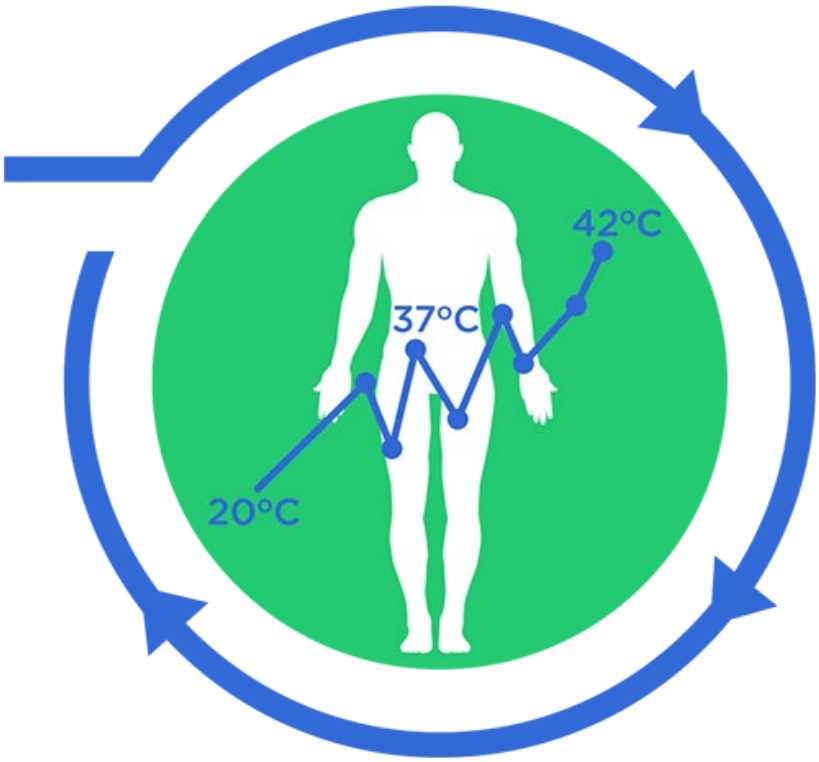
Hato Hone St John

Focused Clinical Review:

Temperature Recording in Trauma Patients



Clinical Audit and Research
Leading Edge

September 2023

Introduction

Acidosis, hypothermia, and coagulopathy are often referred to as the "lethal triad" in trauma and the link between hypothermia and poor outcomes in major trauma patients has been well documented (van Veelen, 2021).

A recent observational study undertaken at Christchurch Hospital aimed to identify factors contributing to the death of trauma patients with major haemorrhage (Carne, et al., 2023). Their study reaffirmed the link between low body temperature and death secondary to haemorrhage in trauma. They considered temperature to be a potentially modifiable risk factor in the pre-hospital setting.

This focused clinical review aimed to quantify the effectiveness of Hato Hone St John (HHSJ) clinicians in identifying and correcting hypothermia in major trauma patients.

Objectives

1) To evaluate the proficiency of HHSJ clinicians in documenting temperature in major trauma patients.
2) To evaluate how effectively HHSJ clinicians treat low body temperature in major trauma patients.

Methods

HHSJ electronic Patient Report Forms (ePRFs) were retrieved for all incidents between 1 January - 30 June 2023. All status 0 (deceased) patients were excluded.

Two approaches were taken to identify major trauma patients.

i) The major trauma clinical impression cohort: those with a primary or secondary clinical impression of 'Major trauma involving multiple body regions'.
ii) The high acuity trauma cohort: those with an initial or final status <3, and an ACC case code.

The number of temperature recordings was determined from the vital sign section of the ePRF and comparisons were made within genders, ethnicities and age groups.

A subset of ePRFs with temperature readings <35°C were reviewed for (a) the recognition of hypothermia in the free text and (b) attempts to warm the patient.

Results

<u>Cohort 1: Major trauma involving multiple body regions.</u>

In the 6-month review period, there were 414 ePRFs with a primary or secondary clinical impression of "major trauma involving multiple body regions". Half of these had no temperature recording in the ePRF. Only 7% had two or more temperature recordings (Figure 1).

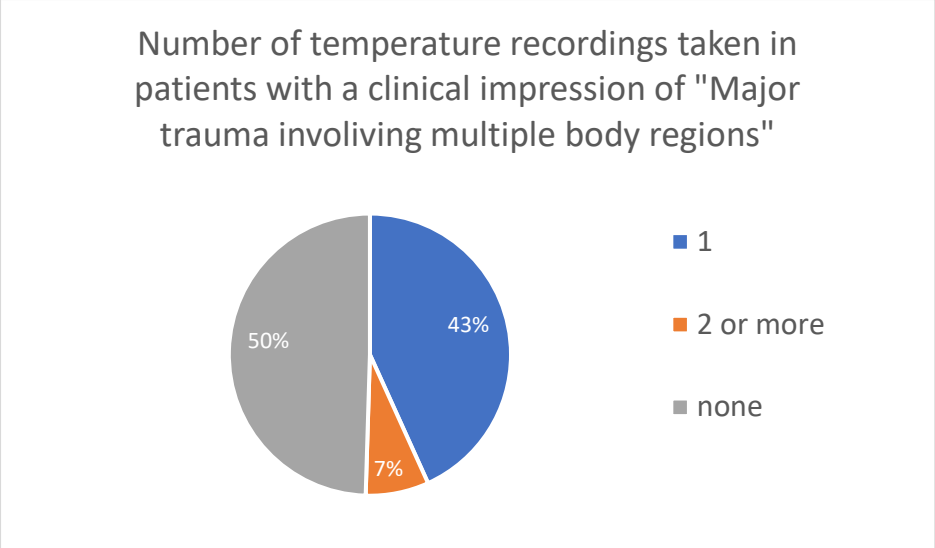


Figure 1: Frequency or temperature recordings in cohort 1

Of the 209 ePRFs with at least one temperature recording, twelve (6%) had an initial temperature reading below 35°C. Only two of these twelve (17%) had a second temperature recorded, both with no change between the initial and final recordings.

There was no mention in the free text of the low body temperature for two-thirds (n=8) of the 12 ePRFs with temperature readings below 35°C. Only 3 ePRFs detailed attempts to warm the patient; one by using blankets, one by increasing the temperature within the ambulance and the last was non-specific, stating “plan made to warm pt”.

Cohort 2: High acuity trauma

In the 6-month period, there were 6,235 ePRFs with an ACC case type and an initial and/or final status of 1 or 2. Seventy-two percent of this cohort had at least one temperature recording, and 9% had more than 1 temperature recorded (Figure 2).

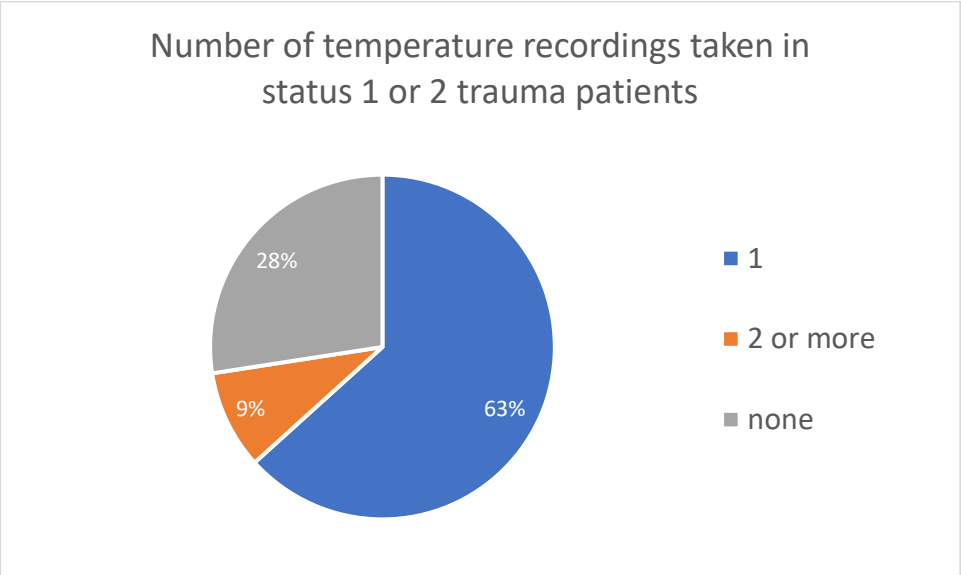


Figure 2: Frequency of temperature recordings in cohort 2

Of the 4,524 ePRFs with at least one temperature recording, 212 (5%) had an initial temperature reading below 35°C. Only 37% (n=79) of these had a second temperature recorded. The median

change between the initial and final temperature recordings for these 79 patients was an increase of 0.7°C (IQR: 0.2-1.3°C).

Twenty ePRFs with a temperature recording below 35°C were randomly selected for freetext review. Of these, 8 (40%) mentioned the patient's low body temperature and 5 (25%) detailed attempts to re-warm the patient. Two patients were warmed by blankets alone, two with the ambulance heater and blankets and the last was non-specific.

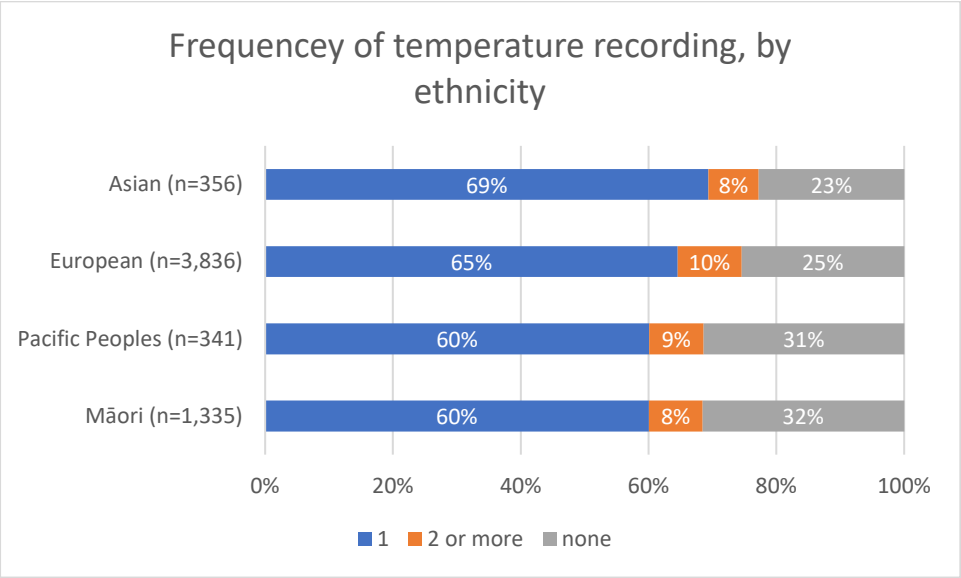


Figure 3: Frequency of temperature recording in cohort 2, by ethnicity

Figure 3 shows the frequency of temperature recordings by prioritised ethnicity. The ethnicity is determined by Manatū Hauora Ministry of Health records, except in cases where this is missing, then the ePRF ethnicity has been used. In cohort 2, a higher proportion of European and Asian patients had at least one temperature recording compared with Māori and Pacific Peoples.

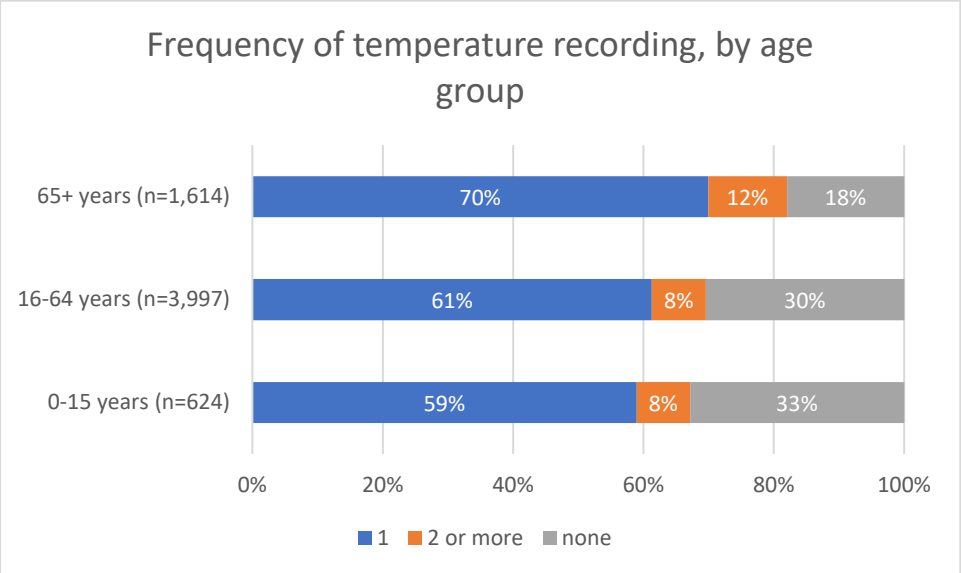


Figure 4: Frequency of temperature recording, by age group

The frequency of temperature recording in cohort 2 increased with the age of the patient (figure 4). A higher proportion of those aged over 64 years had at least one temperature recording, compared with those aged under 16 years (82% vs 67%).

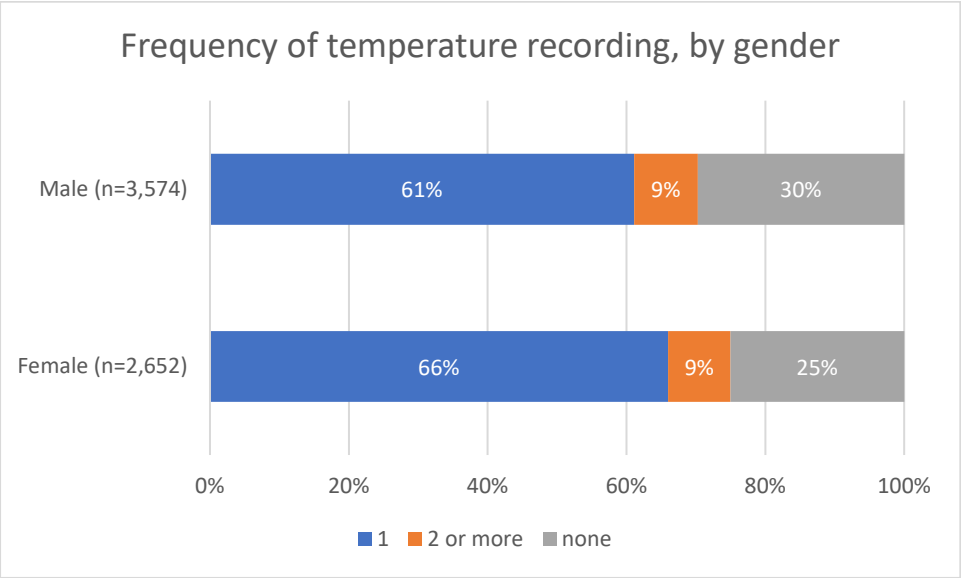


Figure 5: Frequency of temperature recording, by gender

Figure 5 shows a slightly higher proportion of female patients in cohort 2 had at least one temperature recording when compared with males (75% vs 70%).

Discussion

Major trauma occurs infrequently. Depending on the definition, major trauma incidents make up between 0.2% – 3% of all HHSJ ambulance attendances. Major trauma scenes are often chaotic, involving multiple emergency services, hazards, and multiple complex patients. The patient's body temperature can be seen as a low priority. However, hypothermia is a recognised risk factor for poor outcomes in major trauma. Therefore ideally, all major trauma patients would have their temperature recorded pre-hospitally, and treatments to reverse hypothermia should begin as soon as possible. The NZ Emergency Ambulance Service Clinical Practice Guidelines (CPGs) specify that patients with hypovolaemia from bleeding should be kept warm.

Our results found at least one temperature recording in 50-75% of major trauma ePRFs, and multiple temperature recordings in only 7%-9%. Our small sample of those with an initial temperature below 35°C, indicates that most clinicians do not adequately recognise or attempt to reverse low body temperature in major trauma patients.

It is likely that warming methods are under-documented. Many clinicians provide all their patients with a blanket regardless of their body temperature, and the ambulance is likely to be heated on winter days. However, the absence of any mention of hypothermia in the majority of the ePRFs with an initial temperature below 35°C suggests that low body temperature is not given much focus in patients with major trauma.

Limitations

A limitation of this review is the broad definition of major trauma. The study by Carne, et al. (2023), was limited to patients with severe haemorrhage following major trauma. In addition, emerging

research suggests that targeted temperature management can offer neuroprotection following traumatic brain injury (TBI) (Trieu, et al., 2023), although this treatment is not currently standard practice and is not within the CPGs.

Another recognised limitation is the tympanic thermometers available in HHSJ ambulances. These are unsuitable for use in infants and may give incorrect readings in some circumstances (e.g., in drowning patients whose ear canal has been flooded) (Skaiaa, et al, 2015).

Key findings

- Temperature should be recorded in all high-acuity trauma patients. Currently, at least 25% of these patients have no temperature measurement in the ePRF.
- Whenever possible, multiple temperature measurements should be documented to show trends. Currently, only 9% of high acuity trauma patients have more than one temperature recorded.
- A hypothermic finding should dictate an attempt to warm the patient pre-hospitally. Our small review found 75% of hypothermic major trauma patients have no documented rewarming.

References

Carne, B., Raina, A., Bothara, R., McCombie, A., Fleischer, D., & Joyce, L. R. (2023). Factors contributing to death of major trauma victims with haemorrhage: A retrospective case–control study. *Emergency Medicine Australasia*, https://doi.org/10.1111/1742-6723.14275.

Skaiaa, S. C., Brattebø, G., Aßmus, J., & Thomasse, Ø. (2015). The impact of environmental factors in pre-hospital thermistor-based tympanic temperature measurement: a pilot field study. *Scandinavian journal of trauma, resuscitation and emergency medicine*, 23,72. https://doi.org/10.1186/s13049-015-0148-5.

Trieu, C., Rajagopalan, S., Kofke, W. A., & Cruz Navarro, J. (2023). Overview of Hypothermia, Its Role in Neuroprotection, and the Application of Prophylactic Hypothermia in Traumatic Brain Injury. *Anesthesia and analgesia*. https://doi.org/10.1213/ANE.0000000000006503

van Veelen, M. J. (2021). Hypothermia in Trauma. *International journal of environmental research and public health*, 18(16),8719. https://doi.org/10.3390/ijerph18168719.