

Anaesthetic Gases- Greenhouse Gas Reductions Western Health, Melbourne, Australia

GGHH Agenda Goals

- **WASTE- Carbon Emissions and Financial Costs**
- **Chemicals**

Hospital Goal

- **To reduce hospital greenhouse gas emissions by changing the type of anaesthetic gases used.**

Progress Achieved

- Financial benefits- approximately USD \$22,500 per year
- Environmental benefit- 140 tonnes of CO₂e emissions per year. (equivalent to 36 return long haul flights from Melbourne, Australia to London, UK).
- Human health benefit- Workplace safety studies have shown that waste anaesthetic gases can be harmful to staff if not properly exhausted

The Issue

Western Health has approximately 700 beds and is situated in Melbourne, Australia. Like most hospitals in Australia, a variety of different general anaesthetic gases are used, but primarily sevoflurane, desflurane with some nitrous oxide (N₂O). Propofol is an intravenous anaesthetic agent that can be substituted for the prior general anaesthetic gases. The Anaesthetic Department had become aware in May 2012 through publications by Dr. Sulbaek Anderson and Dr. Jodi Sherman in *Anesthesia and Analgesia* that desflurane and N₂O had large global warming potentials (much greater than for sevoflurane or propofol). All general anaesthetic gases have similar clinical effects and there are no large benefits in using one agent appropriately instead of another in most situations.

Undoubtedly, for an *individual* anesthesiologist, the greatest contribution one could make to lessening their effects upon climate change would be to replace all use of desflurane and N₂O with sevoflurane and propofol. For example, complete transfer from the use of desflurane to sevoflurane as one's standard, general anaesthetic gas would be the equivalent of no longer flying return economy Melbourne, Australia to London, UK *fortnightly!*

Desflurane and N₂O have high global warming potentials compared with sevoflurane (or propofol). Through a change away from desflurane and N₂O an individual anesthesiologist can considerably reduce their environmental footprint.

Sustainability Strategy Implemented

As a result of several presentations on this topic in 2012 the majority of the Anaesthetic Department *voluntarily* reduced their desflurane and nitrous oxide use and attempted to use lower flows of gases in general. There was very little appetite within the Anaesthetic Department for *mandatory* cessation of the use of all desflurane and N₂O.

Implementation process

No staff training was required apart from the initial presentations. Implementation was straightforward and achieved by anesthesiologists simply changing their practice to avoid desflurane and nitrous oxide. Note though that junior registrar (resident) doctors from other hospitals on rotation through Western Health were educated by senior anesthesiologists about avoiding the use of desflurane and nitrous oxide where possible.

Tracking Progress

Outcomes were obtained through audits of the usage of the different gases comparing 2011 and 2015. Desflurane use more than halved from 198 bottles in 2011 down to 82. Sevoflurane use remained relatively unchanged at 1,584 bottles in 2011 to 1,522 bottles in 2015. N₂O use declined by just under 15% over the 4 years. As can be seen, desflurane use was but 12% of sevoflurane use in 2011 (and 5% in 2015).

Interestingly the use of propofol (an intravenous general anaesthetic agent) did not change more than 5% from 2011 to 2015. The number of operations per annum also did not markedly change from 2011 to 2015. These data suggest that anesthesiologists were using all gases at lower flows (i.e. becoming more economical/efficient) in 2015 vs. 2011 although this cannot be corroborated.

Challenges and lessons learned

Since we were already a healthcare system that used limited amounts of desflurane compared with sevoflurane the opportunities to reduce such usage were evidently lessened. If we had been a high user of desflurane much more significant financial and environmental improvements could have been made. It is currently impossible at our hospitals to quantify the proportion of nitrous oxide used for laboring mothers in the Birthing Suite vs. that used for general anaesthesia.

Next Steps

1. It has been considered by some members of the Anaesthetic Department to mandate the removal of desflurane and nitrous oxide although this appears unlikely.
2. Removal of desflurane canisters from the anaesthetic machines for use only upon sustained request has also now occurred.
3. Ongoing education of new anaesthetic doctors and nurses to avoid the use of desflurane and nitrous oxide continues.

Demographic information

Western Health, Melbourne, Australia. Approximately 700 beds total, 18 operating rooms. General hospital (no cardiac surgery, minimal neurosurgery) with a large maternity section.

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Submission date: 29/6/2016