SUSQI PROJECT REPORT: CoolStick
Reducing the CO2e of Orthopaedic Surgery

Start date of Project: **20th May 2024**
Date of Report: **16th August 2024**
Team Members:

- Laura Vale - Senior Operating Department Practitioner, laura.vale@hhft.nhs.uk
- Krithea Baker - Recovery Nurse Practitioner, krithea.baker@hhft.nhs.uk
- Dr Jaco DeBeurs - Specialist Doctor Anaesthetics, jaco.debeurs@hhft.nhs.uk
- With special thanks to Oliver Grassby (CT2 Anaesthetics), Jessica Lynch (CT1 Anaesthetics), Alhan Al-Sammak (Speciality Doctor) & Ellie Watson.

Background:

The level of sensory block achieved by spinal anaesthetic is currently assessed using ethyl chloride spray which is a vapo-coolant and cryo-analgesic agent (Grassby et al., 2023). Ethyl chloride is neurotoxic and an irritant to both eyes and lungs (Young et al., 2023) as well as being toxic to aquatic and marine life. The CoolStick® (Theophany Ltd, Dorset, UK), a reusable steel device kept in the fridge offers an alternative to using ethyl chloride spray and is endlessly reusable and has been shown to have equal efficacy when compared with ethyl chloride (Grassby et al., 2023).

Methods:

The project was discussed with the anaesthetic lead and ethical approval was gained, prior to commencing a study into the products efficacy. Sensory block following spinal anaesthesia was assessed firstly using ethyl chloride and then using the CoolStick® (Grassby et al., 2023). Following this study, funding was secured to purchase our own devices through engaging with theatre and labour ward operations managers. Other stakeholders included anaesthetists and anaesthetic practitioners. The change in practice was communicated via weekly huddle meetings and communication groups with instruction to reduce ethyl chloride ordering. This will be audited at a later date to review usage and savings.

Measurement:

Patient outcomes:

Efficacy of the product had previously been assessed by clinicians at our trust prior to implementation to ensure there were no adverse effects on patient experience or outcomes (Grassby et al., 2023). We have therefore utilised this data in our measurement of patient outcomes. Qualitative and quantitative feedback was collected as part of this research.

Environmental sustainability:

The carbon footprint of the ethyl chloride itself was measured using an environmentally extended input output analysis (EEIOA) due to data on specific emissions factors being unavailable. The factor

This template forms part of the SusQI Toolkit available at susqi.org developed by the Centre for Sustainable Healthcare (CSH). CSH is registered as a company limited by guarantee in England & Wales No. 7450026 and as a charity No 1143189. Registered address 8 King Edward Street, Oxford OX1 4HL.

for basic pharmaceutical products and pharmaceutical preparations taken from the 2021 UK Government SIC database was used. Waste and transport associated emissions for both options were calculated using emissions factors from BEIS (2024) and Rizan et al. (2021). GHG emissions associated with the raw materials of the CoolStick® were estimated using emissions factors for stainless steel. Emissions for one clinell wipe per patient was added to the emissions for the CoolStick® option as cleaning is a requirement after each patient use (Rizan et al., 2023).

Economic sustainability:

Initial one-off implementation costs were involved, whereby we purchased thirty CoolStick® devices at an initial outlay of £2,400. Spend, including the number of cans of ethyl chloride ordered for FY 2023-2024 was obtained from our pharmacy purchasing department.

Social sustainability:

Whilst there is a minimal increase in labour for the CoolStick®, requiring cleaning after use and returning to the fridge, there is a reduction in labour relating to ordering of ethyl chloride. We plan to gather qualitative feedback on user experience using simple feedback forms. We also anticipate wider benefits due to negating exposure of toxic ethyl chloride to aquatic life, birds and plants although we are not formally measuring this.

Results:

Patient outcomes:

The efficacy study completed at our trust prior to implementation found that there was complete agreement in perception of sensory block level in 81% of patients tested in obstetric and orthopaedic patients (Grassby et al., 2023). They concluded that the CoolStick® was non-inferior to ethyl chloride in assessing level of sensory block and therefore had no negative impact on patient anaesthetic experience (Grassby et al., 2023).

Environmental sustainability:

Table 3: Carbon Footprint of Ethyl Chloride vs CoolStick®

Ethyl Chloride (kgCO2e)	**CoolStick® (Including 1 cleansing wipe per patient) (kgCO2e)**	**Projected annual saving (kgCO2e)**
6321.15	80.24	**6240.91**

This data assumes a longevity of 10 years for the CoolStick®. Interestingly, the emissions associated with the CoolStick® were mainly attributed to the cleansing wipe necessary for use after each patient, which accounted for 78.17 kgCO2e of the total carbon footprint for the CoolStick®. Using the top down method to carbon footprint the ethyl chloride, due to its high cost and pharmaceutical preparation, the total carbon footprint of the ethyl chloride was mainly attributed to the product, with the transport and waste associated emissions accounting for only 10.58 kgCO2e.

The Centre for Sustainable Healthcare is registered as a company limited by guarantee in England & Wales No. 7450026 and as a charity No 1143189. Registered address 8 King Edward Street, Oxford OX1 4HL.

Economic sustainability:

Table 6: Financial Evaluation of Ethyl Chloride vs CoolStick®				
Cost/can Ethyl Chloride	**Annual Spend Based on 534 cans**	**CoolStick® Cost/unit**	**CoolStick® Spend**	**Annual Saving assuming 10 year lifespan**
£20.34	£10,861.56	£80	£2400	**£10,621.56**

The initial investment in the CoolStick® would be paid back within 3 months, or alternatively, assuming the sticks will last for 10 years as advised by the company, we can project an annual saving of £10,621.56.

Social sustainability:

Although not formally measured, ethyl chloride carries potential risk of frostbite and liver and kidney toxicity in humans, and acute toxicity to aquatic life, birds and plants (Young et al., 2023). Use of the coolstick mitigates this exposure, therefore offering wider health benefits to society and ecological systems. Qualitative feedback on user experience is still being collected at the time of writing.

Discussion:

Our aim for this project was to implement a 'green surgery' within the 2 orthopaedic theatres and to achieve this we wanted to implement as many carbon reducing initiatives as possible. The limited time frame of this project was one of our barriers to completing all our projects. It became evident that to enable change to happen in a complex environment like the operating theatres it can involve many stakeholders. It is important that these stakeholders are engaged early on in the project as some of the processes of engagement can be lengthy.

Patient and staff safety remains of paramount importance, and we must address the potential exposure to risk when implementing new processes. We have addressed issues and concerns around infection control and exposure to anaesthetic gases through developing processes to mitigate risk and seeking advice from specialist practitioners. Seeking approval from divisional governance has also helped us to consider any potential areas for harm so that we could mitigate these.

Going forward, we aim to ensure that these initiatives become embedded into daily practice, through review and audit of our processes. The aspects of our project that are yet to be implemented will be prioritised, and data collection ongoing to measure the impacts across the triple bottom line and improve sustainable value in our department.

Conclusions:

We aimed to look at a number of small changes to our arthroplasty theatres to generate significant impact on the sustainable value of our department. In reality, whilst some aspects of the project were simple and have been successful in achieving our aims, some required greater investment

The Centre for Sustainable Healthcare is registered as a company limited by guarantee in England & Wales No. 7450026 and as a charity No 1143189. Registered address 8 King Edward Street, Oxford OX1 4HL.

than we anticipated and considerable work to ventilation systems which needed more time than we had expected initially. The key elements that contributed to the success of our projects were developing good relationships with key stakeholders. This was essential when things were not going to plan and we needed advice on the next steps.

This project highlighted to us that even when problems or barriers occurred during the implementation stage or the results were not as expected there was still key learning and knowledge to gain. Not all projects will achieve the triple bottom line but the QI practice that is involved in the process of completing a project provides good learning and experience.

To ensure lasting change, we plan to continue to engage with our department, providing updates on projects at clinical governance and also present our findings at relevant events across the trust. We will also continue to seek opportunities to align with national recommendations as outlined in the green surgery report (2023) and work towards a net zero NHS.

References

- Department for Business, Energy & Industrial Strategy (2022). Greenhouse gas reporting: Conversion factors 2022. Retrieved from: Greenhouse gas reporting: conversion factors 2022 - GOV.UK (www.gov.uk)
- Grassby, O., De Beurs, J., Venkataraju, A. & Turner, D. (2023). Comparison of CoolStick®® with ethyl chloride efficacy on the assessment of sensory block level after spinal anaesthesia: A single centre service evaluation. *British Journal of Anaesthesia*, 132(*1*). P205-206.
- Green Surgery Report 2023, Green Surgery Report – UK Health Alliance on Climate Change
- Rizan, C., Lillywhite, R., Reed, M. & Bhutta, M.F. (2023). The carbon footprint of products used in five common surgical operations: identifying contributing products and processes. *Journal of the Royal Society of Medicine*. 116(*6)*. p.199-213. doi:10.1177/01410768231166135
- Young, R., Carter, C., Cardinali, S., Khan, Z., Bennett, K., Jarosz, A., Sobecki, J., Sharma, R. & Martin, R. (2023). Recognizing ethyl chloride neurotoxicity: inhalant abuse hidden in plain sight. *Cureus.* 15*(4)*. Published online April, 2023. DOI: 10.7759/cureus.37795.

The Centre for Sustainable Healthcare is registered as a company limited by guarantee in England & Wales No. 7450026 and as a charity No 1143189. Registered address 8 King Edward Street, Oxford OX1 4HL.