

# Introducing CoolSticks for anaesthesia; a human factors approach

Joseph Swani, Paul Southall, Frances Ives, Shakira Nathoo & Rachael Cresswell

Worcestershire Acute Hospitals NHS Trust

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## SUMMARY

Regional anaesthesia is commonly tested using ethyl chloride spray, but it is harmful to the environment. The CoolStick is a cost-effective alternative with a lower carbon footprint. This project used human factors methodology in the implementation of CoolSticks within a hospital, aiming to achieve a safe and effective transition and to reduce ethyl chloride use.

## KEYWORDS

CoolSticks, Anaesthesia, Healthcare

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## Introduction

When a patient has a regional anaesthetic (for example a spinal or epidural anaesthetic), the aim is to numb a body area, either for pain-relief or for surgery. To check if the anaesthetic is working, it is commonly tested whether the patient can feel cold and touch sensation on their skin. Ethyl chloride spray is a vapo-coolant presented in a disposable cannister, it normally feels cold when it is sprayed on the skin and is one of the most common methods used in the United Kingdom for testing regional anaesthesia. However, ethyl chloride is considerably harmful to the environment, animals and plants. The CoolStick is a cost-effective alternative with a lower carbon footprint and less waste. It consists of a stainless-steel body and a plastic handle, it's reusable and stored in the fridge. This project aimed to transition to using CoolSticks instead of ethyl chloride in a hospital's operating theatres. Given that this would be a significant change in practice, we used human factors methodology with the aim to achieve a safe and effective transition.

## Methodology

The project was initiated by one of the authors, who is a consultant anaesthetist with a specialist interest in sustainability in healthcare and an Environmental Advisor to the Royal College of Anaesthetists. Funding was applied for and granted from Greener National Health Service (Healthier Futures Fund). A working group was created which included an anaesthetic doctor training in human factors and a Chartered Human Factors Specialist experienced in using human factors to support innovation within healthcare. The group formulated a plan for how human factors would be used to support the implementation of CoolSticks.

## *Hierarchical Task Analysis (HTA)*

HTA was used to compare the tasks and sub-tasks involved when using a CoolStick versus using ethyl chloride. Using HTA allowed us to recognise the increased task complexity in gathering and putting away equipment when using a CoolStick in comparison to ethyl chloride. These can be seen below (Figure 1 and Figure 2).

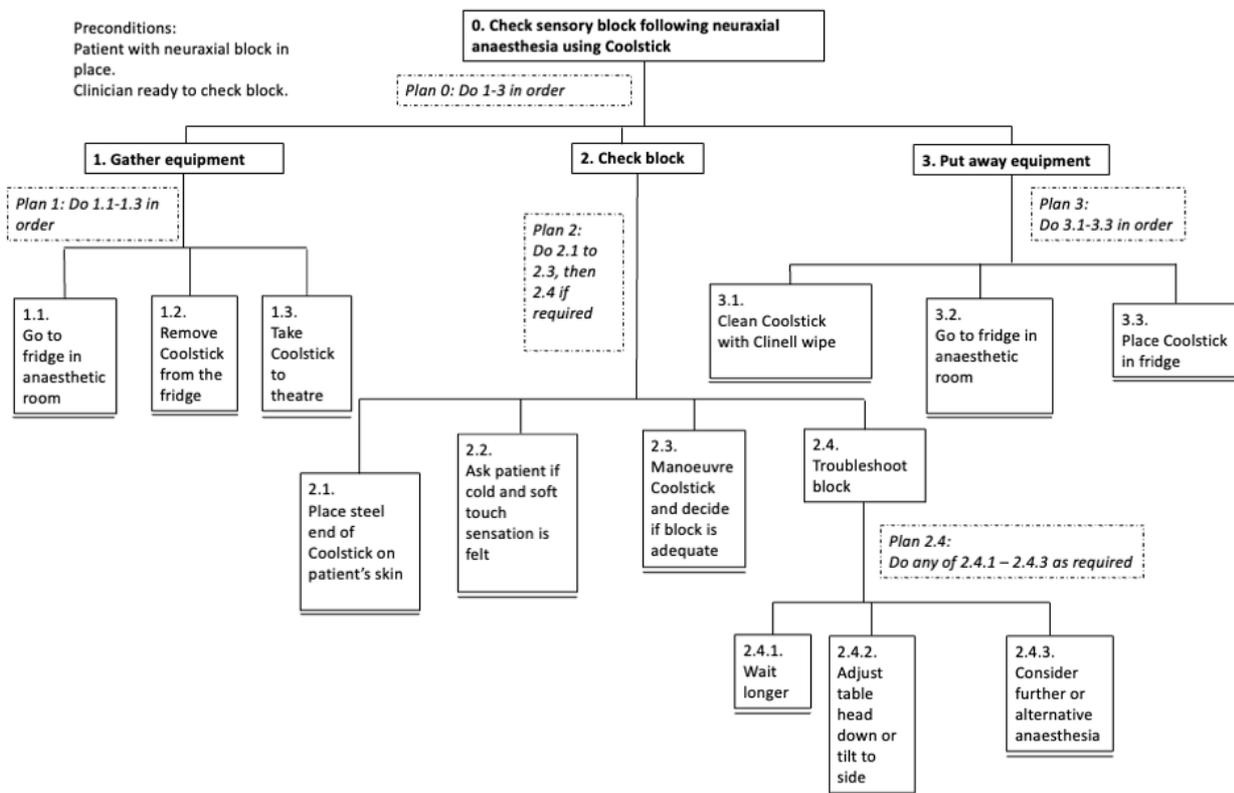


Figure 1: HTA using a CoolStick

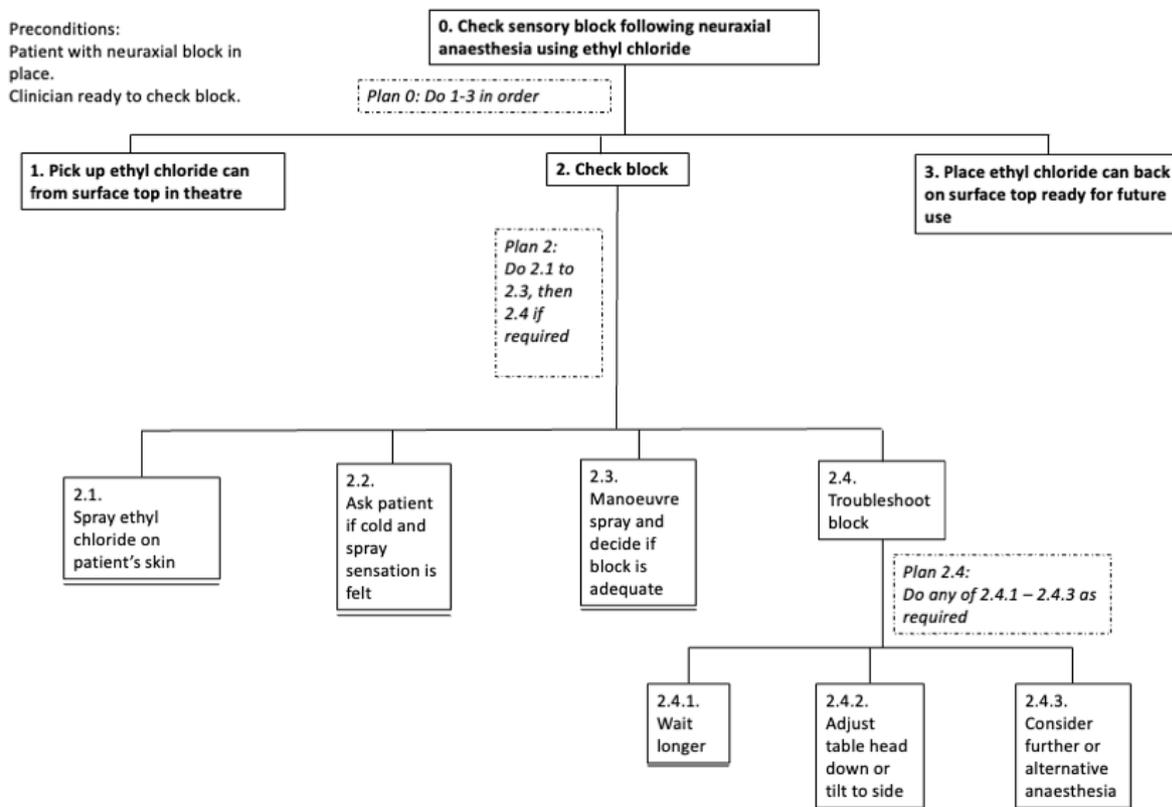


Figure 2: HTA using ethyl chloride spray

### **Failure Mode and Effects Analysis (FMEA)**

Using FMEA, the steps in the process (defined by the HTA) were analysed to predict where and how the implementation of CoolSticks may fail. Consequences were predicted to have the potential to include using ethyl chloride spray instead, contamination of equipment and incorrect analysis of adequacy of anaesthesia. Actions were advised to try and prevent such failures.

### **Staff Training Video**

A training video was created, demonstrating how to use the CoolStick. A video was used to allow staff to view the information easily and in a short space of time (<10 min length). It was shared using a quick-response (QR) code displayed on posters distributed throughout the anaesthetic department and theatres, in locations where CoolSticks are used. The video is continuously available so staff do not have to rely on memory and so new staff can view it without the need or reliance on training sessions. Screenshots from the video can be seen below (Figures 3, 4 and 5).



Figure 3: A CoolStick



Figure 4: Testing sensation using a CoolStick



Figure 5: Cleaning the CoolStick

### ***Observation of practice***

Following the introduction of CoolSticks into practice, time was spent in obstetric theatres to observe anaesthetic teams and their testing of regional anaesthesia. Where possible, observation was done without informing the team and without interruption to try and reduce observer influence on staff behaviour and minimise the gap between work-as-observed and work-as-done. Observations were done in the daytime and overnight including situations of emergency anaesthesia to try and capture all aspects of work. Findings provided valuable information on CoolStick and ethyl chloride use, including how staff may make adaptations to tasks. Ethyl chloride spray was found to often still be on the anaesthetic machine and sometimes used rather than a CoolStick. On occasion staff would even pick up the ethyl chloride spray through habit, then put it down (without using it) after remembering about CoolSticks. CoolSticks were most commonly removed from the fridge at the immediate time of need, but not placed back in the fridge immediately after use. Instead, after using the CoolStick it was more commonly placed on the surface of the anaesthetic machine rather than being put back in the fridge. The most common time to return the CoolStick to the fridge was at the end of the case, after the patient had left theatre. This adaptation is perhaps done to minimise the need to leave the theatre room to go to the anaesthetic room at an important time of anaesthesia, where there are multiple considerations for the patient. It allows anaesthetists to stay in the theatre room, the trade-off is that the CoolStick will remain out of the fridge for longer and become warmer. Additional observations included a variation in how the CoolStick was placed on patient skin for testing, mostly being placed in discrete areas but some would roll or slide the CoolStick along the skin in one motion.

### ***Staff interviews***

Anonymous discussions were conducted with involvement of multiple members of the multidisciplinary team including consultant anaesthetists, trainee anaesthetists and operating department practitioners. Information was gathered on perceived usability comparing CoolSticks to ethyl chloride spray. There were felt to be advantages and disadvantages to each, but overall those who had been using CoolSticks regularly found them to work well. As ethyl chloride spray has been used for many years, staff recognised that this change in equipment is not an easy transition (changing their routine and long-term practice) and this can affect their initial feelings about the new equipment. System challenges were explored including the importance of equipment location. It became clear that the location of ethyl chloride spray in the theatre room is a significant reason for some choosing to use it instead of CoolSticks, in fact the visibility of ethyl chloride spray in theatre can feel like a prompt to use it. Having to leave the theatre room and go to the anaesthetic room to get and put away CoolSticks is a barrier to its use. As not returning the CoolStick to the fridge for a prolonged period of time could mean it warms above the temperature required for cold sensation testing, having multiple CoolSticks is important so that they can be rotated from the fridge. When doing this, some use workarounds to ensure they do not re-select the previous CoolStick. These include not putting a CoolStick back in the fridge until a new one is taken out for the next case or returning a CoolStick to the bottom of the pile and selecting the next CoolStick from the top of the pile.

### ***Learning points***

Using human factors methodology in our project was tremendously beneficial by facilitating a focus on system evaluation and adaptation rather than individual staff training. What could be predicted as a simple introduction of basic equipment was found to be much more complex. Involvement of

staff in the process rather than forcing change upon them was very important for staff engagement. Observations and staff interviews allowed us to get closer to understanding work-as-done. The main recommendations from the project are focussed on the design of the environment, where having CoolSticks located in a fridge in the operating theatre rather than the anaesthetic room would mitigate a lot of the barriers to the gathering and putting away of the equipment, which are the aspects with more complexity in comparison to ethyl chloride. Additional recommendations included the availability and location of cleaning wipes, the storage location of ethyl chloride as an alternative and updates to the training video based on feedback. There has been a 75% reduction in ethyl chloride use in main theatres, which will have significant environmental benefit. In addition, there is financial benefit with a projected saving of around £13,000 per annum. There is ongoing work to try and improve CoolStick use in other areas of the hospital. The learning from this project is very relevant for other hospitals, as they are likely to implement CoolSticks in the future once the financial and environmental benefit is realised.