**National Quality Forum—Evidence (subcriterion 1a)**

**Measure Number** (*if previously endorsed*)**:** Click here to enter NQF number

**Measure Title**: Perioperative Temperature Management

**IF the measure is a component in a composite performance measure, provide the title of the Composite Measure here:** Click here to enter composite measure #/ title

**Date of Submission**: 1/14/2015

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| **Instructions**  *For composite performance measures:*  *A separate evidence form is required for each component measure unless several components were studied together.*  *If a component measure is submitted as an individual performance measure, attach the evidence form to the individual measure submission.*   * Respond to all questions as instructed with answers immediately following the question. All information needed to demonstrate meeting the evidence subcriterion (1a) must be in this form. An appendix of *supplemental* materials may be submitted, but there is no guarantee it will be reviewed. * If you are unable to check a box, please highlight or shade the box for your response. * Maximum of 10 pages (*incudes questions/instructions*; minimum font size 11 pt; do not change margins). ***Contact NQF staff if more pages are needed.*** * Contact NQF staff regarding questions. Check for resources at [Submitting Standards webpage](http://www.qualityforum.org/Measuring_Performance/Submitting_Standards.aspx). |

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| **Note: The information provided in this form is intended to aid the Steering Committee and other stakeholders in understanding to what degree the evidence for this measure meets NQF’s evaluation criteria.**   1a. Evidence to Support the Measure Focus The measure focus is evidence-based, demonstrated as follows:   * Health outcome: [**3**](#Note3) a rationale supports the relationship of the health outcome to processes or structures of care. Applies to patient-reported outcomes (PRO), including health-related quality of life/functional status, symptom/symptom burden, experience with care, health-related behavior. * Intermediate clinical outcome: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4)that the measured intermediate clinical outcome leads to a desired health outcome. * Process: [**5**](#Note5) a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4) that the measured process leads to a desired health outcome. * Structure: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4) that the measured structure leads to a desired health outcome. * Efficiency: [**6**](#Note6) evidence not required for the resource use component.   **Notes**  **3.** Generally, rare event outcomes do not provide adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.  **4.** The preferred systems for grading the evidence are the U.S. Preventive Services Task Force (USPSTF) [grading definitions](http://www.uspreventiveservicestaskforce.org/uspstf/grades.htm) and [methods](http://www.uspreventiveservicestaskforce.org/methods.htm), or Grading of Recommendations, Assessment, Development and Evaluation [(GRADE) guidelines](http://www.gradeworkinggroup.org/publications/index.htm).  **5.** Clinical care processes typically include multiple steps: assess → identify problem/potential problem → choose/plan intervention (with patient input) → provide intervention → evaluate impact on health status. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement. Note: A measure focused only on collecting PROM data is not a PRO-PM.  **6.** Measures of efficiency combine the concepts of resource use and quality (see NQF’s [Measurement Framework: Evaluating Efficiency Across Episodes of Care](http://www.qualityforum.org/Publications/2010/01/Measurement_Framework__Evaluating_Efficiency_Across_Patient-Focused_Episodes_of_Care.aspx); [AQA Principles of Efficiency Measures](http://www.aqaalliance.org/files/PrinciplesofEfficiencyMeasurementApril2006.doc)). |

**1a.1.This is a measure of**: (*should be consistent with type of measure entered in De.1*)

Outcome

Health outcome: Click here to name the health outcome

Patient-reported outcome (PRO): Click here to name the PRO

*PROs include HRQoL/functional status, symptom/symptom burden, experience with care, health-related behaviors*

Intermediate clinical outcome (*e.g., lab value*): Perioperative Temperature Management

Process: Click here to name the process

Structure: Click here to name the structure

Other: Click here to name what is being measured

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**HEALTH OUTCOME/PRO PERFORMANCE MEASURE**  *If not a health outcome or PRO, skip to* [*1a.3*](#Section1a3)

**1a.2.** **Briefly state or diagram the path between the health outcome (or PRO) and the healthcare structures, processes, interventions, or services that influence it.**

**1a.2.1.** **State the rationale supporting the relationship between the health outcome (or PRO) to at least one healthcare structure, process, intervention, or service (*i.e., influence on outcome/PRO*).**

*Note: For health outcome/PRO performance measures, no further information is required; however, you may provide evidence for any of the structures, processes, interventions, or service identified above.*

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**intermediate outcome, PROCESS, or STRUCTURE PERFORMANCE measure**

**1a.3.****Briefly state or diagram the path between structure, process, intermediate outcome, and health outcomes**. Include all the steps between the measure focus and the health outcome.

The anesthesia provider uses warming techniques during the perioperative period to prevent the patient’s core body temperature from dropping below 35.5 degrees Celsius. This prevents perioperative hypothermia, which can result in numerous adverse effects, including adverse myocardial outcomes, subcutaneous vasoconstriction, increased incidence of surgical site infection, and impaired healing of wounds. The desired outcome, reduction in adverse surgical effects due to perioperative hypothermia, is affected by maintenance of normothermia during surgery.

Anesthesia provider uses warming techniques during the perioperative period

Prevents the patient’s core body temperature from dropping below 35.5 degrees Celsius

Prevents perioperative hypothermia, which can result in numerous adverse effects, including adverse myocardial outcomes, subcutaneous vasoconstriction, increased incidence of surgical site infection, and impaired healing of wounds.

**1a.3.1.** **What is the source of the systematic review of the body of evidence that supports the performance measure?**

Clinical Practice Guideline recommendation – ***complete sections*** [***1a.4***](#Section1a4)***, and*** [***1a.7***](#Section1a7)

US Preventive Services Task Force Recommendation – ***complete sections*** [***1a.5***](#Section1a5) ***and*** [***1a.7***](#Section1a7)

Other systematic review and grading of the body of evidence (*e.g., Cochrane Collaboration, AHRQ Evidence Practice Center*) – ***complete sections*** [***1a.6***](#Section1a6) ***and*** [***1a.7***](#Section1a7)

Other – ***complete section*** [***1a.8***](#Section1a8)

*Please complete the sections indicated above for the source of evidence. You may skip the sections that do not apply.*

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**1a.4. CLINICAL PRACTICE GUIDELINE RECOMMENDATION**

**1a.4.1.** **Guideline citation** (*including date*) and **URL for guideline** (*if available online*):

Hooper VD, Chard R, Clifford T, Fetzer S, Fossum S, Godden B, Martinez EA, Noble KA, O’Brien D, Odom-Forren J, Peterson C, Ross J, Wilson L: ASPAN’s evidence-based clinical practice guideline for the promotion of perioperative normothermia: second edition. Journal of PeriAnesthesia Nursing 2010; 25(6):346-65

**1a.4.2.** **Identify guideline recommendation number and/or page number** and **quote verbatim, the specific guideline recommendation**.

**Preadmission/Preoperative Recommendations** (page 352)

*Assessment*

* Assess for risk factors for perioperative hypothermia (Class I, Level C)
* Measure patient temperature on admission (Class I, Level C)
* Determine patient’s thermal comfort level (Class I, Level C)
* Assess for signs and symptoms of hypothermia (Class I, Level C)
* Document and communicate all risk factor assessment findings to all members of the anesthesia/surgical team (Class I, Level A)

*Interventions*

* Implement passive thermal care measures (Class I, Level B)
* Maintain ambient room temperature at or above 24 degrees Celsius (Class I, Level C)
* Institute active warming for patients who are hypothermic (Class IIb, Level B)
* Consider preoperative warming to reduce the risk of intra/postoperative hypothermia (Class IIb, Level B)

**Intraoperative Recommendations** (page 353)

*Assessment*

* Identify patient’s risk factors for unplanned peroperative hypothermia (Class I, Level C)
* Frequent intraoperative temperature monitoring should be considered in all cases (Class I, Level C)
* Assess for signs and symptoms of hypothermia (Class IIb, Level C)
* Determine patient’s thermal comfort level (Class IIb, Level C)
* Document and communicate all risk factor assessment findings to all members of the anesthesia/surgical team (Class I, Level A)

*Interventions*

* Limit skin exposure to lower ambient environmental temperatures (Class I, Level C)
* Initiate passive warming measures (Class I, Level C)
* Maintain ambient room temperature from 20-25 degrees Celsius based on AORN and architectural recommendations (Class I, Level C)
* Patients undergoing a procedure with an anticipated anesthesia time greater than 30 minutes (Class I, Level C) and/or who are hypothermic preoperatively (Class I, Level A), and/or patients at risk for hypothermia (Class I, Level C) or at increased risk for suffering its complications (Class I, Level C)
  + Forced air warming should be implemented (Class I, Level A)
* There is evidence to suggest that alternative active warming measures may maintain normothermia when used alone or in combination with forced air warming (Class IIb, Level B). These warming measures include:
  + Warmed IV fluids (Class IIa, Level B)
  + Warmed irrigation fluids (Class IIb, Level B)
  + Circulating water garments (Class IIb, Level B)
  + Circulating water mattresses (Class IIb, Level B)
  + Radiant heat (Class IIb, Level B)
  + Gel pad surface warming (Class IIa, Level B)
  + Resistive heating (Class IIa, Level B)

**1a.4.3.** **Grade assigned to the quoted recommendation with definition of the grade:**

Grades for each recommendation are provided in 1a.4.2.

**1a.4.4. Provide all other grades and associated definitions for recommendations in the grading system.** (*Note: If separate grades for the strength of the evidence, report them in section 1a.7.*)

**Class I:** The benefit far outweighs the risk and the recommendation should be performed or administered.

**Class IIa:** The benefit outweighs the risk and it is reasonable to perform or administer the recommendation.

**Class IIb:** The benefit is equal to the risk and it is not unreasonable to perform or administer the recommendation.

**Class III:** The risk outweighs the benefit and the recommendation should not be performed or administered.

**Level A:** Evidence from multiple randomized trials or meta-analysis evaluating multiple populations (3-5) with general consistency of direction and magnitude of effect.

**Level B:** Evidence from single randomized trials or non-randomized studies evaluating limited (2-3) populations.

**Level C:** Evidence from case studies, standards of care, or expert opinion involving very limited (1-2) populations.

**1a.4.5. Citation and URL for methodology for grading recommendations** (*if different from 1a.4.1*)**:**

**1a.4.6. If guideline is evidence-based (rather than expert opinion), are the details of the quantity, quality, and consistency of the body of evidence available (e.g., evidence tables)?**

Yes **→ *complete section*** [***1a.7***](#Section1a7)

No **→ *report on another systematic review of the evidence in sections*** [***1a.6***](#Section1a6) ***and*** [***1a.7***](#Section1a7)***; if another review does not exist, provide what is known from the guideline review of evidence in*** [***1a.7***](#Section1a7)

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**1a.5.** **UNITED STATES PREVENTIVE SERVICES TASK FORCE RECOMMENDATION**

**1a.5.1.** **Recommendation citation** (*including date*) and **URL for recommendation** (*if available online*):

**1a.5.2.** **Identify recommendation number and/or page number** and **quote verbatim, the specific recommendation**.

**1a.5.3.** **Grade assigned to the quoted recommendation with definition of the grade**:

**1a.5.4. Provide all other grades and associated definitions for recommendations in the grading system.** (*Note: the* *grading system for the evidence should be reported in section 1a.7.*)

**1a.5.5. Citation and URL for methodology for grading recommendations** (*if different from 1a.5.1*)**:**

***Complete section*** [***1a.7***](#Section1a7)

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**1a.6. OTHER SYSTEMATIC REVIEW OF THE BODY OF EVIDENCE**

**1a.6.1.** **Citation** (*including date*) and **URL** (*if available online*):

**1a.6.2.** **Citation and** **URL for methodology for evidence review and grading** (*if different from 1a.6.1*)**:**

***Complete section*** [***1a.7***](#Section1a7)

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**1a.7. FINDINGS FROM SYSTEMATIC REVIEW OF BODY OF THE EVIDENCE supporting the measure**

*If more than one systematic review of the evidence is identified above, you may choose to summarize the one (or more) for which the best information is available to provide a summary of the quantity, quality, and consistency of the body of evidence. Be sure to identify which review is the basis of the responses in this section and if more than one, provide a separate response for each review.*

**1a.7.1.** **What was the specific structure, treatment, intervention, service, or intermediate outcome addressed in the evidence review?**

The evidence review in these clinical practice guidelines address the risks and complications due to perioperative hypothermia, and techniques used for active perioperative warming.

**1a.7.2.** **Grade assigned for the quality of the quoted evidence with definition of the grade**:

Grades for each guideline are provided in 1a.4.2.

**1a.7.3. Provide all other grades and associated definitions for strength of the evidence in the grading system.**

Please refer to 1a.4.4.

**1a.7.4.** **What is the time period covered by the body of evidence? (*provide the date range, e.g., 1990-2010*). Date range**: 1970-2008

**QUANTITY AND QUALITY OF BODY OF EVIDENCE**

**1a.7.5.****How many and what type of study designs are included in the body of evidence**? (*e.g., 3 randomized controlled trials and 1 observational study*)

Approximately 53 studies are provided in support of the recommendations cited in 1a.4.2, and approximately 20 additional studies are provided that broadly support the link between perioperative hypothermia and associated complications.

**1a.7.6.** **What is the overall quality of evidence across studies in the body of evidence**? (*discuss the certainty or confidence in the estimates of effect particularly in relation to study factors such as design flaws, imprecision due to small numbers, indirectness of studies to the measure focus or target population*)

Of the 20 studies that discuss the link between hypothermia and associated complications and comorbidities, the body of evidence is very strong. Most of the studies are randomized controlled trials in which patients are randomized to the presence or absence of warming techniques during surgical procedures. The studies also include systematic reviews and meta-analyses that draw from many additional studies and original research, thus further strengthening the body of evidence. In the randomized controlled trials, the sample sizes were relatively small (50-100 subjects), however the meta-analyses and systematic reviews draw on multiple studies with large cohorts, increasing precision.

Of the 53 studies that support the specific recommendations cited, the quality of the body of evidence is strong. Most of the studies are randomized controlled trials. The studies also contain non-randomized prospective cohort studies with relatively large sample sizes that increase the statistical power of the evidence across studies. As a whole, these studies examine multiple procedure types and multiple warming techniques with consistent results that support the American Society of PeriAnesthesia Nurses (ASPAN) guidelines and the guidelines’ use for this quality measure.

**ESTIMATES OF BENEFIT AND CONSISTENCY ACROSS STUDIES IN BODY OF EVIDENCE**

**1a.7.7.** **What are the estimates of benefit—magnitude and direction of effect on outcome(s) across studies in the body of evidence**? (*e.g., ranges of percentages or odds ratios for improvement/ decline across studies, results of meta-analysis, and statistical significance*)

The direction of the effect shows uniform support for maintaining normothermia during surgical procedures. Studies that examine the same outcomes show consistent results.

The evidence consistently shows an approximate three-fold increase in risk for adverse myocardial events, tissue hypoxia and surgical site infection when a patient becomes hypothermic during their surgical procedure.

The evidence consistently shows that perioperative hypothermia increases the risk of blood transfusion by about 20%, with transfusion patients requiring an additional 500-1000ml of blood.

Some studies investigated the effect of hypothermia on the duration of action of anesthesia drugs. These studies consistently find that hypothermia increases the duration of action of drugs from varying drug classes, with duration of action increasing between 60 and 100 percent of the expected action the drug.

**1a.7.8.** **What harms were studied and how do they affect the net benefit (benefits over harms)?**

Risk/benefit ratios were assigned to all of the ASPAN clinical practice guidelines (specifically outlined in 1a.4.2 and 1a.4.4). Approximately half of the recommendations received a Class I designation, indicating that benefits far outweigh risks. The remaining half received either a Class IIa or IIb designation, indicating that the benefits equal or outweigh the risks. None of the recommendations received a Class III designation, which indicates that risk outweighs the benefits.

**UPDATE TO THE SYSTEMATIC REVIEW(S) OF THE BODY OF EVIDENCE**

**1a.7.9.** **If new studies have been conducted since the systematic review of the body of evidence, provide for each new study: 1) citation, 2) description, 3) results, 4) impact on conclusions of systematic review**.

Hannan EL, Samadashvili Z, Wechsler A, Jordan D, Lahey SJ, Culliford AT, Gold JP, Higgins RSD, Smith CR: The relationship between perioperative temperature and adverse outcomes after off-pump coronary artery bypass graft surgery. J Thoracic Cardio Surg 2010; 139(6):1568-75.e1

* Retrospective cohort study of 2294 patients who underwent off-pump coronary artery bypass grafting. Patients with moderate to severe hypothermia had significantly higher in-hospital mortality rates than patients with normothermia (OR=3.0). Patients with either mild or moderate to severe hypothermia had significantly higher rates of respiratory failure and unplanned operations. This supports the conclusions of the body of evidence.

Lehtinen SJ, Onicescu G, Kuhn KM, Cole DJ, Esnaola NF: Normothermia to prevent surgical site infections after gastrointestinal surgery: holy grail or false idol? Ann Surg 2010; 252(4):696-704

* Matched case-control study of 469 patients who underwent noncolorectal surgery and developed SSIs. The authors did not find an association between perioperative normothermia and surgical site infection rates. This does not support the conclusions of the body of evidence.

Lista F, Doherty CD, Backstein RM, Ahmad J: The impact of perioperative warming in an outpatient aesthetic surgery setting. Aesthetic Surgery Journal 2012; 32(5):613-20

* Retrospective review of 214 patients who underwent outpatient plastic surgery. 108 of the patients received warming, 106 did not. The requirement for intraoperative analgesia was significantly lower in the warmed group, and patients in the warmed group required less time in the recovery room and met discharge criteria sooner. No significant difference in complications were observed. Although no differences in complications were observed, warming resulted in a shorter recovery time and less resource use. This study supports the conclusions of the body of evidence.

Moretti B, Larocca AMV, Napoli C, Martinelli D, Paolillo L, Cassano M, Notarnicola A, Moretti L, Pesce V: Active warming systems to maintain perioperative normothermia in hip replacement surgery: a therapeutic aid or a vector of infection? J Hosp Infect 2009; 73(1):58-63

* A prospective time-series study measuring concentrations of bacteria in the OR air when the Bair Hugger blanket was used during surgical procedures. Statistical analysis of the concentration measurements demonstrated that the Bair Hugger system does not pose a risk for nosocomial infections and is effective at preventing intraoperative hypothermia.

Moslemi-Kebria M, El-Nashar SA, Aletti GD, Cliby WA: Intraoperative hypothermia during cytoreductive surgery for ovarian cancer and perioperative mobidity. Obstet Gyn 2012; 119(3):590-6

* Retrospective cohort study of 146 women with ovarian cancer undergoing debulking surgery. Hypothermia was associated with an increased risk of any early complication (OR=3.40), specifically VTE events (OR=3.53), infectious morbidity (OR=2.99) and reoperation (OR=4.96). This supports the conclusions of the body of evidence.

Nguyen HP, Zaroff JG, Hindman BJ: Perioperative hypothermia (33C) does not increase the occurrence of cardiovascular events in patients undergoing cerebral aneurysm surgery: findings from the intraoperative hypothermia for aneurysm surgery trial. Anesthesiology 2010; 113(2):327-42

* Randomized controlled trial of 1,000 patients undergoing cerebral aneurysm surgery. No difference was seen between hypothermic and normothermic patients in the occurrence of any single cardiovascular event, composite cardiovascular events, or mortality. This does not support the conclusions of the body of evidence.

Sumer BD, Myers LL, Leach J, Truelson JM: Correlation between intraoperative hypothermia and perioperative morbidity in patients with head and neck cancer. Arch Otolaryngol Head Neck Surg 2009; 135(7):682-6

* Retrospective cohort study of 136 patients who underwent ablative surgery for head and neck cancer. Patients who were hypothermic had a significantly higher rate of complications than normothermic patients. Intraoperative hypothermia was a significant independent predictor for the development of early perioperative complications. This study supports the conclusions of the body of evidence.

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**1a.8 OTHER SOURCE OF EVIDENCE**

*If source of evidence is NOT from a clinical practice guideline, USPSTF, or systematic review, please describe the evidence on which you are basing the performance measure.*

This section provides evidence justifying “perioperative hypothermia” as a core body temperature greater than or equal to 35.5 degrees Celsius.

**1a.8.1** **What process was used to identify the evidence?**

Some of the studies cited below were cited within the ASPAN guidelines. Additionally, a search was performed on Google Scholar using the keyword combinations “perioperative hypothermia” and “perioperative hypothermia randomized”. The searches yielded 39,100 results and 31,500 results, respectively. The first 30 results for each search were examined, and all systematic reviews within those 60 results were subjected to a reference crawl (i.e., examining each citation individually). The following 34 citations provide support for the temperature threshold in two ways:

1. 35.5 degrees Celsius is used as the low threshold for classifying a cohort as “hypothermic”.
2. When randomizing patients to the use of warming treatments, the “hypothermic” group (i.e., no warming technique used) was found to have a core body temperature less than 35.5 degrees Celsius.

**1a.8.2.** **Provide the citation and summary for each piece of evidence.**

Beilin B, Shavit Y, Razumovsky J, Wolloch Y, Zeidel A, Bessler H: Effects of mild perioperative hypothermia on cellular immune responses. Anesthesiology 1998; 89(5):1133-40

Bush HL, Hydo LJ, Fischer E, Fantini GA, Silane MF, Barie PS: Hypothermia during elective abdominal aortic aneurysm repair: The high price of avoidable morbidity. J Vasc Surg 1995; 21(3):392-402

Butwick AJ, Lipman SS, Carvalho B: Intraoperative forced air-warming during cesarean delivery under spinal anesthesia does not prevent maternal hypothermia. Anesth Analg 2007; 105(5):1413-9

Camus Y, Delva E, Just B, Lienhart A: Leg warming minimizes core hypothermia during abdominal surgery. Anesth Analg 1993; 77(5):995-9

Carli F, Emery PW, Freemantle CAJ: Effect of peroperative normothermia on postoperative protein metabolism in elderly patients undergoing hip arthroplasty. Br J Anaesth 1989; 63(3):276-82

Cavallini M, Baruffaldi PFW, Casati A: Effects of mild hypothermia on blood coagulation in patients undergoing elective plastic surgery. Plast Reconstr Surg 2005; 116(1):316-21

Conahan TJ: Heating reduces recovery time (cost) in outpatients. Anesthesiology 1982; 67:128-30

El-Gamal N, El-Kassabany N, Frank SM, Amar R, Khabar HA, El-Rahmany HK, Okasha AS: Age-related thermoregulatory differences in a warm operating room environment. Anesth Analg 2000; 90(3):694-8

Fleisher LA, Metzger SE, Lam J, Harris A: Perioperative cost-finding analysis of the routine use of intraoperative forced-air warming during general anesthesia. Anesthesiology 1998; 88(5):1357-64

Flores-Maldonado A, Medina-Escobedo CE, Rios-Rodriguez HMG, Fernandez-Dominguez R: Mild perioperative hypothermia and the risk of wound infection. Arch Med Res 2001; 32(3):227-31

Frank SM, Fleisher LA, Breslow MJ, Higgins MS, Olson KF, Kelly S, Beattie C: Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events. A randomized clinical trial. JAMA 1997; 277(14):1127-34

Frank SM, Higgins MS, Breslow MJ, Fleisher LA, Gorman RB, Sitzmann JV, Raff H, Beattle C: The catecholamine, cortisol, and hemodynamic responses to mild perioperative hypothermia: a randomized clinical trial. Anesthesiology 1995; 82(1):83-93

Gentilello LM, Jurkovich GJ, Stark MS, Hassantash SA, O’Keefe GE: Is hypothermia in the victim of major trauma protective or harmful? A randomized, prospective study. Ann Surg 1997; 226(4):439-49

Hindman BJ, Todd MM, Gelb AW, Loftus CM, Craen RA, Schubert A, Mahla ME, Torner JC: Mild hypothermia as a protective therapy during intracranial aneurysm surgery: a randomized prospective pilot trial. Neurosurgery 1999; 44(1):23-32

Janicki PK, Higgins MS, Janssen J, Johnson RF, Beatti C: Comparison of two different temperature maintenance strategies during open abdominal surgery: upper body forced-air warming versus whole body water garment. Anesthesiology 2001; 95(4):868-74

Janke EL, Pilkington SN, Smith DC: Evaluation of two warming systems after cardiopulmonary bypass. Br J Anaesth 1996; 77(2):268-70

Just B, Delva E, Camus Y, Lienhart A: Oxygen uptake during recovery following naloxone. Relationship with intraoperative heat loss. Anesthesiology 1992; 76(1):60-4

Kongsayreepong S, Chaibundit C, Chapaibool J, Komoltri C, Suraseranivongse S, Suwannanonda P, Raksamanee E, Noocharoen P, Silapadech A, Parakkamodom S, Pum-In C, Sojeoyya, Lilanuch: Predictor of core hypothermia and the surgical intensive care unit. Anesth Analg 2003; 96(3):826-33

Kurz A, Sessler DI, Lenhardt R: Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group. NEJM 1996; 334(19):1209-15

Kurz A, Sessler DI, Narzt E, Bekar A, Lenhardt R, Huemer G, Lackner F: Postoperative hemodynamic and thermoregulatory consequences of intraoperative core hypothermia. J Clin Anesth 1995; 7(5):359-66

Lenhardt R, Marker E, Goll V, Tschernich H, Kurz A, Sessler DI, Narzt E, Lackner F: Mild intraoperative hypothermia prolongs postanesthetic recovery. Anesthesiology 1997; 87(6):1318-23

Leslie K, Sessler DI, Bjorksten AR, Moayeri A: Mild hypothermia alters propofol pharmacokinectics and increases the duration of action of atracurium. Anesth Analg 1995; 80(5):1007-14

Nathan HJ, Parlea L, Dupuis JY, Hendry P, Williams KA, Rubens FD, Wells GA: Safety of deliberate intraoperative and postoperative hypothermia for patients undergoing coronary artery surgery: a randomized trial. J Thorac Cardio Surg 2004; 127(5):1270-5

Ott DE, Reich H, Love B, McCorvey R, Toledo A, Liu CY, Syed R, Kumar K: Reduction of laparoscopic-induced hypothermia, postoperative pain and recovery room length of stay by pre-conditioning gas with the Insuflow device: a prospective randomized controlled multi-center study. JSLS 1998; 2(4):321-9

Scheck T, Kober A, Bertalanffy P, Aram L, Andel H, Molnar C, Hoerauf K: Active warming of critically ill patients during intrahospital transfer: a prospective, randomized trial. Wien Klin Wochenschr 2004; 116(3):94-7

Schmied H, Kurz A, Sessler DI, Kozek S, Reiter A: Mild hypothermia increases blood loss and transfusion requirements during total hip arthroplasty. Lancet 1996; 347(8997):289-92

Shiozaki T, Hayakata T, Taneda M, Nakajima Y, Hashiguchi N, Fujimi S, Nakamori Y, Tanaka H, Shimazu T, Sugimoto H: A multicenter prospective randomized controlled trial of the efficacy of mild hypothermia for severely head injured patients with low intracranial pressure. J Neurosurg 2001; 94(1):50-4

Smith CE, Gerdes E, Sweda S, Myles C, Punjabi A, Pinchak AC, Hagen JF: Warming intravenous fluids reduces perioperative hypothermia in women undergoing ambulatory gynecological surgery. Anesth Analg 1998; 87(1):37-41

Tanaka M, Nagasaki G, Nishikawa T: Moderate hypothermia depresses arterial baroreflex control of heart rate during, and delays its recovery after, general anesthesia in humans. Anesthesiology 2001; 95(1):51-5

Todd MM, Hindman BJ, Clarke WR, Torner JC: Mild intraoperative hypothermia during surgery for intracranial aneurysm. NEJM 2005; 352:135-45

Vanni SM, Braz JR, Modolo NS, Amorim RB, Rodriguez GR: Preoperative combined with intraoperative skin-surface warming avoids hypothermia caused by general anaesthesia and surgery. J Clin Anesth 2003; 15(2):119-25

Xiao H, Remick DG: Correction of perioperative hypothermia decreases experimental sepsis mortality by modulating the inflammatory response. Crit Care Med 2005; 33(1):161-7

Xu L, Zhao J, Huang YG, Luo AL: [The effect of intraoperative warming on patient core temperature]. Zhonghua Wai Ke Za Zhi 2004; 42(16):1010-3

Zhao J, Luo AL, Xu L, Huang YG: Forced-air warming and fluid warming minimize core hypothermia during abdominal surgery. Chin Med Sci J 2005; 20(4):261-4