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Green Anaesthesia: A Quality Improvement Project to Reduce Desflurane Usage in the Operating Theatre

Authors: Dr Low Zhao Kai, Dr Poh Pei Kee, Dr Ang King Sin, Dr Ng Su Wei Bryan
Department of Anaesthesia, National University Hospital

How bad are anaesthetic gases?

Anaesthetic gases are greenhouse gases that contribute to **5% of a hospital's carbon footprint.**

Desflurane is an anaesthetic gas with especially **high global warming potential** and **long atmospheric lifespan**.

Desflurane is also **more expensive** ($1.23/ml versus $0.47/ml for sevoflurane), and **requires 3x higher dosage** to keep patients asleep due to its lower potency.

Agent	Atmospheric Lifetime (Years)	GWP_{100}	CO_2e per bottle (kg)
Sevoflurane	1.4	140	53
Desflurane	**14.1**	**2530**	890
Nitrous Oxide	**109**	**273**	928 (Size E)

What is the evidence for desflurane usage?

Desflurane is a popular anaesthetic agent due to its favourable pharmacokinetic profile allowing rapid anaesthesia emergence and fast turnover of operating theatre cases.

However, recent evidence has shown **no significant difference in clinical outcomes** compared to sevoflurane, including time to extubation (only 1-2 minutes faster) and postoperative respiratory complications.

Our aim

Starting in 2021, we initiated a **quality improvement project** to:

1. Reduce median usage of desflurane by **50%**
2. Reduce the number of theatre cases administering desflurane by **50%** over 6 months

Greening the OT	LCA Hourly Impact for FGF at 1L/min (MAC of 1)				
	Agent	CO2e (kg)	Cost (S$)	Distance Driven (km)	Environmental Issues
	Propofol (TIVA)	1	12.31	6	Aquatic life toxicity
	Sevoflurane	3	2.71	19	Greenhouse gas
	Desflurane	81	22.13	509	Greenhouse gas

Ref: Hu et al. The Carbon Footprint of General Anaesthetics: A case study in the UK. Resour Conser Recycl, 2021 & NUH Dept of Pharmacy

Educating staff with stickers on anaesthetic machines showing the **per-hour environmental and financial impact of desflurane and lower-carbon alternatives.**

Methodology

Phase 1: Pre-intervention phase
- Baseline data collection on anaesthetic usage
- Root cause analysis
- Pareto analysis to determine top causative factors: (1) lack of education, (2) general attitudes, (3) ease of access

Phase 2: Intervention phase across 3 Plan-Do-Study-Act cycles
- Staff education
- 'Greening the Operating Theatre' bulletin and campaign to foster a culture change
- Incorporating environmental sustainability into anaesthesia curriculum and examinations

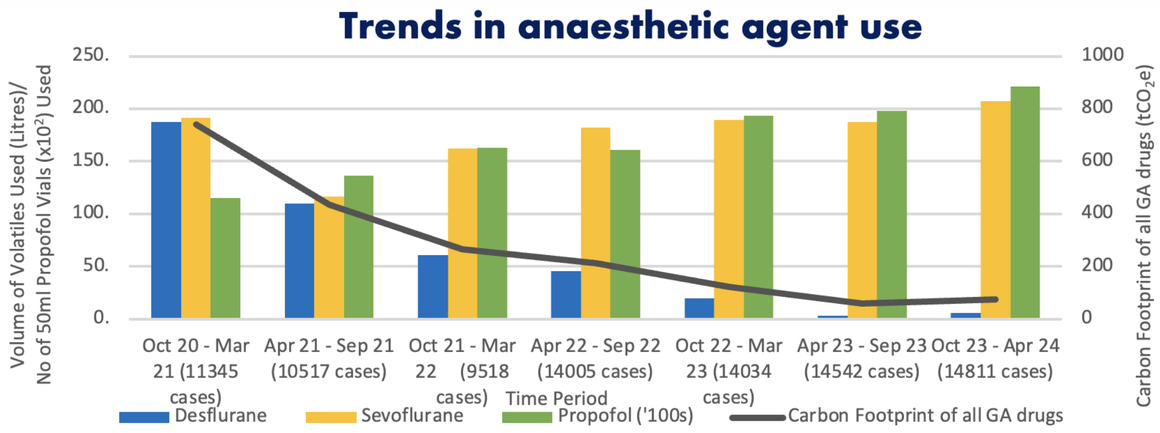
Phase 3: Post-intervention phase
- Assess impact of interventions
- Keeping staff updated about progress at regular intervals and shared 'wins'

Results

Our primary objective of 50% reduction in desflurane usage was **achieved within 3 months** of intervention.

This reduction has been **sustained over 3 years**, with an overall **97% reduction** in monthly median desflurane usage.

Savings:
- Financial: **S$341,900/year**
- Environmental: **1,303 tonnes CO_2e**
  - Equivalent to 8.22 million passenger km
  - Or removing 411 cars off the road



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