

Targeted Temperature Management to Improve In-Hospital Cardiac Arrest Outcomes in the Pediatric Intensive Care Unit

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BACKGROUND

- Less than 40% of children who have an in-hospital cardiac arrest (IHCA) survive.¹⁻²
- A bundled approach to managing post-cardiac arrest syndrome is recommended to mitigate ongoing injury and prevent secondary injury.³⁻⁷
- Targeted temperature management (TTM) is a critical element.³⁻⁸

LOCAL PROBLEM

- The project setting was a 20-bed Pediatric Intensive Care Unit (PICU) in an urban, free-standing children's hospital.
- In 2023, no IHCA patients received TTM within 24 hours of return of spontaneous circulation (ROSC).
- The project's purpose was to implement TTM for IHCA patients in the PICU.
- The project aims were:
 - ≥80% IHCA patients receive orders for TTM within one hour of ROSC
 - ≥80% IHCA patients are placed on a homeothermic blanket within two hours of ROSC

METHODS

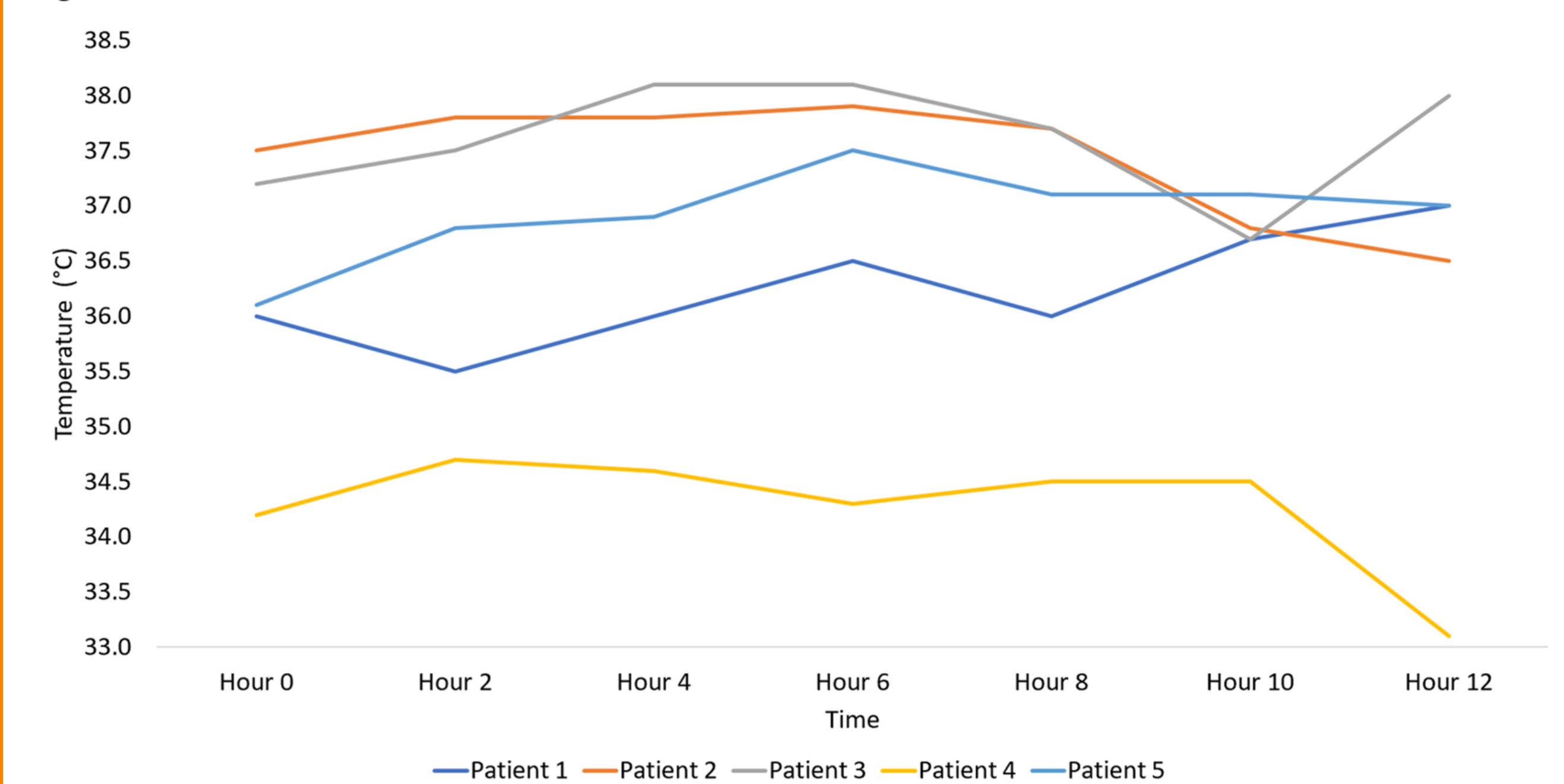
- The Evidence-Based Process Improvement model was utilized as the framework for this project.⁹
- A TTM protocol was developed after literature synthesis.^{3-4, 8}
- We implemented the TTM protocol via PDSA (Plan-Do-Study-Act) cycles (September 2024 – February 2025).
- Process measures were adherence to TTM order entry, homeothermic blanket use, and core temperature monitoring.
- Outcome measures were temperature, length of stay, survival, and discharge morbidity.

INTERVENTIONS

- An algorithm and brief user video (accessed by QR codes) were created and attached to the homeothermic blanket machine.
- Recorded PowerPoint presentation with algorithm and user video shown at regular intervals to staff.
- TTM protocol was indicated for all PICU, OR, and ward IHCA events lasting >4 min with ROSC.

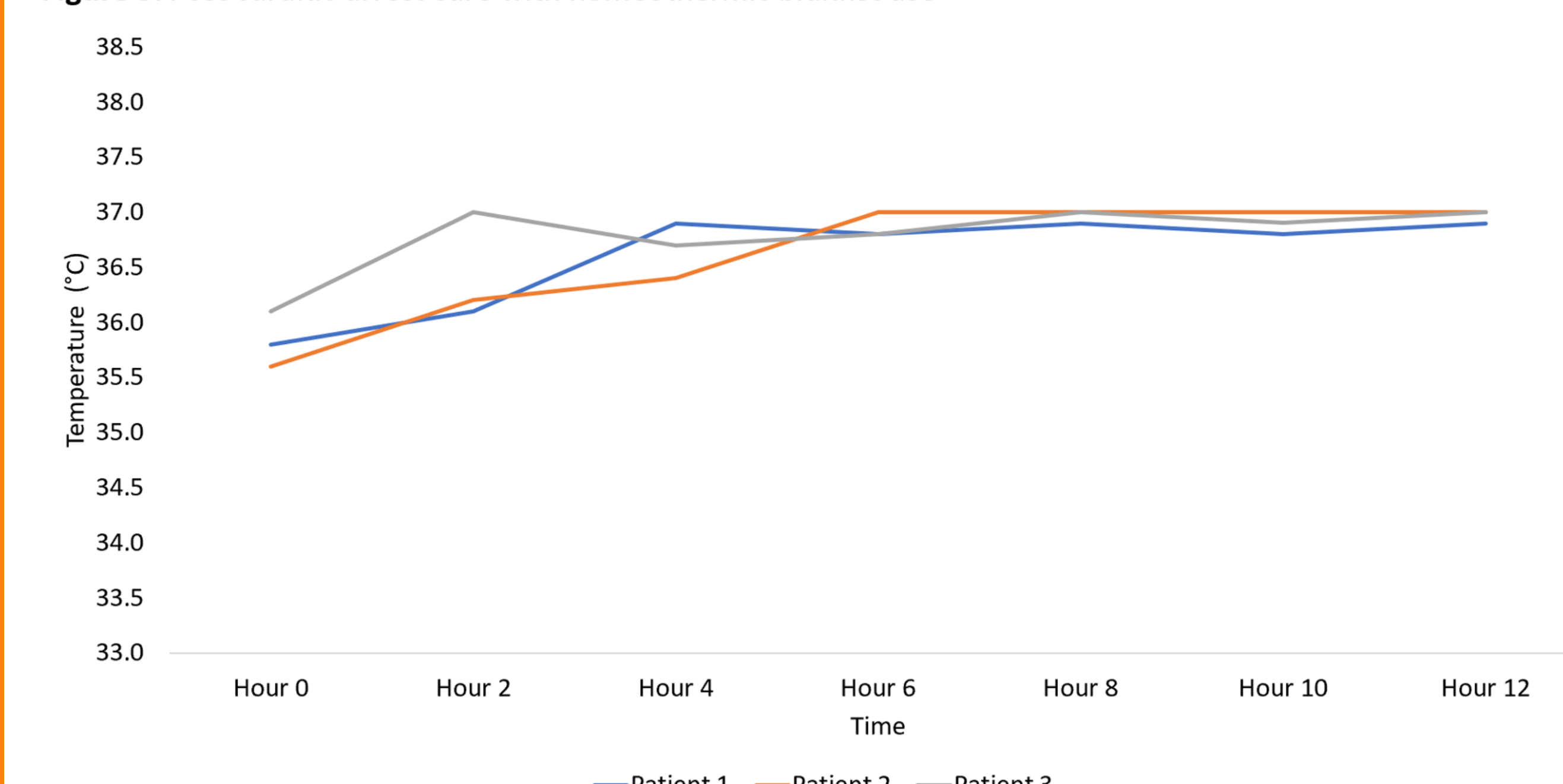
Avoidance of hyperthermia and maintenance of normothermia is associated with improved survival.

Figure 2. Post cardiac arrest care with no homeothermic blanket use



Patients not placed on a homeothermic blanket after surviving cardiac arrest exhibited fluctuating temperatures. Patient 3 had a sepsis diagnosis and was the only patient to receive acetaminophen (at Hour 4) during the first 12 hours post cardiac arrest. Patient 4, an infant whose temperature was regulated by a radiant warmer with a skin probe, died four days later.

Figure 3. Post cardiac arrest care with homeothermic blanket use



Patients placed on a homeothermic blanket within two hours of surviving a cardiac arrest exhibited stable temperatures within the goal parameters of 36 – 37.5°C.

Table 1. Outcome measure differences between treatment groups

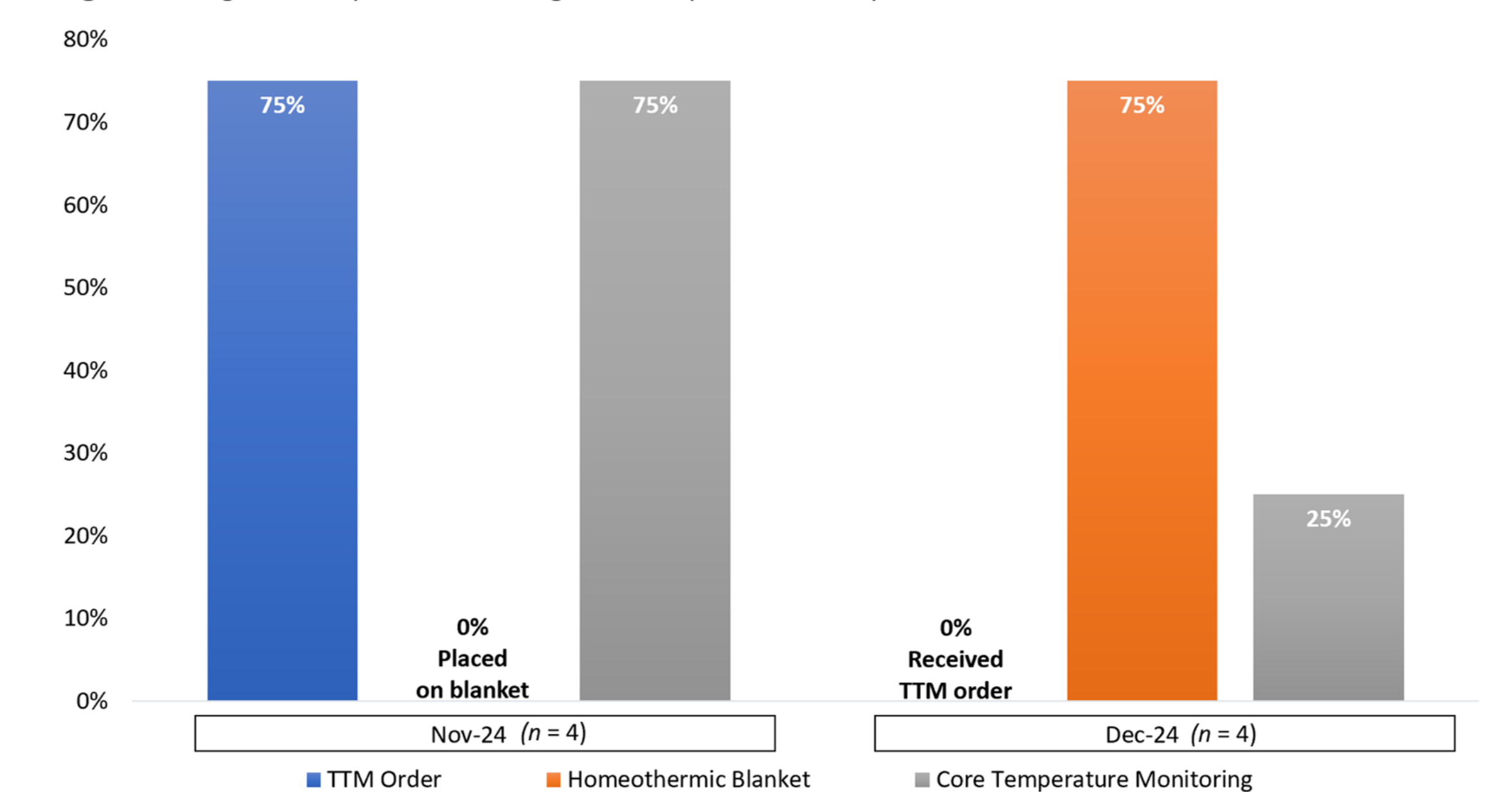
Outcomes	Total Sample (N = 8)	Homeothermic Blanket Use (n = 3)	Non-Homeothermic Blanket Use (n = 5)
Temperature (°C)			
Maximum	38.1	37	38.1
Minimum	33.1	35.6	33.1
Mean	36.6 ± 1.1	36.7 ± 0.4	36.5 ± 1.3
PICU LOS, days	15 ± 15	21.3 ± 24.6	11.2 ± 6.2
PICU survival	4 (50%)	2 (66.7%)	2 (40%)
PICU discharge morbidity	4 (50%)	2 (66.7%)	2 (40%)

PICU= pediatric intensive care unit; LOS = length of stay. PICU LOS reported as mean and standard deviation. Temperature minimum, maximum, and mean with standard deviation reported for 12 hours post-return of spontaneous circulation. PICU discharge morbidity reported as patients receiving a Pediatric Overall Performance Category score of 1, indicating good neurological outcome with no deficits.

RESULTS

- Initial TTM order adherence and core temperature monitoring were at 75% (Figure 1).
- Homeothermic blanket use increased to 75% in December, despite no TTM orders (Figure 1).

Figure 1. Targeted temperature management implementation process measures



TTM= Targeted Temperature Management. TTM order indicates the order was placed within 1 hour of return of spontaneous circulation (ROSC). Homeothermic blanket indicates the blanket was applied within 2 hours of ROSC. Core temperature monitoring indicates that gastric (via nasogastric tube probe) or bladder (via urinary catheter bladder probe) temperature monitoring was initiated within 2 hours of ROSC.

- Mean temperature was similar in both groups, however temperature range differed significantly (Table 1).
- A broad and clinically concerning temperature range was observed in the non-homeothermic blanket group (Table 1), along with a more variable temperature trend (Figure 2).
- The homeothermic blanket group exhibited tightly controlled temperature range (Table 1) with minimal variability (Figure 3).
- PICU survival and discharge morbidity improved with homeothermic blanket use (Table 1).

CONCLUSIONS

- IHCA is a high risk, low frequency event.
- Long-term process monitoring and patient outcome evaluation are required to establish definitive conclusions.
- A concurrent EMR change and blanket supply shortage complicated implementation.
- The scarcity of IHCA events makes both initial adoption and sustained adherence to practice change exceptionally challenging.
- Despite challenges and a small sample size, results suggest TTM with a homeothermic blanket improves outcomes for pediatric IHCA patients.



Scan for contact information and reference list.

FUNDING DISCLOSURE: This project was funded by the Project Site's Quality & Safety Innovation Grant