



## **Reducing the Carbon Footprint of Anesthesia Middlemore Hospital, Counties Health Board, Auckland, New Zealand**

### **GGHH Agenda Goals**

- **Pharmaceuticals**
- **Climate**

### **Hospital Goal**

- **To reduce hospital anesthetic greenhouse gas emissions by an iterative process of education, measurement, and encouragement**

### **Progress Achieved**

- Environmental benefit: 600 metric tons of CO<sub>2</sub>e per year
- Financial benefits – spending on volatiles has fallen by over 60%
- Increased esprit de corps, and adoption of a culture of environmental awareness

### **The Issue**

Middlemore Hospital has ~800 beds and 14 operating rooms, and there are more of both at its elective surgery satellite facility 10 km away. The case mix at Middlemore includes (but is not limited to) surgery for burns, reconstructive plastics, hands, spine, vascular, and general. It is the busiest obstetric unit in the New Zealand. Most of the work is not elective. Middlemore Hospital patients tend to poverty, obesity and co-morbidity.

In early 2015, Middlemore Hospital began a process to reduce the carbon footprint from volatile inhaled anesthetic agents. These drugs have potent greenhouse effects, with desflurane the worst culprit by a factor of approximately 20. Sevoflurane and isoflurane are less environmentally harmful. (The gas nitrous oxide, less potent on a per gram basis, can also contribute significantly to greenhouse gas release, because of the large amounts which may be required. For several reasons, some unrelated to climate, nitrous oxide anesthesia at Middlemore Hospital has been almost zero for years.) Lowering anesthetic gas flows reduces pollution, and choosing regional anesthesia or total intravenous anaesthesia with propofol rather than volatile general anesthesia has been shown to be orders of magnitude less harmful with respect to global warming.

### **Sustainability Strategy Implemented:**

- Education: the relative carbon costs of the volatile agents, and non-volatile techniques, for over 70 specialists, and 20 trainees. (Minimizing use of desflurane, lowest possible flows in inhalational anesthesia, encouragement of regional and TIVA techniques.)
- Education on better use of our complex anesthetic machines, to exploit low flow features. We enlisted others with leadership and portfolio roles within the department.
- An email forum for discussion, leadership, and team communication



- Monthly calculation of carbon footprint, for simplicity, based upon volatile use only. (Again, nitrous oxide use has been negligible for some time.) Pharmacy gave data for volatile agents dispensed. Knowing volume, density, and global warming potential we can calculate total monthly greenhouse gas release from clinical work directly related to anesthetic decision-making.
- Indexing carbon footprint to anesthetic work. This makes trends in efficiency more apparent in the context of variable load. We chose minutes of anesthetic time (not local anesthetic cases), supplied by our Infometrics department. We hypothesized that an indexed figure would be more relatable for individuals, and was more likely to achieve change in day-to-day decision-making.
- A simple group decision to set sevoflurane as the “default” (left mounted) vaporizer.
- Published monthly data, in a graphical form, via email. The email went to every member of the department, clinical and non-clinical. In this forum, we attempted to cajole, exhort, and enthuse. We appealed to pride, competition, and to team spirit.

### **Implementation process**

There has been no compulsion, on any part, and all grades of anesthesiologist have been involved, from junior trainee to older specialists. No money has been required. No new data has been collected, but combining data from 2 sources gave us monthly feedback, indexed to our clinical work.

The process began in early 2015. It is ongoing.

### **Tracking Progress**

Success is measured as a falling monthly CO<sub>2</sub>e release. Without any compulsion, there has been a change in culture, and behavior. Our use of desflurane has steadily dwindled, our use of TIVA has tripled, and our volatile bill has plummeted. On a basis of gCO<sub>2</sub>e/minute, our anaesthetics have dropped from ~250-300 to <100.

