GE HealthCare

Driving sustainability in anaesthesia: How continuous analytics and End-tidal Control cut emissions and costs at Christchurch Hospital

Carestation Insights case study

Background

Christchurch Hospital is the major regional hospital in the upper South Island of Aotearoa, New Zealand, serving a primary population of 600,000, along with a range of supra-regional services. For 22 years, the Christchurch team tracked fresh gas flow (FGF) during sevoflurane anaesthesia. This tracking included data from the entire case, not just the maintenance phase, because high FGF in the early phase of anaesthesia has a significant effect on overall consumption[1].

To understand the hospital's anaesthetic agent use and emissions, in August 2018, the hospital installed and connected GE HealthCare's Carestation Insights™ Agent Cost digital analytics application to their GE HealthCare Aisys™ CS[2] anaesthesia machines in 10 of the 30 operating rooms. Two years later, in 2020, they expanded the application's use to an additional 10 operating rooms, which included cardiac, paediatric and neurosurgical ORs. Finally, in 2024, the application's use was further expanded to all 30 operating room locations, including interventional radiology, obstetric OR and four ORs at a separate site.

Results of tracking low flow anaesthesia over a five-year period

The environmental impact of anaesthetic gases is clear[1], and steps need to be taken to reduce its use, such as:

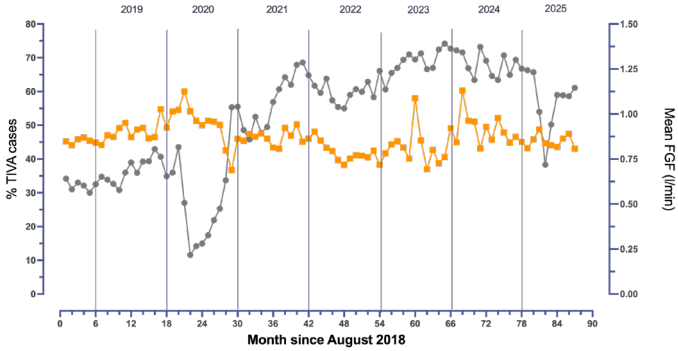
- Choosing lower-impact agents and minimizing FGF during volatile anaesthesia
- Reducing total nitrous oxide (N_2O) use and encouraging intravenous anaesthesia (TIVA), though TIVA comes with its own concerns about residual waste

Christchurch Hospital.

In 2018, according to the Carestation Insights Agent application, the mean FGF at the hospital for volatile agents was 840 ml/min. As the additional 10 ORs were added to the application's use in 2020, the mean FGF increased to 965 ml/min. However, in the first half of 2025, the mean FGF decreased back to 840 ml/min, even with the addition of the pediatric ORs, which were not included in the previous years' samples. The hospital believed a potential reason for the FGF changes between the 2018, 2020, and 2025 samples was that trainees might not be skilled in administering inhalational anaesthesia.

In addition to reviewing to FGF utilisation, the Christchurch team also looked at their TIVA utilisation over a five-year period. In 2020, TIVA was used in more than 55 percent of cases. In 2023, TIVA rate grew to 60 and 70 percent. For the first half of 2025, it decreased to 58 percent due, in part, to propofol shortages but also because of a drive from trainees to maintain skills with volatile anaesthesia.

Since mid 2021 the Christchurch team has undertaken a more regular detailed analysis of the FGF (l/min) and TIVA case data and provided regular, bi-monthly feedback and commentary to the hospital's leadership.



Monthly trend of % TIVA cases in grey and mean FGF (l/min) in orange.

Christchurch's approach: Using Carestation Insights to optimize anaesthetic agent cost, reduce environmental impact, and enhance technology adoption

In 2018, Christchurch's initial focus with the Carestation Insights Agent Cost analytics application was to obtain insights on their low-flow anaesthesia use and its impact on anaesthetic agent cost. At that time the team was not using N_2O during the maintenance phase anymore and the use of desflurane was minimal and decreasing.

Agent Cost monthly overview.[4]

Besides understanding the utilisation and cost of anaesthetic agents, understanding agents' environmental impact is also important. The Agent Cost application's dashboard showcases a CO_2 emissions value to highlight the environmental impact of volatile anaesthetics and nitrous oxide. The kilograms of carbon dioxide equivalent ($KgCO_2e$) value provide a direct overview of the emissions of anaesthetic agents and N_2O combined.

The Christchurch team also found that the usage of the Aisys CS[2] anaesthesia machine's End-tidal Control (EtC) unique technology helped reduce the agent consumption during the initial high flow and the maintenance phase of anaesthesia. With the addition of EtC's percentage usage in the application's dashboard, the hospital gained better insight where EtC was used and where the adoption of the technology could further be improved.

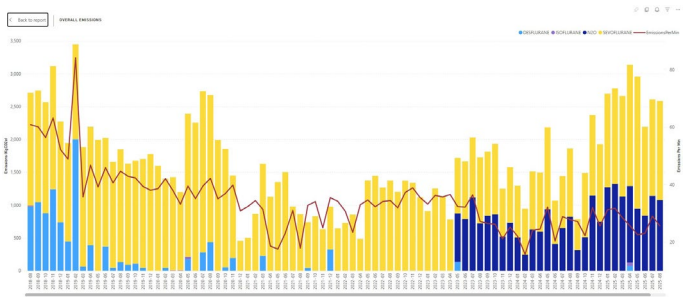
During this usage period, additional functionality was added to the Agent Cost dashboard, allowing for N_2O use filtering in short or paediatric cases in the hospital. This enabled the Christchurch team to review the utilization of N_2O in these areas.

Consistent reduction of agent costs and CO_2 emissions over the past eight years

Although the TIVA rates increased from ~30% to ~60% in the seven-year period, the hospital experienced a gradual reduction in emissions based on consistent feedback on the importance of low-flow anaesthesia and the increased adoption of EtC.[2]

Over time, since June 2023, the Agent dashboard included the N_2O emissions into the combined emissions from sevoflurane and N_2O. At the same time, the team added 10 additional ORs to the dashboard increasing the number of cases with volatile anaesthesia captured per month from ~450 in 2024 to ~850-900 cases in 2025. To eliminate the effect of additional cases the team started to compare the emissions per minute in the red trend below and sevoflurane consumption rates (ml/ Hr) visible in the dashboard.

Christchurch hospital also has increasing interest in the utilisation of nitrous oxide from both the environmental footprint and the increasing awareness of the waste from pipelines and fittings. The team knew that outside of obstetrics, N_2O use is limited to an adjunct for inhalational induction and is almost never used during maintenance. Because of the nitrous oxide waste from the pipelines and fittings, the team decommissioned N_2O pipelines in almost half of the ORs.[3] The Carestation Insights data supports an informed discussion in which cases and OR's nitrous oxide are actively used and where the use could be further reduced.



Trend of emissions over 7-year period with emissions per minute in red line.

Staff turn-over visible in low-flow practices require continuous education

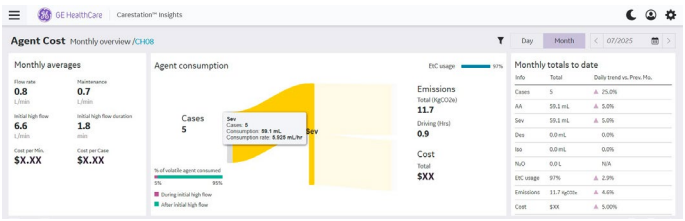
The team understands that they have a persistent low-flow culture at the hospital. During 2022-2023 , the team experienced more staff shortages and turnover than usual. The team had several short-term locums (both anaesthesiologist and anaesthesia assistants) and anaesthesia providers joining them who had trained and worked in different places rather than undertaking a part of Christchurch's training locally.

The rapid increase in mean fresh gas flows and emissions in $KgCO_2e$ were directly visible in the dashboard during this period. The graphical representation above shows the emissions in $KgCO_2e$ and the emissions per minute of the volatile anaesthetics and N_2O over a seven-year period. According to Dr. Richard French, clinical director of Service Improvement at Christchurch Hospital, "We speculate staff shortages and more turnover was the underlying cause in the great variability in fresh gas flow rates seen between second quarter 2023 and mid 2024. We have been able to return to the same average fresh gas flow and emissions, seen prior to the Q2 2023 increase, through low-flow and End-tidal Control education."

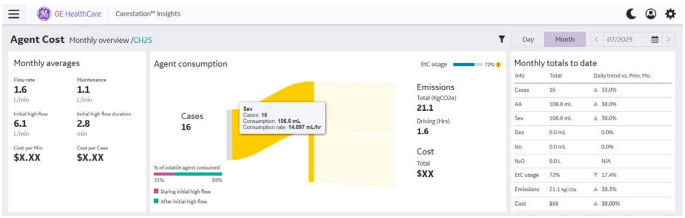
High usage of End-tidal Control is linked to low agent consumption

At Christchurch hospital, activating the EtC technology on GE HealthCare's Aisys CS^2 machine directly after endotracheal intubation or LMA insertion, was routine. The team noticed that trainees were not turning on volatile between induction and securing airway which comes from both the generational increasing environmental awareness, and the hospital's messaging. EtC allows a clinician to set both EtAA and EtO_2 targets, which can typically be reached in less than 90 seconds. Once the clinician-set targets are reached, EtC reduces the FGF automatically to the minimal FGF clinician-configuration and continuously adjusts the rates as well as oxygen and anaesthetic outputs and concentrations to the achieve the target EtO_2 and EtAA settings. Both the duration of the Initial High and the Maintenance flows are important for low agent usage and emissions.

Two examples from the hospital's practices show the difference in EtC usage and the anaesthetic agent consumption below. In the screen capture below the EtC usage target is highlighted because it was below the threshold.



97% EtC usage in OR CH08 resulting in sevoflurane consumption rate 5,89 ml/hr, and cost per min $X,XX.[4]



72% EtC usage in CH25 resulting in sevoflurane consumption rate 14,0 ml/hr, and cost per min $X,XX.[4]

Conclusions

Over time, since 2020, Christchurch hospital experienced a 19 percent decrease in mean FGF (970 to 780 ml/min) despite the increasing use of TIVA, and the hospital's trainees concern about losing skills associated with volatile anaesthetic agent use. Comparing 2018 and 2025, inhaled anaesthesia emissions per minute have reduced by 58%. Maintaining the hospital's leading standards in low-flow practices requires continuous monitoring, feedback and education. This has become more prevalent during times when the team experienced high staff turnover.

By providing the anaesthesia staff constant feedback on the usage of EtC, the Carestation Insights Agent Cost application provided the data they needed to validate the importance of low flow and the environmental impact of volatile anaesthetic agent use.

For Christchurch hospital, the Carestation Insights Agent Cost application demonstrated to be a valuable continuous improvement tool. By providing both individual OR and cumulative data on FGF, anaesthetic agent, N_2O usage and emissions it enabled the Christchurch leadership to see the importance of utilizing EtC to drive low flow anaesthesia practice and environmental impact awareness.

At the time the analytics application was introduced to Christchurch, the team did some work with GE HealthCare exploring patterns of use and establishing the significance of an initial high flow period on both overall average FGF and agent consumption. A contributor to consumption during this period was the habit / tradition of turning on the vapouriser as soon as bag mask ventilation was commenced. Increasing awareness of the "waste" during this period and familiarity with the ability of EtC to rapidly achieve and maintain a target has meant this practice is now reserved for selected cases.

About Carestation Insights analytics applications

The Carestation Insights suite of applications analyzes breath-to-breath OR data to find actionable insights and displays the analyses on the hospital's mobile devices. Based on over 500 high-fidelity data points from the anaesthesia machine and the patient monitor, the insights can be leveraged to support decisions that drive perioperative productivity, reduce operating costs, and standardize best practices.

Carestation Insights Agent Cost Application helps to show the benefits of adopting low-flow anaesthesia strategies in the OR.

References

1. Trends in greenhouse gas emissions from volatile anaesthetics in 41 countries: 2013–2023 https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.16709
2. Kennedy, R. Ross M.B., Ch.B., Ph.D.1,*; McCombie, Andrew Ph.D.1,2; French, Richard A. M.B., B.S.1. Maintaining Lower Fresh Gas Flows When Using Sevoflurane: An Observational Exploration of Data from a Single Center. Anesthesiology, January 09, 2026. DOI: 10.1097/ALN.0000000000005867
3. How are we using nitrous oxide in anaesthesia? Ross Kennedy & Paul Current. Aotearoa New Zealand Annual Scientific Meeting, Hamilton New Zealand Nov 12- 15.
4. Actual costs have been redacted. Values will be available to customers using this dashboard.

Note: Et Control in the United States is indicated for patients 18 years of age and older. Refer to the anesthetic agent labeling for information regarding indications for use, warnings, and other relevant clinical information specific to that anesthetic agent. Any decisions regarding selection of anesthetic agent and flow rate should be made at the discretion of the clinician and in their medical judgment based on available information.

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The statements of Christchurch hospital described here are based on their own opinions and on results that were achieved in their unique setting. Since there is no “typical” hospital/clinical setting and many variables exist, i.e. hospital size, case mix, staff expertise, etc. there can be no guarantee that others will achieve the same results. This information is not intended to dictate hospital/facility practices and is not a substitute for GE HealthCare’s published user manuals and does not supersede any facility's specific protocols and guidelines.

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