# Pre-warming patients to prevent hypothermia by Leanne McLeod, RVN, NCert Ana

**RCVS Knowledge Quality Improvement Award Champion 2023**

**Earlswood Veterinary Hospital, Independent Vetcare**

## Introduction

I am an RVN who has been working in practice for the last eleven years. I graduated six years ago, and have worked in various fields, from first opinion to University Hospitals. My current role is as a Theatre Nurse in a first opinion and referral clinic in Northern Ireland; part of the IVC Evidensia group of practices. In 2021, I completed a Certificate in Anaesthesia and Analgesia, which led to a greater appreciation of patient safety and Quality Improvement (QI).

As a whole, QI was rarely mentioned during my college experience. Only when I started my certificate did I realise how important it is and how I could use quality improvement techniques to improve outcomes for the patients we see in our hospital.

I was aware surgeons kept records of surgeries and complications but that this data was rarely shared with the rest of the team in a structured way. This is something I wanted to see change. I felt routine data collection and recording of areas for improvement could be implemented within my setting, with learning from QI activities being more routinely shared with the whole practice team.

## Aims of the clinical audit

After starting in this hospital, I quickly realised that many patients recovering from general anaesthesia were hypothermic and required an additional heat source during their recovery period. I had shared my initial concerns at clinical team meetings, but I lacked the data to support my concerns, so decided to focus on pre-warming canine and feline patients to prevent hypothermia during general anaesthesia for my audit.

The physical warming of dogs and cats before the induction of anaesthesia significantly reduces the incidence of intraoperative hypothermia and post-operative shivering[1]. This was reiterated by Brodbelt, 2007 during the Confidential Enquiry into Perioperative Small Animal Fatalities (CEPSAF)[2] study which found that most fatalities in cats and dogs occurred

during the post-operative period. Intraoperative hypothermia can result in a prolonged recovery, with increased susceptibility to hypoventilation and aspiration.

To quantify the incidence of hypothermia experienced by our patients, an initial round of data collection was carried out over a four-week period and all patients included were not pre-warmed before sedation.

## Actions

The initial step was to inform all clinical team members of the intended data collection to establish a baseline; this was distributed via email. Each morning during the audit period we had a small theatre team meeting to plan the day and at this point, I encouraged the team to collect the data. The importance of the data collection was further reiterated by my Head Nurse, who supported my project and helped to encourage engagement from the rest of the team.

A data collection form was created and displayed on the main surgical whiteboard. Clinical teams were requested to complete a form after every general anaesthetic procedure they performed.

The form required the following information:

- Patient name
- Species
- Breed
- Age
- Purpose for general anaesthesia
- Pre-sedation temperature
- Temperature one hour into the general anaesthesia
- Post-operative temperature

I had never carried out a clinical audit before, so I referred to the RCVS Knowledge website for direction. I used the audit checklist for initial guidance and used the RCVS Knowledge

Clinical Audit template as I felt this was a good place to start. This provided me with an insight into what an audit requires.

Once the data had been collected, I presented our findings at a team meeting, and they were openly discussed by all team members. We were concerned by the results of our baseline data and concluded that this area of patient care should be audited. I volunteered to carry out the next round of the clinical audit to measure any improvement following the implementation of the changes we agreed on and planned to present my findings at the next team meeting.

## Results

To establish the baseline, 42 patients were included in the first audit: 36 dogs and 6 cats. No exotic species were involved in the audit.

The number of patients that developed post-operative hypothermia was calculated as a percentage of the total number of general anaesthetics carried out during the data collection period.

These results demonstrated (Annex 1):

- A 100% hypothermia rate in post-operative recovery.
- No temperatures were recorded in the normothermic range. (38.3°c – 39.2°c in dogs and 38.2°c – 38.6°c in cats)[3]

## Interventions

As a team, we decided and agreed on the changes to be made to our protocol for warming patients pre-operatively:

- All patients receiving sedation should be placed in a kennel lined with a 'VetBed®'
- Once the sedation is administered an electric pet-safe heat mat is turned on under the bed.
- A soft fleece blanket to be placed over the patient.
- Temperature monitored every ten minutes by the ward nursing team and acted upon if there is any reduction in temperature.

## Results of the re-audit

The second audit included 42 patients, 38 dogs and 4 cats. Again, no exotic species were involved in the audit to maintain consistency.

These results demonstrated a marked improvement (Annex 2):

16.6% of patients experienced post-operative hypothermia.

By simply introducing pre-operative warming interventions the outcomes had changed drastically, resulting in just seven of the 42 patients included in the audit suffering from hypothermia. A reduction of 83.4%!

## Impact of intervention

When I first discussed with the team about obtaining data to use as supportive evidence to ensure we could improve patient care, all of the nursing team was very supportive. Many of the veterinary surgeons were not aware of the issues we had in this area. However, once the issue was discussed further, they too were all very supportive. My main champion within the team was our hospital's Head Nurse. She is always striving to do the best for our patients and to improve their care whilst hospitalised. She was the main person who helped drive data collection and engagement with the audit on days that I was absent.

The whole team is now looking for further opportunities to develop more QI activities and gain confidence in this area. We are all aware of how to make changes and understand the support and guidance provided to us throughout the whole process.

## Summary

Clinical audit is a process for monitoring standards of clinical care to see if it is being carried out in the best way possible, known as best practice.

A clinical audit can be described as a systematic cycle. It involves measuring care against specific criteria, taking action to improve it, if necessary, and monitoring the process to sustain improvement. As the process continues, an even higher level of quality is achieved.

### What the clinical audit process is used for

A clinical audit is a measurement process, a starting point for implementing change. It is not a one-off task, but one that is repeated regularly to ensure ongoing engagement and a high standard of care.

It is used:

- ⇒ To check that clinical care meets defined quality standards.
- ⇒ To monitor the changes made to ensure that they are bringing about improvements and to address any shortfalls.

A clinical audit ensures concordance with specific clinical standards and best practices, driving improvements in clinical care. It is the core activity in the implementation of quality improvement.

A clinical audit may be needed because other processes point to areas of concern that require more detailed investigation. A clinical audit facilitates a detailed collection of data for a robust and repeatable recollection of data at a later stage. This is indicated on the diagram wherein in the 2nd process we can see steps 4, 5 and 6 repeated. The next page will take you through the steps the practice took to put this into practice.

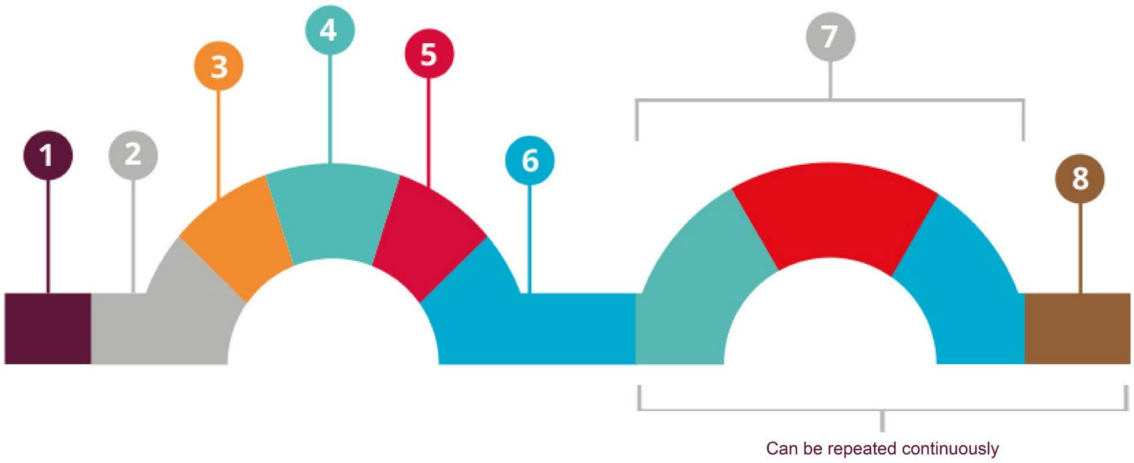


*Figure 1: The Veterinary Clinical Audit Cycle by RCVS Knowledge. Available from www.rcvsknowledge.org. Developed by the Royal College of General Practitioners www.rcgp.org.uk/qi-ready*

1. Choose a topic relevant to your practice

   **The topic should be amenable to measurement, commonly encountered and with room for improvement.** Baseline data and team discussions identified a high incidence of post-operative hypothermia experienced by canine and feline patients.

2. Selection of criteria

   **Criteria should be easily understood and measured.** All canine and feline patients undergoing general anaesthetic procedures to have their temperatures monitored post-sedation, peri-operatively, and post-operatively.

3. Set a target

   **Targets should be set using available evidence and agreeing best practices. The first audit will often be an information-gathering exercise, however, targets should be discussed and set.** The majority of patients to have temperatures in the normothermic range post-operatively.

4. Collect data

**Identify who needs to collect what data, in what form and how.** The data collection was carried out by all team members over a 4-week period and the number of patients that developed post-operative hypothermia was calculated as a percentage of the total number of general anaesthetics carried out.

5. Analyse

**Was the standard met? Compare the data with the agreed target and/or benchmarked data if it is available. Note any reasons why targets were not met. These may be varying reasons and can take the discussion from the entire team to identify.** The initial audit showed 100% of patients experienced post-operative hypothermia, with no animals having recorded temperatures within normal parameters.

6. Implement change

**What change or intervention will assist in the target being met? Develop an action plan: what has to be done, how and when? Set a time to re-audit.** The team discussed, agreed on, and implemented changes to practice protocols for providing patient warming interventions post-sedation.

7. Re-audit

**Repeat steps 4 and 5 to see if changes in step 6 made a difference. If no beneficial change has been observed them implement a new change and repeat the cycle. This cycle can be repeated continuously if needed. Even if the target is not met, the result can be compared with the previous results to see if there is an improvement.** A repeat audit showed improved rates of hypothermia, with 16.6% (7/42) of patients experiencing post-operative hypothermia.

8. Review and reflect

**Share your findings and compare your data with other relevant results. This can help to improve compliance.** The findings from the complete audit cycle were fed back to the team and discussed at team meetings. The team are now looking to identify further areas for improvement.

## References


1. Mosing, M. et al. (2013) Oxygenation and ventilation characteristics in obese sedated dogs before and after weight loss: a clinical trial. *The Veterinary Journal*, 198 (2), pp. 367-371. https://doi.org/10.1016/j.tvjl.2013.08.008

2. Brodbelt, D.C. et al. (2007) Risk factors for anaesthetic related deaths in cats: results from the confidential enquiry into perioperative small animal fatalities (CEPSAF). *British Journal of Anaesthesia*, 99 (5), pp. 617-623. https://doi.org/10.1093/bja/aem229

3. Goddard, L. and Phillips, C. (2011) Observation and assessment of the patient. In: Cooper, B., Mullineaux, E. and Turner, L. (eds) *BSAVA textbook of veterinary nursing*. Fifth ed. Quedgeley: BSAVA. pp. 376 - 377.

You should reference this resource like this: RCVS Knowledge,. McLeod, L, (2023).*Pre-warming patients to prevent hypothermia*. [Online] Available at www.rcvsknowledge.org/pre-warming-patients/

Interested in submitting your own case example? Email us at ebvm@rcvsknowledge.org.

## Annex 1: Patient Details and Data Collected Pre-Intervention

| Species - Breed | Age | Reason for general anaesthetic | Pre-sedation temp in °c | Temp 1 hour into surgery in °c | Post-operative temperature in °c |
|---|---|---|---|---|---|
| Canine | 5 years | Cholecystectomy | 38.2 | 37.9 | 37.6 |
| Canine | 4 years | TPLO | 38.2 | 37.4 | 36.2 |
| Canine | 10 years | Fracture Repair | 37.3 | 36.9 | 37.1 |
| Canine | 8 years | Ventral Slot Surgery | 38.9 | 35.6 | 35.0 |
| Feline | 7 years | Fracture Repair | 38.3 | 36.4 | 36.2 |
| Canine | 3 years | Fractured Pelvis Repair | 38.1 | 35.9 | 36.5 |
| Canine | 3 years | TPLO Surgery | 39.1 | 36.6 | 36.5 |
| Canine | 6 years | Fractured Jaw Repair | 37.8 | 36.3 | 36.6 |
| Canine | 4 years | TPLO Surgery | 37.2 | 34.8 | 35.1 |
| Canine | 2 years | Pancarpal Arthrodesis | 37.9 | 35.5 | 36.2 |
| Canine | 11 years | Bone Biopsy | 39.3 | 37.2 | 36.4 |
| Canine | 5 years | Fracture Humerus Repair | 37.7 | 36.7 | 37.0 |
| Canine | 9 years | Hemilaminectomy | 38.7 | 37.1 | 37.0 |
| Canine | 5 years | TPLO Surgery | 38.4 | 37.9 | 37.4 |
| Canine | 3 years | Fracture Radius and Ulna Repair | 38.6 | 36.4 | 36.3 |
| Canine | 2 years | Bilateral Elbow Arthroscopy | 38.1 | 37.4 | 37.3 |
| Feline | 1 year | Fractured Pelvis Repair | 38.2 | 37.0 | 36.4 |
| Canine | 6 years | TPLO Surgery | 38.3 | 37.0 | 36.1 |
| Feline | 11 years | Dental with extractions | 38.1 | 37.3 | 36.3 |
| Canine | 2 years | Fractured Elbow Repair | 37.6 | 36.0 | 35.3 |
| Feline | 1 year | Nail Removal | 38.3 | Surgery took less than one hour | 36.7 |
| Feline | 13 years | Dental | 38.6 | 36.1 | 35.2 |

| | | | | | |
|---|---|---|---|---|---|
| Canine | 9 years | Fractured Femur Repair | 38.9 | 36.9 | 37.1 |
| Canine | 3 years | TPLO Surgery | 38.2 | 37.0 | 36.3 |
| Canine | 6 years | Wound Closure | 37.9 | Surgery took less than one hour | 37.1 |
| Canine | 7 years | Implant Removal | 38.4 | 36.4 | 36.9 |
| Canine | 12 years | Mammary Strip Surgery | 38.6 | 37.6 | 35.2 |
| Canine | 11 years | Ear Flush | 38.1 | 36.2 | 36.9 |
| Canine | 7 years | Imaging - CT | 38.0 | Imaging took less than one hour | 37.2 |
| Canine | 8 years | Ventral Slot Surgery | 38.6 | 34.9 | 35.0 |
| Canine | 11 years | Urethral Repair Surgery | 37.9 | 35.8 | 36.1 |
| Canine | 14 years | Membrane Flap Surgery –Eye Ulcer | 38.1 | 38.0 | 37.3 |
| Canine | 10 years | Bilateral Phacoemulsification Surgery | 38.4 | 36.0 | 36.3 |
| Canine | 8 years | Hemilaminectomy | 38.4 | 36.3 | 35.9 |
| Canine | 9 months | Placement of a Central Line | 38.9 | 37.2 | 37.0 |
| Canine | 6 years | Hemilaminectomy | 39.1 | 38.3 | 37.2 |
| Canine | 12 years | Dental with extractions | 37.8 | 36.9 | 35.2 |
| Canine | 3 years | Imaging - CT | 38.0 | Imaging took less than one hour | 37.2 |
| Canine | 13 years | Bronchial Scope | 38.6 | 37.5 | 36.3 |
| Canine | 3 years | Patella correction Surgery | 38.7 | 37.3 | 36.6 |
| Canine | 15 years | Imaging - CT | 38.1 | Imaging took less than one hour | 37.0 |
| Canine | 6 years | Membrane Flap – Eye ulcer | 37.8 | 37.0 | 36.6 |

## Annex 2: Patient Details and Data Collected Post-Intervention

| Species - Breed | Age | Reason for general anaesthetic | Pre-sedation temp in °c | Temp 1 hour into surgery in °c | Post-operative temp in °c |
|---|---|---|---|---|---|
| Canine | 9 years | Fracture repair | 38.6 | 38.2 | 38.5 |
| Canine | 14 years | Bone Biopsy | 38.2 | 38 | 38.3 |
| Canine | 2 years | Imaging - CT | 38.9 | 39 | 38.4 |
| Canine | 6 years | Ventral Slot Surgery | 38.7 | 37.8 | 38.3 |
| Canine | 9 years | Hemilaminectomy | 39 | 38.6 | 37.2 |
| Canine | 3 years | Central Line placement | 38.3 | 37.9 | 38.4 |
| Canine | 3 years | Wound Closure | 38.9 | 39.0 | 38.7 |
| Canine | 5 years | Fractured Jaw Repair | 38.2 | 38.3 | 38.3 |
| Canine | 4 years | TPLO Surgery | 38.2 | 38.4 | 38.5 |
| Canine | 2 years | Fractured Humerus repair | 38.9 | 38.4 | 38.0 |
| Canine | 3 years | TPLO Surgery | 38.6 | 38.0 | 38.3 |
| Canine | 5 years | Splenectomy | 39.0 | 39.2 | 38.7 |
| Canine | 8 years | Ventral Slot Surgery | 38.7 | 39.2 | 38.9 |
| Canine | 5 years | Bilateral Phacoemulsification Surgery | 38.7 | 38.6 | 38.4 |
| Canine | 2 years | Hemilaminectomy | 38.6 | 38.3 | 38.2 |
| Canine | 4 years | TPLO Surgery | 38.1 | 38.3 | 38.4 |
| Canine | 1 year | Hemilaminectomy | 38.3 | 38.6 | 36.5 |
| Canine | 6 years | TPLO Surgery | 38.9 | 38.6 | 38.6 |
| Canine | 8 years | Imaging -CT | 38.2 | 38.7 | 38.6 |
| Canine | 7 years | Fractured Elbow Repair | 38.0 | 38.3 | 38.4 |
| Canine | 11 years | Feeding Tube Placement | 38.3 | 38.5 | 38.3 |
| Canine | 8 years | Stitch up | 38.6 | Surgery took less than one hour | 39.0 |
| Canine | 9 years | Fractured Femur Repair | 38.0 | 37.6 | 37.3 |
| Canine | 4 years | TPLO Surgery | 38.3 | 38.0 | 38.3 |
| Canine | 6 years | Ventral Slot Surgery | 38.8 | 38.9 | 38.6 |

| | | | | | |
|---|---|---|---|---|---|
| Canine | 7 years | Implant Removal | 38.4 | 38.4 | 38.6 |
| Canine | 12 years | Mammary Strip Surgery | 38.7 | 38.6 | 38.2 |
| Canine | 11 years | Ear Flush | 38.4 | 38.2 | 38.3 |
| Canine | 7 years | Imaging - CT | 38.9 | Imaging took less than one hour | 38.5 |
| Canine | 8 years | Ventral Slot Surgery | 38.6 | 38.9 | 39.0 |
| Canine | 11 years old | Urethral Repair Surgery | 38.9 | 38.8 | 39.1 |
| Canine | 14 years | Membrane Flap Surgery –Eye Ulcer | 39.1 | 39.0 | 38.7 |
| Feline | 10 years | Feeding Tube Placement | 38.4 | 37.8 | 37.3 |
| Canine | 8 years | Hemilaminectomy | 38.4 | 38.3 | 38.3 |
| Feline | 8 months | Placement of a Central Line | 38.9 | 38.2 | 38.3 |
| Canine | 8 years | Hemilaminectomy | 39.1 | 38.9 | 38.7 |
| Canine | 12 years | Dental with extractions | 38.8 | 38.9 | 38.2 |
| Canine | 4 years | Imaging - CT | 38.0 | 38.3 | 38.4 |
| Canine | 10 years | Imaging - CT | 38.6 | Imaging took less than one hour | 38.6 |
| Canine | 6 years | Patella correction Surgery | 38.1 | 37.9 | 37.6 |
| Feline | 10 years | Imaging - CT | 38.3 | Imaging took less than one hour | 38.2 |
| Feline | 8 years | Fractured Pelvis | 38.5 | 38.1 | 38.6 |