EDITORIAL

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# Closing the Perioperative Temperature Gap: Lessons from Implementation Science

Busy clinicians are faced with a constantly expanding body of published literature. The wealth of evidence available to improve patient outcomes and health system efficiency is enormous and growing. The prospect of applying best practice based on a mass of data, even with consensus of certain themes, is usually characterized by significant delays from bench to bedside. Most published data will not achieve widespread adoption. When scientific evidence does make the transition to practice improvement the lag between generating evidence and routine clinical use is estimated to be 17 years.[1] Addressing this evidence-to-practice gap is the primary focus of implementation science.

The evidence-to-practice gap is not merely academic. Experienced clinicians can typically cite examples of fundamental safety practices that fail to occur reliably in their institutions. Perioperative temperature management is a case in point. A period-prevalence study of five Australian hospitals (1,690 surgical patients) observed that more than half of the patients had just two or fewer temperature measurements during the entire surgical pathway.[2] Notably no temperature was recorded at any stage before the Post-Anaesthetic Care Unit (PACU) arrival in one third of patients. In PACU, temperature monitoring was near-universal but in many ways not soon enough, with approximately one third of patients unintentionally hypothermic post-operatively. This is the "perioperative temperature gap". Guidelines and devices are at hand, yet systems fail to deliver routine, risk-aligned warming and monitoring that would benefit our patients and healthcare systems.

The most sobering finding in this multi-site prevalence study is that emergency and ASA IV patients had the lowest monitoring rates.[2] Closing the temperature gap is therefore also an equity agenda. Implementation plans should prioritise high-risk operating lists and shifts (after-hours, weekends), stratify dashboards by urgency and severity of illness, and make equity an explicit success criterion, not a post-hoc consideration.

Effectiveness research determines whether an intervention works and provides the foundation for evidence-based practice. Implementation science is defined as the scientific study of methods to promote the systematic uptake of research findings and other evidence -based practice into routine practice, and hence improve the quality and effectiveness of health services and care.[3] Implementation research asks how people and organisations will do an evidence-based intervention sustainably and at scale.

Quality improvement activities are important and complement implementation science but are distinct.[4] Quality improvement tackles local problems with methods that may not be broadly applicable or scalable. Implementation science seeks generalisable, assessable methods to embed and spread change across settings. Perioperative practice needs both, but only an implementation lens will close a persistent, system-level issue, such as the perioperative temperature gap.

Implementation science has been criticized for inconsistent strategy, terminology and under-measurement of implementation outcomes (acceptability, appropriateness, feasibility, adoption, fidelity, sustainability).[5] Perioperative programs should also resist 'black box' bundles without characterizing components transparently.

Effectiveness research and implementation science can be brought together. The GLOW trial operationalises a hybrid study design with co-primary outcomes (PACU hypothermia, as well as the extent of monitoring and warming).[6] Team-based facilitation, local adaptation

within a common framework, and an economic evaluation are proposed. This approach may develop templates that can be adopted by perioperative services beyond the study sites. By reporting implementation outcomes alongside clinical outcomes, results should be generated that other services can reproduce and regulators can recognise.

Detailed guidelines can overwhelm busy clinical teams. As a prerequisite of the GLOW trial, a national, multidisciplinary consensus distilled the perioperative thermal care evidence and guidelines into three simple principles: (1) monitor core temperature frequently; (2) warm actively; (3) minimise exposure throughout the perioperative pathway.[7] These principles established non-negotiables, against which fidelity can be determined. Local teams can adapt workflows including device selection, handover checklists, and electronic medical record (EMR) automations. This 'principled adaptation' preserves predictability without succumbing to idiosyncratic alteration that dilutes the intervention.

Improvements that depend on champions tend to fade. Contemporary implementation rationale emphasises building scalable units.[5] To address the perioperative temperature gap, this could include a local multidisciplinary 'warmth' team (including an internal facilitator) supported by a regional facilitation hub that coaches sites, maintains fidelity, and curates a concise set of indicators. Further support could be added as a broader (perhaps national) learning network that spreads and sustains effective implementation strategies.

Closing the gap also requires stopping practices that are unsafe or wasteful. One example of this would be the use of active warming without concurrent temperature monitoring. This appears to be regular practice and is at odds with the basic principle of titrating treatment based on response. Another example may be skipping pre-anaesthesia temperature checks due to an emphasis on throughput, only to 'discover' hypothermia in PACU and prolong discharge due to rewarming requirements. De-implementation (stopping things that do not help) and avoidance of mis-implementation (the mistake of de-implementing things that work) should be anticipated and strategies embedded as components of perioperative temperature programs.[4]

Artificial intelligence, continuous monitoring devices, and automated data-capture systems promise to accelerate improvements in perioperative care by reducing documentation burden, signaling risk earlier, and supporting real-time decision making. Emerging large language model (LLM) tools can help generate concise handover summaries, translate complex guidelines into simple checklists, and provide rapid access to evidence.[8] Reliable, passive background processes may also be provided by integrated temperature dashboards and EMR-linked sensors.[9]

Highly capable innovations may be abandoned when they are difficult to use, poorly integrated, or misaligned with clinical workflow. By looping implementation science principles back into technology selection, perioperative teams may ensure they adopt innovations because they fit the clinical problem, integrate cleanly with workflows, minimise cognitive load, and deliver quantifiable value.[8] In this way, AI and digital systems may become enablers rather than distractions. By making the right thing easier to do and reinforcing fidelity to best-practice, thermal care could become a dependable property of the system rather than vulnerable to the effort of individuals.

Measured early and often, warmed wisely, and implemented scientifically, perioperative temperature management can move from well-meaning intention to reliability. Even if the only improvement was fewer chills and shivers in the recovery room, patient experience would justify the effort. Beyond that, closing the perioperative temperature gap will result in fewer perioperative complications, faster recovery, and a standard of care that keeps people warm and safe by design, not by chance.

## CONFLICT OF INTEREST

Prof. Sturgess serves as a Key Opinion Leader for Solventum (previously 3M Healthcare). No financial support was received for the preparation of this editorial, and Solventum had no role in its content.

## REFERENCES

1. Balas EA, Boren SA. Managing clinical knowledge for health care improvement. In: Bemmel JH, McCray AT, editors. Yearbook of Medical Informatics 2000: Patient -Centered Systems. Stuttgart: Schattauer; 2000. p. 65-70.
2. Munday J, Delaforce A, Heidke P, et al. Perioperative temperature monitoring for patient safety: A period-prevalence study of five hospitals. Int J Nurs Stud. 2023;143:104508. doi:10.1016/j.ijnurstu.2023.104508.
3. Eccles MP, Mittman BS. Welcome to Implementation Science. Implement Sci. 2006;1:1.
4. Chu F. Implementation science: why should we care? J Med Libr Assoc. 2024;112(3):281-285. doi:10.5195/jmla.2024.1919.
5. Fixsen DL, Van Dyke MK, Blase KA. Is implementation science a science? Not yet. Front Public Health. 2024;12:1454268. doi:10.3389/fpubh.2024.1454268.
6. Munday J, Duff J, Wood FM, et al. Implementing Guidelines for hypothermia prevention with Local adaptation to keep periOperative patients Warm (GLOW): protocol of a stepped-wedge cluster randomised hybrid type II effectiveness-implementation study. BMJ Open. 2025;15:e091577. doi:10.1136/bmjopen-2024-091577
7. Munday J, Duff J, Wood FM, et al. Perioperative hypothermia prevention: development of simple principles and practice recommendations using a multidisciplinary consensus-based approach. BMJ Open. 2023;13:e077472. doi:10.1136/bmjopen-2023-077472.
8. Reddy S. Generative AI in healthcare: an implementation science informed translational path on application, integration and governance. Implement Sci. 2024;19:27. doi:10.1186/s13012-024-01357-9.
9. Munday J, Sturgess D, Oishi S, et al. Implementation of continuous temperature monitoring during perioperative care: a feasibility study. Patient Saf Surg. 2022;16:32. doi:10.1186/s13037-022-00341-w.

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