

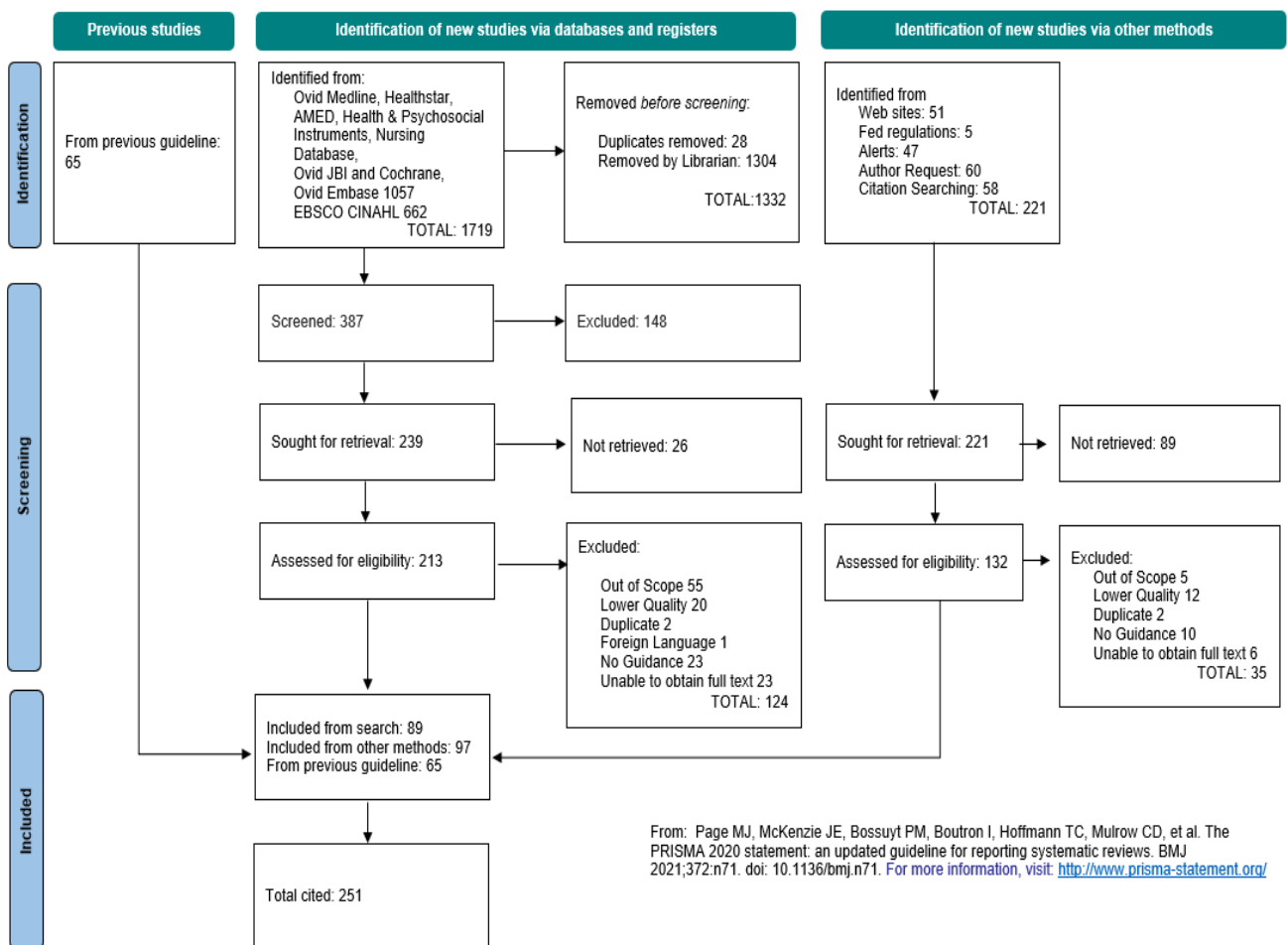
EVIDENCE REVIEW

The Guideline for Patient Temperature Management (formerly Prevention of Unintended Hypothermia) was approved by the AORN Guidelines Advisory Board and became effective December 19, 2024.

A medical librarian with a perioperative background conducted a systematic search of the databases Ovid MEDLINE®, Ovid Embase®, EBSCO CINAHL®, and the Cochrane Database of Systematic Reviews. The search was limited to literature published in English from October 2018 through October 2023. At the time of the initial search, weekly alerts were created on the topics included in that search. Results from these alerts were provided to the lead author until February 2024. The lead author requested additional articles that either did not fit the original search criteria or were discovered during the evidence appraisal process. The lead author and the medical librarian also identified relevant guidelines from government agencies, professional organizations, and standards-setting bodies.

Included were research and non-research literature in English, complete publications, and publications with dates within the time restriction when available. Historical studies were also included. Excluded were non-peer-reviewed publications and older evidence within the time restriction when more recent evidence was available. Editorials, news items, and other brief items were excluded. Low-quality evidence was excluded when higher-quality evidence was available, and literature outside the time restriction was excluded when literature within the time restriction was available. Articles identified in the search were provided to the project team for evaluation. The team consisted of the lead author and one evidence appraiser. The lead author and the evidence appraiser reviewed and critically appraised each article using the AORN Research or Non-Research Evidence Appraisal Tools as appropriate. A third appraiser was consulted if there was a disagreement between the lead author and the primary evidence appraiser. The literature was independently evaluated and appraised according to the strength and quality of the evidence. Each article was then assigned an appraisal score. The appraisal score is noted in brackets after each reference as applicable. Each recommendation rating is based on a synthesis of the collective evidence, a benefit-harm assessment, and consideration of resource use. The strength of the recommendation was determined using the AORN Evidence Rating Model and the quality and consistency of the evidence supporting a recommendation. The recommendation strength rating is noted in brackets after each recommendation. See the PRISMA 2020 flow diagram (Figure 1) below for more information about the systematic review and nature of included studies and resources.

Figure 1: PRISMA 2020 Flow Diagram



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org/>

On October 9, 2023, a medical librarian with a perioperative background conducted searches for relevant publications on websites of organizations selected by the author (including government departments). Full details of these supplementary searches is included in the Supplementary Content on the aorn.org web site. These results were also screened by two screeners: the medical librarian, and then the lead author.

On October 4, 2023, a medical librarian with a perioperative background conducted a systematic search of 18 health science databases, the names and date coverage of which are given in Table 1. These results were screened by the medical librarian, and then the lead author.

Table 1: Databases searched and coverage

Database	Coverage
AORN Full Text Journals@Ovid	
Books@Ovid	October 02, 2023
JBI EBP Database	Current to September 27, 2023
EBM Reviews: ACP Journal Club	1991 to September 2023
EBM Reviews: Cochrane Central Register of Controlled Trials	September 2023
EBM Reviews: Cochrane Database of Systematic Reviews	2005 to October 4, 2023
EBM Reviews: Cochrane Clinical Answers	September 2023
EBM Reviews: Cochrane Methodology Register	3rd Quarter 2012
EBM Reviews: Database of Abstracts of Reviews of Effects	1st Quarter 2016
EBM Reviews: Health Technology Assessment	4th Quarter 2016
EBM Reviews: NHS Economic Evaluation Database	1st Quarter 2016
AMED (Allied and Complementary Medicine)	1985 to September 2023
Embase	1974 to 2023 October 04
Health and Psychosocial Instruments	1985 to July 2023
Ovid Healthstar	1999 to August 2023
Ovid MEDLINE(R) ALL	1946 to October 04, 2023
Ovid Nursing Database	1946 to September Week 5 2023
CINAHL Complete via EBSCOhost	1937 to Current

Search strategy development process: The medical librarian referred to a search strategy used for the previous Guideline. A draft search strategy was developed using terms listed in the previous strategy and additional search terms identified from a meeting with the lead author. Using the MeSH Subject Headings database, additional search terms were identified and added to the search strategy. The strategy was limited following the constraints in the eligibility criteria outlined by the lead author.

Editor’s note: MEDLINE is a registered trademark of the US National Library of Medicine’s Medical Literature Analysis and Retrieval System, Bethesda, MD. Embase is a registered trademark of Elsevier B.V., Amsterdam, The Netherlands. CINAHL, Cumulative Index to Nursing and Allied Health Literature, is a registered trademark of EBSCO Industries, Birmingham, AL.

Search Strategies

Ovid (Medline, Cochrane, and Embase)

1 Heating/ or "Body Temperature"/ or Rewarming/ or hypothermia/pc, co, et, nu, sn or hypothermia.de,sh,hw. or (hypothermi* or normothermi*).ti,ab,kw. 351517

2	((heat adj2 (production or loss)) or ((preoperative or intraoperative or comfort) and warming) or ((technique or Mattress\$ or blanket\$) adj3 (warm\$ or Electric)) or (("negative pressure" or "forced air" or convect\$ or cutaneous or intravenous or irrigation) and \$warming) or ("circulating water garment" or "resistive heating" or thermoregulat\$) or ((adaptive or nonshivering or facultative) adj2 thermogenesis) or ((thermal or temperature) adj3 manag\$) or ("thermoregulatory" and ("response threshold" or vaso\$)) or (CO2 adj6 warming) or (an?esthetic adj6 warming) or (pre-warm\$ or prewarm\$ or "heat distribution" or "inspired gas humidification").ti,ab,kw. or "body temperature regulation".de,hw,sh.	108376
3	(trembl* or shak* or shudder* or shivering or thermogenesis or ((unplanned or inadvertent or redistribution or unintentional or core) and hypothermia)).ti,ab,kw.	115954
4	1 or 2 or 3	519752
5	exp "Surgical Procedures, Operative"/ or exp "Postoperative Complications"/ or exp "Intraoperative Complications"/ or exp "Perioperative Care"/ or exp "Postoperative Care"/ or exp "Preoperative Care"/ or exp anesthesia/ or anesthesia/ae or exp "intraoperative care"/ or ((operat\$ or recovery) adj3 room\$).ti. or ((operat\$ or surg\$) adj3 complic\$).ab. or ("intraoperative care" or "operating room nursing" or "perioperative care" or "surgical procedures, operative").de,sh,hw. or ("operative surgical procedures" or "operative procedures" or "perioperative nursing" or "operating room staff").ti,ab.	13082408
6	4 and 5	108278
7	thermometers/is, mt or "monitoring, intraoperative"/is, mt or thermography/is, mt or ("thermal management" or "intraoperative monitoring" or "temperature mapping" or "skin surface temperature gradient" or "temperature reporting").ti,ab,kw. or ((skin or esophog* or tympan* or "temporal artery" or oral or axilla* or rect* or bladder) adj2 (thermometer* or temperature*)).ti,ab,kw.	71341
8	7 and 6	3864
9	(BairHugger or "Bair Hugger" or "3M Bair Hugger" or "3M Bair Paws" or ThermoCare or Gaymar or Optisan or WarmAir or FilteredFlow or WarmTouch or "Covidien WarmTouch" or CareDrape or "Life-Air" or "Snuggle Warm" or "Warm-Gard" or Hotdog or "Stryker Mistral" or "Stryker Altrix" or Thermawrap or "Steris Patient Warming System").mp. or (thermal and (blanket or pad)).ti,ab,kw.	3916
10	6 and 9	773
11	("risk factors" and ("blood transfusion" or obesity or "diabetic neuropathies" or tourniquets or "pressure ulcer" or burns or pediatrics or "skin pigmentation")).de,sh,hw. or "skin temperature"/de	114631
12	exp infant/ and "risk factors".de,sh,hw.	158428
13	exp "population groups"/ and "risk factors".de,sh,hw.	81308
14	((("pneumatic tourniquet" or obese or "decubitus ulcers" or "bed sores" or bedsore or "pressure injuries" or neonat\$ or infant or "older adult" or geriatric or "compromised skin") and "risk factors").ti,ab,kw.	131761
15	((("risk factors" and ((patients or individuals) adj3 size)) or ("risk factors" and (burn and (victims or patients)))) or ("risk factors" and (skin adj5 (color or tone))).ti,ab,kw.	6505
16	11 or 12 or 13 or 14 or 15	442019
17	6 and 16	842
18	((("malignant hyperthermia" or "myopathy, central core" or "muscular dystrophies" or "muscular diseases" or "heat stroke" or hyperthermia) and "risk factors").de,sh,hw. or (((("health correlates" or "risk factors") and "malignant hyperthermia crisis") adj8 ("central core disease" or "central core myopathy" or "shy-magee syndrome" or "Anesthesia Related Hyperthermia" or "muscular dystrophy" or myopath\$ or "Hyperthermia of Anesthesia" or heatstroke)).ti,ab,kw. or (("emergency response" or (MH adj2 (cart or drill or protocol))) and ("team training" or simulation or education)).ti,ab,kw.	3766
19	18 and (5 or 7)	747
20	"cardiac surgical procedures"/ae or "Circulatory Arrest, Deep Hypothermia Induced"/ae or "hypothermia, induced"/ae or ("temperature increase" or "intentional hypothermia" or "therapeutic hypothermia" or "planned hypothermia" or "deep hypothermic circulatory arrest" or "intentional hypothermia" or "cardiac surgical procedure").ti,ab,kw.	65293
21	20 and 1	25983

22	6 or 8 or 10 or 17 or 19 or 21	126473
23	limit 22 to cochrane library	66117
24	limit 23 to embase records	63891
25	limit 24 to english language	53952
26	limit 25 to full systematic reviews	53952
27	limit 26 to human	40986
28	limit 27 to medline records	40755
29	limit 28 to new	40755
30	limit 29 to yr="2018 -Current"	8137
31	limit 30 to recently updated reviews	8137
32	limit 31 to humans	8137
33	limit 32 to original articles	8137
34	limit 33 to "review articles"	1654
35	limit 34 to primary source	1654
36	limit 35 to secondary source	1654
37	remove duplicates from 36	1057

EBSCOhost (CINAHL)

1	"temperature increase" or "intentional hypothermia" or "therapeutic hypothermia" or "planned hypothermia" or "deep hypothermic circulatory arrest" or "intentional hypothermia" or "cardiac surgical procedure"	20,473
2	(heat N2 (production or loss)) OR ((preoperative or intraoperative or comfort) and warming) OR ((technique or Mattress* or blanket*) N3 (warm* or Electric)) OR (("negative pressure" or "forced air" or convect* or cutaneous or intravenous or irrigation) and *warming) OR ("circulating water garment" or "resistive heating" or thermoregulat*) OR ((adaptive or nonshivering or facultative) N2 thermogenesis) OR ((thermal or temperature) N3 manag*) OR ("thermoregulatory" and ("response threshold" or vaso*)) OR (CO2 adj6 warming) OR (an*esthetic N6 warming) OR (pre-warm* or prewarm* or "heat distribution" or "inspired gas humidification")	5,635
3	(trembl* or shak* or shudder* or shivering or thermogenesis) OR ((unplanned or inadvertent or redistribution or unintentional or core) and hypothermia)	18,064
4	S1 OR S2 OR S3	37,457
5	(MH "Anesthesia/AE") OR (MH "Anesthesia+") OR (MH "Perioperative Care+") OR (MH "Surgery, Operative+") OR (MH "Intraoperative Care+") OR (MH "Postoperative Care+") OR (MH "Postoperative Complications+") OR (MH "Intraoperative Complications+") OR (MH "Preoperative Care+") OR ((operat* or recovery) N3 room*) OR ((operat* or surg*) N3 complic*) OR ("intraoperative care" or "operating room nursing" or "perioperative care" or "surgical procedures, operative") OR ("operative surgical procedures" or "operative procedures" or "perioperative nursing" or "operating room staff")	852,926

6	S4 AND S5	6,443
7	(MH "Intraoperative Monitoring/MT") OR (MH "Thermometers") OR (MH "Thermography/MT") OR ("thermal management" or "intraoperative monitoring" or "temperature mapping" or "skin surface temperature gradient" or "temperature reporting") or (skin or esophog* or tympan* or "temporal artery" or oral or axilla* or rect* or bladder) N2 (thermometer* or temperature*)	12,120
8	S6 AND S7	594
9	TX (BairHugger or "Bair Hugger" or "3M Bair Hugger" or "3M Bair Paws" or ThermoCare or Gaymar or Optisan or WarmAir or FilteredFlow or WarmTouch or "Covidien WarmTouch" or CareDrape or "Life-Air" or "Snuggle Warm" or "Warm-Gard" or Hotdog or "Stryker Mistral" or "Stryker Altrix" or Thermawrap or "Steris Patient Warming System") OR (thermal and (blanket or pad))	788
10	S6 AND S9	132
11	(MH "Skin Temperature/DE") OR ((MH "Risk Factors") AND ((MH "Blood Transfusion") OR (MH "Diabetic Neuropathies") OR (MH "Pressure Ulcer") OR (MH "Skin Pigmentation" OR (MH "Tourniquets") OR (MH "Pediatrics") OR (MH "Burn Patients") OR (MH "Obesity") OR (MH "Blood Transfusion") OR (MH "Diabetic Neuropathies") OR (MH "Pressure Ulcer") OR (MH "Skin Pigmentation"))))	12,240
12	(MH "Infant+") AND (MH "Risk Factors")	16,592
13	(MH "Ethnic Groups"+) AND (MH "Risk Factors")	0
14	("pneumatic tourniquet" or obese or "decubitus ulcers" or "bed sores" or bedsore or "pressure injuries" or neonat\$ or infant or "older adult" or geriatric or "compromised skin") AND "risk factors"	59,130
15	"risk factors" AND ((skin N5 (color or tone))) OR (burn and (victims or patients)) OR ((patients or individuals) N3 size))	25,141
16	S11 OR S12 OR S13 OR S14 OR S15	92,070
17	S8 AND S16	26
18	(MH "Risk Factors") AND ((MH "Malignant Hyperthermia") OR (MH "Hyperthermia") OR (MH "Heat Stroke") OR (MH "Muscular Diseases") OR (MH "Muscular Dystrophy") OR "central core myopathy")	163
19	(("health correlates" or "risk factors") and "malignant hyperthermia") AND ("central core disease" or "central core myopathy" or "shy-magee syndrome" or "Anesthesia Related Hyperthermia" or "muscular dystrophy" or myopath\$ or "Hyperthermia of Anesthesia" or heatstroke)	70
20	((MH N2 (cart or drill or protocol)) OR "emergency response") AND ("team training" or simulation or education)	412
21	S18 OR S19 OR S20	624
22	S5 OR S7	858,387
23	S21 AND S22	88
24	(MH "Surgery, Cardiovascular/AE") OR (MH "Hypothermia, Induced/AE") OR "Deep Hypothermia Induced Circulatory Arrest" OR "temperature increase" or "intentional hypothermia" or "therapeutic hypothermia" or "planned hypothermia" or "deep hypothermic circulatory arrest" or "intentional hypothermia" or "cardiac surgical procedure"	20,241
25	S1 AND S24	5,194

26	S6 OR S8 OR S10 OR S17 OR S23 OR S25		10,503
27	S6 OR S8 OR S10 OR S17 OR S23 OR S25	Limiters - Published Date: 20180901-20231031; English Language; Peer Reviewed; Exclude MEDLINE records; Human	662

Web Searches// All searches conducted in 2023.

10/9: Used google.com to search for "agency for healthcare research and quality." 2] Under "Research" drop-down menu, selected "AHRQ Research Studies." 3] In "Search by Keyword" box, entered "hypothermia." 4] Browsed results, saved for author screening.

10/9: Used google.com to search for "agency for healthcare research and quality." 2] In search bar for first result, for www.ahrq.gov, typed "normothermia." 3] Browsed results; saved for author screening. (x4)

10/9: Used google.com to search for "centers for medicare and medicaid". 2] In search bar for first result (www.cms.gov), typed "normothermia." 3] Browsed results, saved for author screening. (x4)

10/9: Used google.com to search for "dnv gl healthcare." 2] Chose first result, for www.dnv.com> healthcare. 3] Chose "NIAHO Accreditaion Standards"; saved for author screening.

10/9: Used google.com to search for the US FDA; chose first result, www.fda.gov. 2] Entered "warming system" in search bar. 3] Scrolled results; saved for author screening.

10/9: Used google.com to search for the US FDA; chose first result, www.fda.gov. 2] Entered "heater cooler" in search bar. 3] Scrolled results; saved for author screening.

10/9: Used google.com to search for the US FDA; chose first result, www.fda.gov. 2] Started typing "warming" in search bar, and site auto filled with "... warmers" ("warming warmers"). 3] Scrolled results; saved for author screening.

10/9: Used google.com to search for the US FDA; chose first result, www.fda.gov. 2] Scrolled down to "PRODUCTS WE REGULATE" heading; chose "Medical Devices". 3] Scrolled down to "SEARCH MEDICAL DEVICE DATABASES" heading. 4] Saved result for author screening.

10/9: From Ref ID result 1749, navigated to this result on L side of page. 2] Saved for author screening.

10/9: Used google.com to search for "surgical care improvement project (scip) measures". 2] Chose first result, from the Joint Commission. 3] Clicked link for measure #7 related to patient perioperative normothermia. 4] Saved for author screening.

10/9: Used google.com to search for "surgical care improvement project (scip) measures". 2] Chose first result, from the Joint Commission. 3] Clicked link for measure #7 related to patient perioperative normothermia. 4] Noticed link to this document at very bottom of Ref ID 1752. 5] Saved for author screening. (x2)

10/11: Used google.com to search "normothermia site:cdc.gov". 2] Browsed results, saved for author screening. (x2)

10/12: Used google.com to navigate to ecri.org. 2] Signed in. 3] Entered "perioperative OR hypothermia OR normothermia OR warming" in search box. 4] Filtered by date (oct 2015 to 2023). 4] Browsed results, saved for author screening (x17)

10/12: Used google.com to navigate to ecri.org. 2] Signed in. 3] Entered "perioperative OR hypothermia OR normothermia OR warming" in search box. 4] Filtered by date (oct 2015 to 2023). 4] Browsed results, noticed download available from FDA; saved for author screening

10/12: Used google.com to navigate to the Anesthesia Society of America (www.asahq.org). 2] Scrolled to bottom, chose "Find Standards and Practice Parameters" under "Popular" heading. 3] Chose "Standards for Basic Anesthetic Monitoring" under "Standards" heading. 4] Saved for author screening.

10/12: Used google.com to navigate to MHAUS (www.mhaus.org). Clicked on "Healthcare Professionals" on the top navigation bar. 2] Clicked on "MHAUS Recommendations". 3] Clicked link to view recommendations. 4] Browsed recommendations, saved for author screening. (x7)

10/12: Used google.com to navigate to "Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection." 2] Chose first result. 3] Saved for author review.

10/13: Used google.com to navigate to the Amer Assn of Nurse Anesthesiology (www.aana.com). 2] Chose first result, identifying itself as the AANA. 3] Chose "Practice" drop-down from top navigation bar. 4] Chose "Clinical Practice" from the "Practice" menu on the Right. 5] Chose "Professional Practice Manual". 6] Chose "Sections of the Manual". 7] Scrolled down to "Standards for Nurse Anesthesia Practice"; saved for author screening.

10/13: Used google.com to navigate to the Amer Assn of Nurse Anesthesiology (www.aana.com). 2] Chose first result, identifying itself as the AANA. 3] Chose "Practice" drop-down from top navigation bar. 4] Chose "Clinical Practice" from the "Practice" menu on the Right. 5] Chose "Professional Practice Manual". 6] Scrolled to "Position Statements" heading and expanded section. 7] Browsed results; saved for author screening.

10/13: Used google.com to navigate to the Amer Assn of Nurse Anesthesiology (www.aana.com). 2] Chose first result, identifying itself as the AANA. 3] Chose "Practice" drop-down from top navigation bar. 4] Chose "Clinical Practice" from the "Practice" menu on the Right. 5] Chose "Clinical Practice Resources". 6] Scrolled to "Malignant Hyperthermia". 7] Browsed results; saved for author screening.

PUBLICATION HISTORY

- Originally published as Recommended Practices for the Prevention of Unplanned Perioperative Hypothermia in Perioperative Standards and Recommended Practices, 2008 edition.
- Minor editing revisions made to omit PND codes; reformatted September 2012 for publication in Perioperative Standards and Recommended Practices, 2013 edition.
- Minor editing revision made in November 2014 for publication as Guideline for Prevention of Unplanned Perioperative Hypothermia in Guidelines for Perioperative Practice, 2015 edition.
- Revised November 2015 for online publication as Guideline for Prevention of Unplanned Patient Hypothermia in Guidelines for Perioperative Practice.
- Revised 2019 for online publication in Guidelines for Perioperative Practice.
- Revised and renamed Guideline for Patient Temperature Management (added recommendations for MH prevention) December 2024 using PRISMA2020 for publication in Guidelines for Perioperative Practice online.
- Scheduled for review 2029.