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Sustainability within Anesthesia Abstracts

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Getting Righteous with Nitrous

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INTRODUCTION

Inhaled anaesthetic agents have been identified as significant contributors to the global warming impact of acute hospitals¹. Growing international data demonstrate that in facilities with nitrous oxide (N₂O) manifolds and piping networks, the proportion of purchased N₂O wasted through leaks can be as high as 95%²; a feat of inefficiency rarely seen in modern-day healthcare. We set out to compare (A) volumes of N₂O used clinically with (B) volumes of N₂O procured by two inner city hospitals.

METHODS

(A) Clinical use of N₂O at both a quaternary academic hospital and an affiliated secondary care centre was described by a departmental survey. The frequency and intended purpose of N₂O use over the preceding 12 months was explored. Data to quantify N₂O volumes delivered (including duration, fresh gas flow and inspiratory fractions) were sampled from anesthesia machine logs (Aisys CS², GE Healthcare, Chicago USA).

(B) Procurement data was provided by a provincial medical gas supplier. Locally, N₂O is supplied to manifolds in 64.59lb (29.3kg) size 44 'K' cylinders which contain 16,013 litres (L) of gas when full (at 20°C). Cylinders are typically replaced every 3-4 months at each hospital. Annual procurement was calculated by averaging 3 monthly turnover and extrapolating to year. Average rates of manifold depletion accounted for incomplete emptying of cylinders when returned to the supplier (typically 8% of cylinder contents).

RESULTS

Quaternary care centre

- 1 82/83 (99%) of staff responded to the survey. Only 3 staff (4%) reported infrequent N₂O use (< 3 cases/year).
- 2 44 cylinders were supplied to this facility during 2022, corresponding to a total volume of 545,396.28 L of N₂O.

Secondary care centre

- 1 87/90 (96%) of staff responded to the survey. 10 (11%) staff reported infrequent N₂O use (<3cases/year) and 3 staff (3%) reported frequent N₂O use (3-10 cases/year). The majority of N₂O users reported using N₂O for gas inductions exclusively with one anesthetic machine. To quantify N₂O volumes typically used,

- data stored on this machine were retrieved and interrogated. N₂O administration occurred twice in the hundred cases reviewed. Volumes of N₂O delivered (calculated with fresh gas flow, inspired fraction and duration) were 7 and 16 L.
- 2 48 cylinders were supplied to this facility during 2022, corresponding to a total volume of 594,977.76 L of N₂O.

DISCUSSION

We have demonstrated a large discrepancy between volumes of N₂O used clinically and volumes procured. N₂O is used infrequently and typically in volumes much less than 100 litres per administration. In contrast, N₂O depletion from the manifold supply averages >1500L/day at each hospital.

The CO₂ equivalent of this volume of N₂O (GWP100 = 265³) is 264,444 kg and 288,479 kg at the larger and smaller hospital respectively, equating to 8% of the total global warming impact of an academic quaternary-care hospital surgical suite⁴.

These findings, although alarming, are consistent with many other sites investigating N₂O waste.

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