

Investigating the usage and reducing wastage of nitrous oxide at Kingston General Hospital: a Quality Improvement Initiative

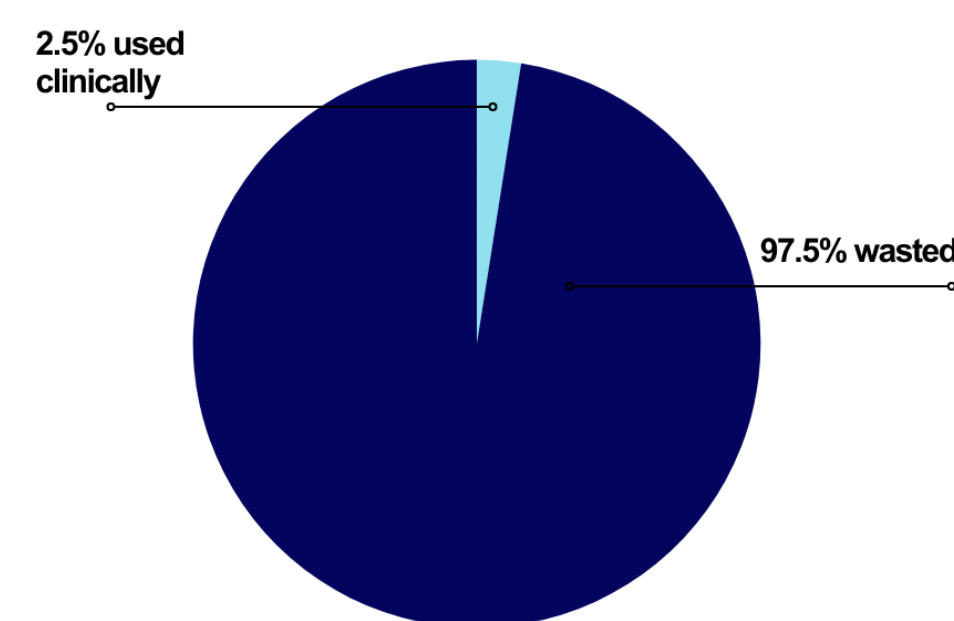
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Background

Nitrous oxide (N₂O) is an anesthetic gas with sedative, amnestic, and analgesic properties. It has a significant negative environmental impact, with an atmospheric life of approximately 120 years and a global warming potential of 265. Multiple hospital systems spanning various countries have detected significant leaks in their N₂O pipeline system, indicating a large loss of gas before the product reaches the patient.

A survey of our department showed that N₂O is not frequently used by most clinicians, and that when it is used, it is typically for short time periods and in specific cases (GA c/section, pediatric inhalational inductions, facilitating IV access).

An audit performed at KGH in the spring of 2024 showed that 338, 000 litres of N₂O were purchased over a 17-week period, while clinical use only accounted for 8, 500 litres.



Aim

By October 2025, we aim to reach zero wastage of manifold nitrous oxide at Kingston General Hospital and to have a 50% decrease in the amount of nitrous oxide that is ordered by KGH.

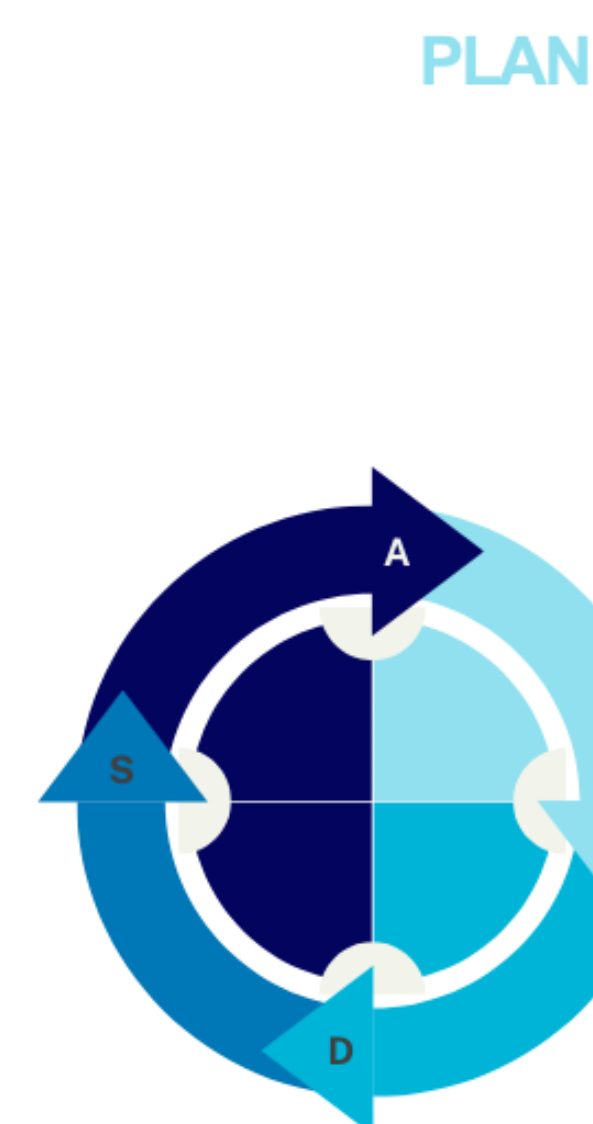
Strategy for Change

Eliminate pipeline N₂O wastage by disabling the N₂O manifold and using E-cylinders outfitted on the back of each anesthetic gas machine (AGM) to provide point of care delivery of N₂O .

N2O QI PROJECT TIMELINE



Attempt # 1



- Survey department members to gauge clinical N₂O usage
- Assess number of large N₂O tanks ordered over 17 week period
- Assess amount of N₂O used weekly over 17 week period
- Obtain departmental approval to run a trial of using N₂O E-cylinders and shutting off the N₂O manifold

- Connect a portable E-cylinder of N₂O to each anesthetic gas machine
- Shut off the N₂O manifold



- PROBLEM: N₂O low pressure alarms**

Attempt # 2 – In progress

ACT

- Permanently decommission the N₂O manifold

PLAN

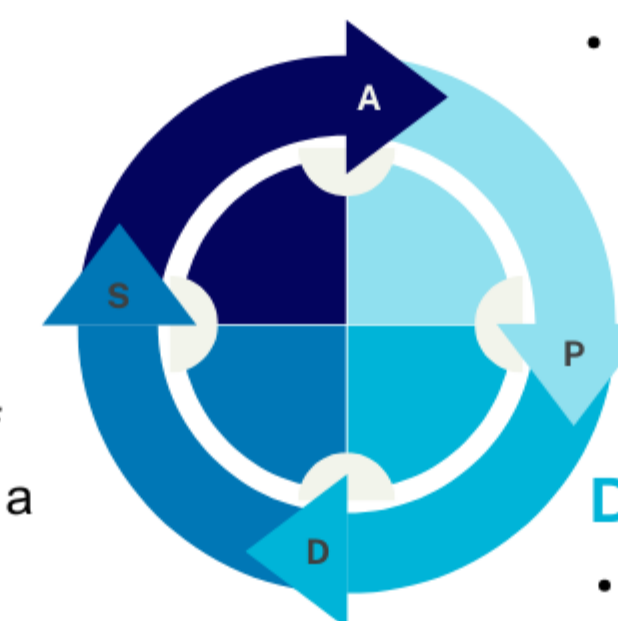
- Collaboration with maintenance department to circumvent the local N₂O low pressure alarms
- Plan to connect a medical air compressor to the pipeline and proceed with using E-cylinders on each anesthetic machine

STUDY

- Reassess the amount of N₂O ordered by KGH in a 3 month time period and compare to previous ordering practices
- Determine the amount of N₂O wastage by comparing supplied amount of N₂O with clinical use

DO

- Go live with the above plan of using E-cylinders as the supply of N₂O



SWOT ANALYSIS

Strengths

Support from maintenance team

Support from Anesthesia Assistant group

Support from the anesthesia department

Weaknesses

Opening the tank at the back of the AGM before use

Leakage through the E-cylinder

Inability to easily and accurately determine how much N₂O is left in each tank

Lack of storage areas for extra E-cylinders

Opportunities

Educate clinicians about the environmental effects of N₂O

Educate clinicians about viable alternatives to using N₂O

Expanding the project to Hotel Dieu Hospital if successful at KGH

Threats

Supply chain issues leading to difficulty obtaining E-cylinders

Clinician dissatisfaction

Next

steps

- Cap off N₂O manifold to eliminate manifold and pipeline wastage.
- Reassess the amount of nitrous oxide being ordered by KGH.
- Assess clinician satisfaction with using E-cylinders on AGMs.
- Expand the project to the Hotel Dieu Hospital site of KHSC and eliminate the nitrous oxide pipeline at HDH.
- Engage clinicians in further education regarding the environmental effects of nitrous oxide to decrease clinical use.