is a crude back-of-the-envelope method that has no place in the environmental analysis of policies that can actually affect climate. Even the climate scientist who introduced GWP has questioned its usefulness [18], particularly in reference to evaluating climate change associated with emissions of inhaled anesthetics [23].

Forecasts of temperature changes [21], benchmarked by observed historical changes in the climate system [22], provide a secure foundation for the evaluation of alternative policy choices. This methodology shows that even if desflurane were used for more than 300 million surgical procedures per year into the indefinite future, its effect on climate would be lost in the natural variation of global average temperature. Moreover, cessation of utilization would result in the rapid reversal of desflurane's effects. It is impossible to compare desflurane to carbon dioxide as climate change agents since the carbon dioxide emitted into the atmosphere today will still be affecting the climate for hundreds of thousands of years into the future, while the influence of desflurane will disappear within a few decades after cessation of use.

In a world beset with environmental challenges, we must direct our attention and energy to important problems and not allow ourselves to be distracted by inconsequential ones. In the absence of compelling societal interest, the choice of safe and effective anesthetic agents should be left where it belongs—in the hands of physicians—not written into national or supranational regulations.

AVAILABILITY OF DATA AND MATERIALS

This editorial derives its information from its cited references.

AUTHOR CONTRIBUTIONS

RLK—Wrote the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

ACKNOWLEDGMENT

This work was inspired by conversations with Laurentiu Marin, who also participated in the initial research.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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How to cite this article: Robert L. Kleinberg. Should inhalation anesthetics with large global warming potentials be banned? Signa Vitae. 2025; 21(9): 1-3. doi: 10.22514/sv.2025.122.