Perioperative Normothermia Initiative Summary

Statement of the issue:
- Normothermia (defined as ≥36°C) in the OR is an important factor to preventing complications in patients (MI, infection, coagulopathy).
- The World Health Organization sets a standard to maintain patient core temperature greater than 36°C throughout the perioperative period.
- Randomized studies suggest that maintaining at higher temperatures may further reduce complications (complications in abdominal surgery were less for group at 36.4°C than the control group at 36.0°C\(^{1-5}\)).

Purpose:
To utilize Vanderbilt University Medical Center’s access to perioperative temperature measurements through the VPIMS reporting system to achieve normothermia outcomes well above national standards. Current data suggests great opportunity for improvement.

Goal:
- **Reduce the % of patients with temperature less than or equal to 36°C to:**
  - Less than 10% for **first OR temp** (ie greater than 90% of patients above 36°C)
  - Less than 10% for **post-op temp** (ie greater than 90% of patients above 36°C)
  - Less than 20% for **lowest intraop temp** (ie greater than 89% patients above 36°C)

Measures of perioperative normothermia performance:

SCIP Measures:
Based on the original randomized study examining normothermia and infections in colorectal patients, SCIP incorporated temperature into its performance measure. The original measure, “Colorectal Surgery Patients with Immediate Postoperative Normothermia,” required documentation of a temperature greater than or equal to 36 C within 15 minutes after leaving the operating room, and it only applied to patients having colorectal surgery.

In October 2009, the measure was changed to “Surgery Patients with Perioperative Temperature Management.” It applies to all patients in all SCIP procedures, though patients with intentional hypothermia (e.g. cardiopulmonary bypass) are excluded. The requirement is for active warming intraoperatively, or a documented temperature greater than or equal to 36 C within 30 minutes prior to or 15 minutes after Anesthesia End Time—which gives us a larger window to meet the metric.

The original compliance measure requires a temperature endpoint. The newer version only requires the use of warming devices and compliance with this rather less stringent measure is easier to attain. Some VUMC performance reflecting the two measures is provided below. **Note:** compliance with the original patient temperature based parameter was much lower than compliance with process parameter currently used.

### Representative VUMC SCIP Performance on Temperature management:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Type</th>
<th>Aggregated</th>
<th>Q3-08</th>
<th>Q4-08</th>
<th>Q3-09</th>
<th>Q4-09</th>
<th>Q1-10</th>
<th>Apr-10</th>
<th>May-10</th>
<th>Q2-10</th>
<th>FY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIP-Inf-7</td>
<td>Normothermia</td>
<td>63.20%</td>
<td>71.40%</td>
<td>43.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43.8%</td>
</tr>
<tr>
<td>SCIP-Inf-10</td>
<td>Perioperative Temperature Management</td>
<td>99.4%</td>
<td>99.4%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>99.6%</td>
<td></td>
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</tr>
</tbody>
</table>
Normothermia compliance based upon VPIMS data:
Current literature suggests that maintaining core temperature above the SCIP standards can reduce perioperative complications. The VUMC VPIMS system provides access to information that allows our perioperative services to achieve performance measures well beyond those currently measured by SCIP. Some temperature data for 4 separate services is provided below. Note that a large proportion of patients develop core temperatures below desired levels during the perioperative period for the services reported.

**Historical data of four services and the percentage of patients with temperature <36°C**

![Minimum Temperature Hypothermia by Service](image)

Percentage of patients whose **lowest perioperative** temperature is below 36°C.

![Post-operative Hypothermia by Service](image)

Percentage of patients whose **post-operative** temperature is below 36°C.
Perioperative Normothermia Initiative Summary

Action Plan:
To improve the perioperative maintenance of normothermia, the SSIPC has begun a multi-phase process including

1) Review and updating of the VUMC Normothermia Policy
2) Enhancements to ambient room temperature measurement and recording
3) Enhanced availability of appropriate warming devices
   a. Trials of additional devices underway and data analysis pending
4) Standardization of warming processes for patients
5) Pursuing creation of reporting process for temperature compliance data to PODs
6) Educational models and visual aids for nursing, anesthesia, and surgical staff/faculty
   a. Single page visual aid (see attachment in the following addendum)
   b. Power point presentation presented to perioperative nursing (see attachment in the following addendum)
   c. On-line educational modules for
      • pre and post-op nursing
      • intra-op nursing
      • surgeons and anesthesia providers
      (these documents are viewable as PDFs on SSIPC website)

The educational power point and visual aid are attached as an addendum to this summary. More detailed information and documentation of individual components is available upon request or by accessing the SSIPC website (http://www.mc.vanderbilt.edu/root/vumc.php?site=ssip).

REFERENCES
Perioperative Normothermia Initiative

Background and Problem Statement:
- Normothermia (defined as >36°C) in the OR is an important factor to preventing complications in patients (MI, infection, coagulopathy).
- The World Health Organization sets a standard to maintain patient core temperature greater than 36°C throughout the perioperative period.
- Randomized studies suggest that maintaining at higher temperatures may further reduce complications (complications in abdominal surgery were less for group at 36.4°C than the control group at 36.0°C).
- Currently, perioperative hypothermia may occur in as many as 50-80% of patients undergoing procedures by VUMC adult surgical services.

Aim: What are we trying to accomplish?
To achieve normothermia (>36°C) throughout perioperative period for 90% of surgical patients at VUMC
- Exclusions: patients whose procedure specifically requires a lower body temperature

Measures of Success: How will we know that a change achieves improvement?
Reduce the % of patients with temperature less than 36°C to:
- Less than 10% for first OR temp (i.e. greater than 90% of patients 36°C & above)
- Less than 10% for post-op temp (i.e. greater than 90% of patients 36°C & above)
- Less than 20% for lowest intra-op temp (i.e. greater than 80% patients 36°C & above)

Action Plan: What practices can we do that will result in an improvement?

Pre-operative: Holding room
- Measure patient’s temperature on admission
- Utilize Bear Paws:
  - All elective cases should have Bear Paws placed on the patient in holding room and forced warm air turned on to maintain temperature greater than 36.5°C at all times

Process – Intra and Post - operative:
- Ambient room temperature:
  - For non-trauma cases: Room temperature should be set to 24°C (upper end of current policy 20°C to 24°C) or 75°F.
  - Record room temperature in VPIMS
  - Room temperature may be adjusted following prepping and draping of the patient as the patients core temperature allows (if core temp > 36.5°C)
- Peri-induction and intra-operative management:
  - Bear Paws (if elective) or Bear Hugger should be applied and forced air turned to 40°C prior to induction and patient prep
  - Upper and lower forced air warming devices should be applied as allowed by the case and air temperature set to 40°C prior to prepping the patient as possible.
  - Intraoperative fluids and irrigation should be warmed to 37°C as possible.
- Post-operative management:
  - Patients should be immediately covered with either warm blankets or a forced air device depending on the core temperature at the end of the case.

More detailed information and references can be found @ the Surgical Site Infection Prevention Collaborative website: [http://www.mc.vanderbilt.edu/root/vumc.php?site=SSIP&doc=18946](http://www.mc.vanderbilt.edu/root/vumc.php?site=SSIP&doc=18946)
WARMING-UP TO NORMOTHERMIA

A Presentation from VUMC Perioperative Services
Kathleen C. Kelley, MSN, ARNP, BC
August 20, 2010

Course Objectives

- To know the definition of Normothermia
- To know the VUMC Perioperative Goals for Surgical Patients
- To become familiar with Normothermia terminology
- To identify Dangers of Hypothermia
- To be able to identify common risk factors & causes of hypothermia
- To identify Perioperative Expectations
- To change practice- “Make Warm the Norm”

What is Normothermia?

A core temperature range of
36° C to 38° C
(98.6° F–100.4° F)

Medical Center Perioperative Goals

For Surgical Patients:
To provide the patient with a consistent approach for Normothermia while in the Perioperative setting unless the procedure necessitates a hypothermic environment

Target Patient Temperature:
90% patients with first and post-op temp > 36° C
80% patients with minimum temp > 36° C

Intra-op Room Temperature Goals:
OR Temperature = 24° C (75° F)
Level 1 Trauma = 29.5° C (85° F)

Terminology

Core Temperature: The thermal compartment of the body composed of highly perfused tissues where the temperature is uniform and high compared to the rest of the body

Ambient Temperature: simply means “the temperature of the surroundings”

Hypothermia: core temperature less than 36° C anytime during the Perioperative period
Physiological effects of Mild Hypothermia

Patient Temperature is 32–35 °C or 90–95 °F

- Shivering
- Hypertension
- Tachycardia
- Vasodilation

Cold diuresis
Mental confusion
Hyperglycemia
Hepatic Dysfunction
Piloerection (goose bumps)

Risks Factors for Hypothermia

- Extreme in patient ages
- Female sex, and physical status
- Ambient room temperatures
- Length and type of surgical procedure
- Amount of body fat (Cachexia-physical tissue wasting with loss of weight and muscle mass)
- Pre-existing conditions - peripheral vascular disease, endocrine disease, pregnancy, burns, open wounds, etc.
- Significant fluid shifts/use of cold irrigates
- Use of general and regional anesthesia

WHAT ARE THE PHYSIOLOGICAL OUTCOMES OF HYPOTHERMIA?

Increased Infection

- Increased susceptibility to infections:
  - Decreased perfusion, altered phagocytic function and decreased antibiotic penetration
  - Decreased cutaneous blood flow
  - Directly impaired immune function (neutrophils less effective)
  - Protein wasting and decreased collagen synthesis

Increased Blood Loss

- Increased blood loss secondary to:
  - Temperature-induced coagulopathy (bleeding or clotting disorders)
  - Altered and reduced platelet function
  - Decreased activation of coagulation cascade
  - Increased need for transfusion of red blood cells, platelets, and plasma

Increased Infection

- Increased susceptibility to infections:
  - Decreased perfusion, altered phagocytic function and decreased antibiotic penetration
  - Decreased cutaneous blood flow
  - Directly impaired immune function (neutrophils less effective)
  - Protein wasting and decreased collagen synthesis

Research suggests that patients who are hypothermic during the Perioperative phase of their care have an increased risk of developing the following:

- Surgical site infections
- Adverse cardiac events
- Discomfort
- Longer length of stay in the hospital
- More prone to bleeding during surgery

In randomized studies, efforts to maintain Normothermia:

- Reduced infectious complications by 50%
- Reduced ileus, Hospital LOS for infected and uninfected patients
- Reduced cardiac morbidity
- Reduced blood loss

Bibliography: Barie PS Surgical Site Infections: Epidemiology and Prevention. Journal of Anesthesiology. Vol 3, Suppl 2002;S9-S21
Barie, PS Surgical Site Infections: Epidemiology and Prevention. Journal of Anesthesiology. Vol 3, Suppl 2002;S9-S21
Other Potential Complications

- Increased risk for adverse cardiac events (increases cardiac morbidity; vasoconstriction, shivering, cardiac dysrhythmias)
- Increased oxygen consumption due to shivering (400% to 500%)
- Increased energy requirements related to the increase in oxygen consumption
- Increased need for postoperative mechanical ventilation
- Medication metabolism is reduced while duration of action is longer

Hypothermia in the Holding Room

In the Pre-op/Holding Room, reasons for patient being hypothermia may be due to
Nurse/Patient perception
Nurses may assume that a patient knows if he or she is cold thru interview. The patient may not always be aware that they are hypothermic.
Or, the Patient may be unable to communicate (example-trauma pt)

This is an educational opportunity for nurse to inform the patient of the benefits of Normothermia.

Perioperative Expectations

It is not uncommon for patients to be hypothermic upon arrival to the Holding Room or Post Anesthesia Care Unit (PACU) unless hypothermia is indicated (i.e. CABG).

Unless hypothermia is indicated, the goal for the Perioperative patient is to maintain

**NORMOTHERMIA!**

Measure patient core temperature – if < 36.6, turn on forced air warming via BAIR PADS. If greater, can d/c forced air warming.

Increase Ambient Room Temperature

Recommended AORN Practice Guidelines 20° - 24° C or 68° - 75° F.

Pre-Operative Management

- Measure patient’s temperature on admission (Tympanic is the preferred method)
- All elective cases should have Bair Paws placed on the patient in holding room and forced warm air turned on to maintain temperature greater than 36.5°C at all times
- Identify patient risk factors for hypothermia (age, weight, overall health etc)
- Determine the patient’s thermal comfort level
- Observe for symptoms of hypothermia (shivering, plexus discoloration/goose bumps) and/or cold extremities

Temperature Regulating Device Safety

**Device Safety for HR/PACU**

Plastic surfaces should not come in contact with patient’s skin. Unless temperature regulating blankets are designed to be placed next to patient’s skin a thin cloth covering should be placed between the device and the patient to protect the skin.

Any heat regulating device should be used according to manufacturer’s recommendations. Skin integrity should be inspected before, periodically during (when possible), and after using devices such as ice packs and temperature regulating blankets.

- Apply warm blankets per policy
- Adjust room temperature
- Monitor patient temperature to avoid overheating
- Use heat maintaining devices (e.g., hats, blankets, socks)
- Administer warmed irrigation or infusion solutions
- Administer humidified oxygen and/or anesthetics gases
- Fluids should be heated or cooled in devices intended for that purpose
- Microwaves and autoclaves should not be used as warming devices

The Celsius/Fahrenheit Conversion Calculator can be found in the electronic VPIMS charting (Pre-op, Intra-op and Post-op)
Intra Operative Causes Hypothermia

• In the Intra-Operative/OR areas, hypothermia may be due to:
  • Low ambient temperature in the operating room
  • Administration of un-warmed IV fluids
  • Decreased metabolic rate during surgery
  • Medication-induced vasodilation
  • Exposure of body cavities to room-temperature air
  • Loss of heat from lungs when un-warmed
  • Inhaled gases are used
  • Use of general anesthesia

Intra-Op Management

1. Room temperature to be recorded in VPIMS. Recommended ambient room temperature: 20° - 24° C or 68° - 75° F
2. Anesthesia records during case and * 30 minutes prior to or 15 minutes after anesthesia end time* in Gas Chart.
3. Room temperature may be adjusted during case as long as the patient core temp > 36.5 °C
4. Peri-induction and intra-operative management: Bear Paws (if elective) / Bear Hugger applied, forced air @ 40° C prior to induction & prep
5. Upper & lower forced air warming devices should be applied as allowed by the case
6. Intra-operative fluids and irrigation should be warmed to 37° C per fluid warmer
7. Should cover the lower body with Bear Hugger prior to prep to avoid air turbulence over the prep
8. Drape patient prior to turning on the upper body warmer to prevent air turbulence
9. Forced air devices should be utilized during induction of general anesthesia, held for prep of patient, but reinstituted as soon as draping is completed
10. Patient exposure should be minimized as much as possible during and after induction

Temperature Regulating Device Safety

Device Safety for Intra-OP

Plastic surfaces should not come in contact with patient’s skin.

Unless temperature regulating blankets are designed to be placed next to patient’s skin, a thin cloth covering should be placed between the device and the patient to protect the skin.

Any heat regulating device should be used according to manufacturer’s recommendations. Skin integrity should be inspected before, periodically during, and after using devices such as ice packs and temperature-regulating blankets.

• Apply warm blankets per policy
• Limit amount of skin surface exposed during positioning and skin preparation
• Limit amount of time between skin preparation and draping
• Prevent surgical drapes from becoming wet
• Adjust room temperature
• Monitor patient temperature to avoid overheating
• Use heat-maintaining devices (e.g., hats, blankets, socks)
• Administer warmed irrigation or infusion solutions
• Administer humidified oxygen and/or anesthetic gases
• Fluids should be heated or cooled in devices intended for that purpose
• Microwaves and autoclaves should not be used as warming devices.

Post-Operative Management

In the PACU, Hypothermia may be due to the failure to recognize warming device is not connected or the inadvertent removal of the warming device during transfer from the OR bed to the stretcher.

• Patients are immediately covered with either warm blankets and/or forced air device depending on patient core temperature
• Initial patient temperature is taken on ALL PACU patients
• Nurses are to contact Anesthesia Provider or Attending Physician
  • If patient core temperature is < 36° C
• Increase ambient room temperature (minimum: 26° C or 75° F)
• Warm fluids: Intravenous
• Humidify and warm gases on ventilator patient (38° C - 40° C)
• Assess temperature and patient’s thermal comfort level every 30 minutes until Normothermia is reached
• Measure and record temperatures thru out PACU care and prior to discharge
Intra Operative Recommendations for Providers

Intra-operative, ambient room temperature for Non-trauma cases should be set at 24° C (75° F)
Level 1 Trauma 25.5° C (78° F)

Anesthesia records temperatures during case and "30 minutes prior to or 15 minutes after anesthesia end time" in Gas Chart-vitals grid as shown below

The second temperature is charted under the Emergence Tab in the PACU Vital Sign section.

Where We Stand with Hypothermia?

The graph demonstrates the percentage of patients' temperatures < 36° C by Service

The Bottom-Line on Normothermia

Patient exposure should be minimized as much as possible during and after induction. Forced air vents should be utilized during induction of general anesthesia, held for prep, but reinitiated as soon as draping is completed

Normothermia:
- Reduces the negative effects experienced by the patient
- Optimizes wound healing and recovery times
- Prevents extended hospitalization, thereby reducing cost of care and increasing patient satisfaction
Questions?

Thank you for your time and the opportunity in sharing this information on Normothermia!

And Remember.....Make Warm the Norm!

A Presentation from VUMC Perioperative Services

MAKE WARM THE NORM!

This is Norm