

Challenges and objections to body temperature monitoring among pre-hospital personnel. A modified nominal group technique study.

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Abstract

Background: Hypothermia is common and correlates with mortality and morbidity for emergency patients, but a pre-hospital temperature measurement is often omitted.

Objectives: To investigate barriers that pre-hospital care (PHC) providers experience with temperature monitoring, and solutions to the problem.

Study design: Modified nominal group technique.

Materials and methods: Fourteen PHC providers from air and ground services were invited to the study. Initially, each participant was asked to suggest through e-mail topics of importance regarding barriers to pre-hospital thermometry. Afterwards, they received a list of all disparate topics, and were asked to individually rank the topics after importance. The top ranked topics were discussed in a consensus meeting. The meeting was audio-recorded, and a transcript was written and then analyzed through an inductive thematic analysis.

Results: Thirteen participants accepted the invitation. 63 suggestions were reduced to 24 disparate topics after removal of duplicates. Twelve highly ranked topics were discussed during the consensus meeting. Thematic analysis revealed 47 codes that were grouped together into six overarching themes, of which four described challenges to monitoring and two described potential solutions: Equipment dissatisfaction, little focus on patient temperature, fear of iatrogenic complications, thermometry is subordinated, more focus on temperature, and simplification of thermometry.

Conclusion: To increase the rate of temperature measurement on correct indication, we suggest introducing PHC protocols that specify patients and conditions where proper temperature measurement should have a high priority. Furthermore, there is a profound need for more suitable techniques for temperature monitoring in the pre-hospital setting.

Strengths and limitations of this study

- Hypothermia is a well-studied topic, but as far as the authors know, no previous studies have qualitatively assessed which challenges pre-hospital care (PHC) providers experience when measuring body temperature.
- Topics of discussion were determined prior to the consensus meeting, to avoid verbally dominating group members from affecting the individual responses.
- Several different personnel categories within PHC were included to ensure a rich variety of perspectives in the generation of topics.
- Only one researcher coded and analyzed the data, which introduces a risk of losing potential insight presented by another researcher.
- One of the researchers worked within PHC prior to and during the study, which entails a risk of introducing researcher bias to our results.

Background

A stable human body temperature is essential to preserve proper organ function. Core temperature is strictly regulated through thermoregulation, and small deviations trigger physiological compensatory mechanisms (1). Accidental hypothermia is defined as an involuntary drop in core temperature below 35°C and much emphasis has been placed on severe reduction of the core temperature (1). However, several studies have reported that even less profound hypothermia independently increases mortality and morbidity in trauma patients (2-10), although some authors conclude otherwise (11, 12). Hypothermia may cause coagulopathy with consecutively increased hemorrhage (9, 10, 13, 14), and it reduces the hemoglobin's ability to release oxygen to tissues, increasing oxygen debt (10). Furthermore, hypothermia might have detrimental effects on cardiac, pulmonary, renal and neurologic functions, with the potential of cardiac arrest and coma (9, 10, 15, 16), and it is uncomfortable for the patient (17, 18). Studies from the more controlled perioperative setting have also demonstrated how hypothermia is associated with increased transfusion rates (13, 14, 19), wound infections (20, 21) and cardiovascular mortality, as well as delayed wound healing and prolonged hospital stay (18). Finally, core temperature is important in several treatment and

patient triage algorithms, and critical for correct triage of patients suffering from cardiac arrest or victims to avalanche or drowning (22).

Hypothermia is a common finding in severely injured patients (2, 3, 7, 23, 24), and these patients lose temperature both at the site of accident and during transport to the hospital (25). Pre-hospital services have several ways of preventing hypothermia (26), but in order to combat its many adverse effects, the problem must be acknowledged by measuring an early and precise body temperature. For this reason, one might expect that temperature monitoring and actions to preserve normal body temperature has high priority in the treatment of emergency patients. However, measurement is often omitted in early stages of patient treatment (2). The lack of a universal standard for proper pre-hospital body temperature measurement combined with the variety of methods available might contribute to this (10, 27-29). Regardless, the omission of temperature measurement and consecutive temperature conservation in hypothermic patients reduces the overall quality of health care that the emergency medical services (EMS) can deliver.

Northern Norway is characterized by cold climate and a vast geographical area, which makes for challenging work environments for the EMS. Patients in this region – many far from nearest hospital – are susceptible to developing hypothermia, which makes optimal patient treatment demanding. Assessing potential hypothermia and preventing further progression is essential for many patients. Several studies have been conducted on hypothermia and its adverse effects, but as far as the authors know, no previous studies have addressed which challenges and objections the EMS personnel experience when measuring body temperature. For this reason, we invited pre-hospital care (PHC) providers to a consensus process about their attitudes and perceptions around temperature monitoring, and which challenges they face when attempting to monitor body temperature. We also invited the same participants to suggest solutions to the problems they were facing. The overall objective of the study was to increase the rate of temperature measurement on correct indication, and thus contribute to increase the quality of health care provided to patients in the pre-hospital setting.

Materials and methods

Study design

We used a modified nominal group technique (NGT) to define topics relevant for discussion and a subsequent thematic analysis. The NGT was originally developed by Delbecq and Van de Ven (30), and is closely related to focus group discussions. We modified the NGT in the sense that potential topics and rankings of said topics were gathered through e-mail prior to the consensus meeting.

Study participants

We invited a purposeful sample of fourteen participants who were known as opinion holders in the University Hospital of North Norway (UNN) EMS (31). Participants were invited by telephone. The sample included fixed wing (FW) flight nurses, helicopter EMS (HEMS) physicians and ground ambulance (GA) paramedics. Upon invitation, a short brochure written by the research team, describing the importance of the topic and reason for conducting the study, was shared with the participants. The participants were encouraged to avoid discussing the study with each other before the consensus meeting. This was to minimize the possibility of dominant group members affecting the individual responses with their opinions, with the potential of losing valuable information (32). The number of employees, and the different categories of employees, was deemed adequate to ensure both a rich variety of themes, and an adequate representation of all personnel categories in the final group discussion.

Consensus process

Phase one – Open suggestions

Participants were asked to list up to five challenges with, or objections to, pre-hospital temperature measurement based on their own experience. They responded by e-mail to the research team. Short explanatory comments could be included if necessary. All suggestions were sorted by the authors; duplicates were removed, and a list of all disparate suggestions was compiled.

Phase two – Ranking of the suggestions

The list of all disparate suggestions was e-mailed back to the participants, and they were asked to individually rank the top ten suggestions according to relevance and importance. At this point, the participants were informed that the ten highest ranked suggestions overall would be discussed in detail in the upcoming group discussion. Ten was deemed a feasible number to cover during a one-day consensus meeting.

An overall ranking was then calculated from the individually submitted rankings by awarding ten points to the highest ranked suggestion, nine points to rank two, and so on. In addition, two points were awarded whenever a suggestion was included in a participant's top ten list, similar to the methodology by Fevang et al. (33).

Phase three – Consensus meeting

The top ten ranked suggestions from phase two were discussed from top to bottom in a one-day consensus meeting. In addition, one highly ranked suggestion brought up by the FW-nurses and one from HEMS doctors that did not reach the overall top ten were included. This was because these groups were relatively under-represented during the ranking process.

The physical meeting took place in February 2019 at the University of Tromsø (UiT) and lasted for six hours, including breaks. The authors acted as group moderator (KF) and secretary (RWS). Only participants and researchers were present. The meeting was audio-recorded, and written notes were taken. The moderator let all participants take turns to initiate discussion on the various suggestions, and they were allowed to make their points without interruption by the other participants before the rest could join the discussion of the topic. This was to ensure that all participants were actively involved and thus enhance discussion.

Phase four – Final comments and participant checking

A written summary describing the themes and subthemes produced from the analysis of the consensus meeting discussion, with explanations, was e-mailed to the participants for participant checking and to gather final comments, including those that did not attend the meeting. No participants provided additional feedback on the summary.

Analysis

One of the authors (RWS) transcribed the audio-recording from the meeting *ad verbum* with the recording on ear, ensuring a precise foundation of the research data. The participants were anonymized, before the transcript was re-read for familiarization, and memo notes about first impressions were made. A thematic analysis of the research data was conducted in an inductive manner, based on the guide written by Braun and Clarke (34). Inductive means that the themes were derived from the data, as opposed to a deductive approach where the analysis is driven by the researcher's pre-existing theories and ideas. The analytic process was approached with a realist framework, focusing on the individual participants' actual experiences and their described realities from the field regarding problems with pre-hospital temperature measurement. Themes were identified and approached at a semantic level, meaning that the analysis was conducted based on the surface meaning of the data, as opposed to a latent level which attempts to discover underlying meanings.

Initially an open coding was performed, by going thoroughly through the transcript and labelling all sentences and paragraphs thought to be relevant into codes. Next, a process of categorization was done; similar codes were grouped together under describing names, and initial codes regarded as irrelevant were discarded. Subsequently, codes were sorted into more general themes. These themes went through multiple modifications ensuring that all the relevant data was represented, before eventually being finalized. Subthemes were generated for comprehensive themes where appropriate. NVivo qualitative data-analysis software (QSR International, version 12) was used during the analysis, and the COREQ-checklist (35) was applied to ensure a thorough process.

Ethical considerations

Written, informed consent was obtained for participation and audio-recording from all participants.

Patient and public involvement

No patients involved.

Results

Thirteen out of fourteen invited employees agreed to participate, encompassing four FW flight nurses, four HEMS physicians, and five GA paramedics. Their PHC experience ranged from 5-25 years. Four participants were female. All thirteen took part in phases one and two, while only seven participated in phase three. The first phase generated 63 suggestions, which were reduced to 24 disparate suggestions after removing duplicates (Table 1). The top 10 overall suggestions included in the consensus meeting are shown in Table 2a, and the top 5 suggestions for the individual occupations are shown in Table 2b.

Two flight nurses (2/2 females), three anesthesiologists (0/3 females), and two paramedics (0/2 females) participated in the consensus meeting. Remaining participants were unable to attend due to busy time schedules (5/13) or illness (1/13).

During analysis, 47 codes were grouped together into six overarching themes, with a total of 12 subthemes (Figure 1). The research question was two-folded; therefore, the themes were split in two groups: Challenges and objections, and suggestions for solutions, consisting of four and two themes respectively.

Challenges and objections

Theme 1: Equipment dissatisfaction

Lack of adequate equipment for thermometry was emphasized as a prominent issue. Quick and simple methods such as axillary, tympanic, and oral measurement was deemed unreliable, thought to often give falsely too low values. *“And that is a feeling I have had several times. I have been sitting there, wondering why I am spending valuable time on getting that temperature measurement. I know that it won’t be correct.”* (Participant 13). This was explained as an important reason of omitting a measurement. Rectal probes were considered reliable, but in many situations inconvenient and difficult to establish properly, particularly when patients are already secured to the stretcher under clothes and duvet. This was also true for the axillary thermometer. *“Our patients are strapped to the stretcher for safety reasons. We cannot begin unbuckling them during transportation, and hence it’s a problem if we don’t establish a probe before we start transportation.”* (Participant 9). Seatbelts limiting personnel movement, and cramped space – especially inside the helicopter – further complicated this

issue. Furthermore, unbuckling while in motion violates the health, safety, and environment (HSE) regulations.

Discomfort was also an issue. Placing a rectal temperature probe was considered embarrassing and uncomfortable for both patients and personnel, especially with conscious patients. It was regarded as an invasion of privacy, especially if the indication of a temperature measurement was unclear. Regardless, all participants agreed that this threshold should be – and in most situations was – exceeded, and that a proper temperature measurement was done when indication was clear.

Discomfort with an esophageal probe was also brought up during the discussion. All participants agreed that this technique was only practically feasible in sedated patients because of the displeasure associated with the procedure. However, this was also difficult to establish correctly, and blind introduction of the probe entailed a risk of the probe curling back into the pharynx, measuring the pharyngeal temperature. A correctly established probe – which was considered reliable by the participants – may also initially give misleading readings if the stomach and esophagus are filled with cold liquids.

The participants considered it probable that lack of reliable equipment could be a useful excuse for not measuring patient temperature. In some situations, a subjective assessment of the patient's temperature (e.g., feeling the skin temperature with one's hand, or asking the patient if they were cold) could easily replace actual measurement. In other situations, a measurement would have no consequence because actions to preserve body temperature had already been taken, or a temperature measurement would not be relevant for the respective patient's presenting condition.

The participants emphasized the importance of being aware of equipment limitations. Uncritical use could lead to over-triage due to falsely low measurements, which in turn could lead to unnecessary use of resources – in worst case initiating the establishment of extracorporeal membrane oxygenation (ECMO) in unresponsive patients. Lastly, the assumption that the patients would have a new rectal probe placed after admission also led to omitting temperature measurement in some situations.

Theme 2: Little focus on patient temperature

According to the participants, body temperature was not fronted as very important in the professional environment. Unawareness of its importance could result in the temperature not being monitored. This was especially relevant in complex patients where hypothermia did not present itself as an obvious issue. *“I don’t see the point of doing a temperature measurement in a situation where I don’t understand why it is important or necessary, or what I should do with the result.”* (Participant 9).

Sometimes, thermometry was simply forgotten. This was partly explained by the abovementioned reasons. However, another important reason was that patients and PHC providers sometimes experienced ambient temperature differently. This was deemed relevant in situations where the personnel had worked hard physically. When warm and sweaty, it was simple to forget that the patient might be immobilized and cold. This discrepancy was especially relevant in the FW service, because the cabin heating outlet was placed close to the nurse’s position. However, the nurses were aware of this issue and regularly removed unnecessary personal clothing if they felt warm. This was more difficult in the HEMS where the crew normally is dressed for outdoor work even during flight - sometimes also including survival suits. Furthermore, neither the HEMS nor the FW services had cabin thermometers showing the ambient temperature, which the participants meant could serve as a reminder to check patient temperature.

Theme 3: Fear of iatrogenic complications

Fear of causing additional harm was brought up as an issue. Undressing the patient to measure the temperature would often conflict with temperature conservation measures. The participants emphasized the importance of considering whether exposing the patient to establish a temperature probe was worth it, or if it should be omitted to avoid heat loss. The possibility of inducing arrhythmias was also mentioned in severely hypothermic patients, especially those with a core temperature of 30 °C or below. Establishing an esophageal probe in these patients may provoke malignant arrhythmias, and this potential complication made the personnel reluctant to use rectal probes as well.

It was considered important to avoid patient exposure to cold environment, because of possible loss of body heat with its following complications. However, this was in many situations challenging. Even though the personnel actively attempted to keep high

temperatures inside the patient compartments, heat immediately escaped when doors were opened, especially during winter and in the helicopters which have big, sliding doors. Both the HEMS and FW environments are particularly exposed to cold temperatures, due to thin fuselages and high altitudes. FW nurses attempted to counter this issue with frequent use of blankets.

Theme 4: Thermometry is subordinated

It was emphasized that a critically ill patient with ABC-problems demands other priorities before measuring body temperature, which for this reason sometimes was delayed, omitted, or even forgotten. This was especially relevant for short missions with limited time for the necessary pre-hospital diagnostics and treatments. It also applied to situations requiring focused ABC-interventions followed by immediate transportation, where HSE measures limited access to the patient. *“In regard to forgetting, we have to remember that it’s called ABCDE. Exposure is at the bottom of the list, which means that we should always prioritize airways, breathing, circulation before we address the temperature. Obviously, there are patients where we might forget to conduct a temperature measurement due to having full focus on the basics”*. (Participant 5).

Suggestions for solutions

Theme 5: More focus on temperature

More departmental focus on body temperature was emphasized as an important solution to ensure more frequent temperature measurements, especially when it was clearly indicated. Increasing personnel enthusiasm was also believed to be important, by increasing awareness, especially in situations where it might not be obvious that the patient is at risk of hypothermia. *“I would like more training and understanding as to why a temperature measurement could be important. If I understand why it could be important to measure temperature on a patient who seemingly have no deviations in temperature, it might be easier to do”*. (Participant 9).

Developing clear guidelines was also suggested, e.g., by listing conditions and situations where thermometry should be considered because it has potential consequences for the patient. Such guidelines should also explain why measuring is relevant in a listed patient category. *“I believe the threshold for measuring would be lower if we had a list of “yes-*

patients” regarding temperature measurement. It would be easier to get at it if we know that our patient is within the target group where a temperature measurement is important, and that it will be valuable for those taking over after us”. (Participant 9).

Theme 6: Simplification of thermometry

Simplification of techniques and reliable methods could also increase the frequency of measurement. Rectal and esophageal probes are both available and reliable, albeit in many situations considered not applicable. The mini digital thermometer used in the HEMS instead of the larger multimonitor was one example of more applicable equipment. Simplifying the workflow also felt important, with reference to intubated HEMS patients, where thermometry has been included in the pre-anesthesia induction checklist, and the probe is placed in the intubation kit. A similar level of simplicity was requested for non-intubated patients. Lastly, several participants suggested that introducing cabin thermometers in the vehicles would help to remind them about temperature management.

Discussion

We have discovered several challenges and objections faced by PHC providers suggesting that pre-hospital thermometry still is an unsolved issue. The participants described lack of reliable equipment for temperature monitoring that was feasible prehospitally, and they stated that body temperature monitoring is not given high priority in the service. Fear of causing iatrogenic complications was also important, and temperature measurement was often subordinated other measures and even forgotten in time-critical situations. Some possible solutions were suggested: To increase focus on monitoring and conservation of patient temperature, and to facilitate the procedure as much as possible.

The study design, with collection of individually suggested topics before the participants met, reduced the potential influence of dominating personalities in the selection of topics (31). Several measures were also taken to minimize the impact of the researcher's own beliefs and thereby contamination of the results with subjectivity. Most of the communication prior to the meeting was done by the first author – a medical student with limited PHC experience. Furthermore, the topics for the group discussion were defined by the participants. The discussion was also driven solely by the participants, and the researchers actively avoided sharing their own ideas. Reflexivity was an important part of the methodological approach, especially since the group moderator also worked as an anesthesiologist at the UNN HEMS. Furthermore, we believe that a semantic, instead of a latent, analysis reduced the risk of bias, as an attempt to discover underlying ideas likely could be more prone to researcher bias. Participant checking was done after the analysis to ensure that the researchers' interpretations did not introduce bias. Direct participant quotes have also been included to support the analysis. We used the COREQ checklist to ensure a comprehensive and transparent reporting and inclusion of as many relevant aspects as possible (33).

The *ad verbum* transcription of the consensus meeting was written, coded, and analyzed by a researcher who was present at the meeting, which we believe gave us a better foundation to contextualize and tie verbal comments to non-verbal behavior, compared to paid external assistance with the transcription. Inconsistencies and incorrect transcription would have been a large source of bias contaminating analytic process, which we attempted to avoid.

Furthermore, having a fully transcribed data set, compared to relying solely on memory and

notes taken during the meeting, also reduced the risk of omitting anything important due to oversight.

The data was however coded and analyzed by just one researcher. This introduced a theoretical risk of losing insight presented by another researcher, but we attempted to reduce this risk by frequent discussions within the research group. Furthermore, participants were recruited from just one PHC center in Northern Norway, and potentially important insights from other centers is therefore not considered. Regardless, cold environmental temperature and patient hypothermia is not specific to our region, and we therefore believe that our results may be applied to other environments.

Personnel dissatisfaction with the available equipment was not surprising and has been described by others (29). Apart from this, the pre-hospital setting with challenging climate, tight spaces and inconvenient locations limits the feasibility of most methods for temperature monitoring. The discussion about a high threshold for using the rectal temperature probe further illustrates the issue. It is irrelevant that rectal temperature is reliable prehospitally if the personnel are reluctant to use it. However, this mainly appeared as a problem when the indication for a reliable measurement was unclear. We support the participants' suggestion of personnel education, together with protocols specifying patients and conditions where an accurate temperature measurement is important. This could reduce the risk of deliberate use of potentially unreliable techniques, such as axillary or tympanic probes, or in the worst case, to refrain from measuring at all (28, 29).

It must be emphasized that thermometry is not equally important in all patients. However, a correct measurement should be considered in selected groups where deviation from a normal core temperature has clear clinical implications, for treatment as well as for diagnostics. A consensus-based protocol, specifying that e.g., critically ill patients, patients in general anesthesia, and multi-trauma always should be monitored, may increase the frequency of temperature monitoring when the indication is strong.

Active patient temperature conservation was discussed during the group meeting. This might easily be forgotten in stressful clinical situations. More focus on temperature monitoring as well as protocols on temperature conservation would serve as reminders to always keep doors shut and frequently apply duvets, hypothermia bags and even external heaters for selected groups of patients.

Lastly, it is important to remember that the argument that simple measurement methods are considered unreliable is, however, only relevant in diagnosing hypothermia. It is unlikely that the equipment in use today will show a higher temperature than what is present, and thus an increased temperature should be trusted to confirm a fever, and a normal temperature excludes hypothermia. Still, the PHC environment awaits reliable and feasible techniques and equipment with such a level of simplicity that the personnel will not hesitate to measure temperature.

Conclusion

We have revealed several challenges with temperature monitoring in PHC and even suggestions for solutions to the apparent lack of monitoring. Based on the findings in the present study, we suggest introduction of PHC protocols for temperature measurement, with a list of patients and conditions where measurement should have high priority. We also believe that more focus on temperature in the professional environment, including personnel education, may be beneficial. Current equipment for temperature monitoring has a limited functionality outside the hospital, and there is a profound need for developing suitable techniques and equipment.

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Footnotes

Contributors: RWS and KF conceived the study. KF recruited the participants, while RWS collected and analyzed data prior to the consensus meeting. Both participated in the meeting, RWS analyzed the data, and drafted the manuscript. Both authors have revised and approved the final version.

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Patient consent for publication: No patients.

Ethical approval statement: The study did not include health related data and did thus not need approval from the Regional Ethical Committee. The study did not need approval from the UiT Data Protection Authorities as the participant consented to participate voluntarily and anonymously, and no sensitive information was collected.

Data availability statement: The transcript of the group discussion is in Norwegian language and is available upon reasonable request.

Table I. All disparate suggestions from the participants.

	Challenge or objection
A	Axillary thermometer is inaccurate and difficult to establish properly, especially in a moving vehicle
B	Thermometry is forgotten or omitted due to lack of time and/or it being subordinated other measures
C	Administration's accentuation of the costs of disposable equipment makes measuring demotivating
D	Undressing patients for rectal measurement exposes them to cold
E	Moving patients between vehicles may expose them to cold weather
F	Rectal measurement is considered contraindicated in patients with pelvic fractures*
G	Rectal measurement is considered unhygienic
H	Personnel experience high threshold for establishing a rectal probe
I	Body temperature is rarely requested upon patient handover at the emergency department
J	Temperature measurement may be omitted in favor of a subjective evaluation
K	Little focus on hypothermia in the professional environment when hypothermia is not the primary issue
L	Lack of sufficient heat-preserving equipment in the EMS**
M	Motor restlessness and non-cooperative patients due to hypothermia might complicate measurements
N	Negligence of the potential importance of temperature measurement in seemingly healthy patients
O	Rectal temperature is often perceived as unnecessary, intimate and/or unworthy for the patient
P	Establishing a rectal probe is time-consuming
Q	Increasing the temperature in the ambulance is time-consuming
R	Patient and personnel might perceive the ambient temperature differently***
S	Available equipment for measuring is considered unreliable and/or inconvenient
T	Recognizing the necessity of a temperature measurement is sometimes difficult
U	Proper fixation of the probe for continuous monitoring is sometimes difficult
V	Difficulties establishing the equipment for measurement****
W	Difficulties choosing the most suitable area of measurement
X	Equipment for measuring ear temperature is perceived as inaccurate

Comments

-
- | | |
|------|--|
| * | Rectal measurement requires movement of the pelvic area or the lower extremities |
| ** | Active heating blankets are only available in the HEMS. Wool blankets are described as potentially inadequate |
| *** | Different clothing between patient and personnel, and/or increased body temperature in personnel due to labor |
| **** | When the patient is strapped to the stretcher, heavily dressed and wrapped in blankets, it is difficult to properly establish a rectal or axillary probe. Equipment for ear temperature in the field is described as too large |
-

This table lists all disparate suggestions from the participants, after removal of duplicates. Asterisks shows explanatory comments, given by the participants where necessary.

Table IIa. Top 10 overall highest ranked suggestions

Rank	Challenge/objection
1	Thermometry is forgotten or omitted due to lack of time and/or it being subordinated other measures
2	Difficulties establishing the equipment for measurement
3	Undressing patients for rectal measurement exposes them too cold
4	Temperature measurement may be omitted in favor of a subjective evaluation
5	Available equipment for measuring is considered unreliable and/or inconvenient
6	Personnel experience high threshold for establishing a rectal probe
7	Axillary thermometer is inaccurate and difficult to establish properly, especially in a moving vehicle
8	Negligence of the potential importance of temperature measurement in seemingly healthy patients
9	Little focus on hypothermia in the professional environment when hypothermia is not the primary issue
10	Motor restlessness and non-cooperative patients due to hypothermia might complicate measurements

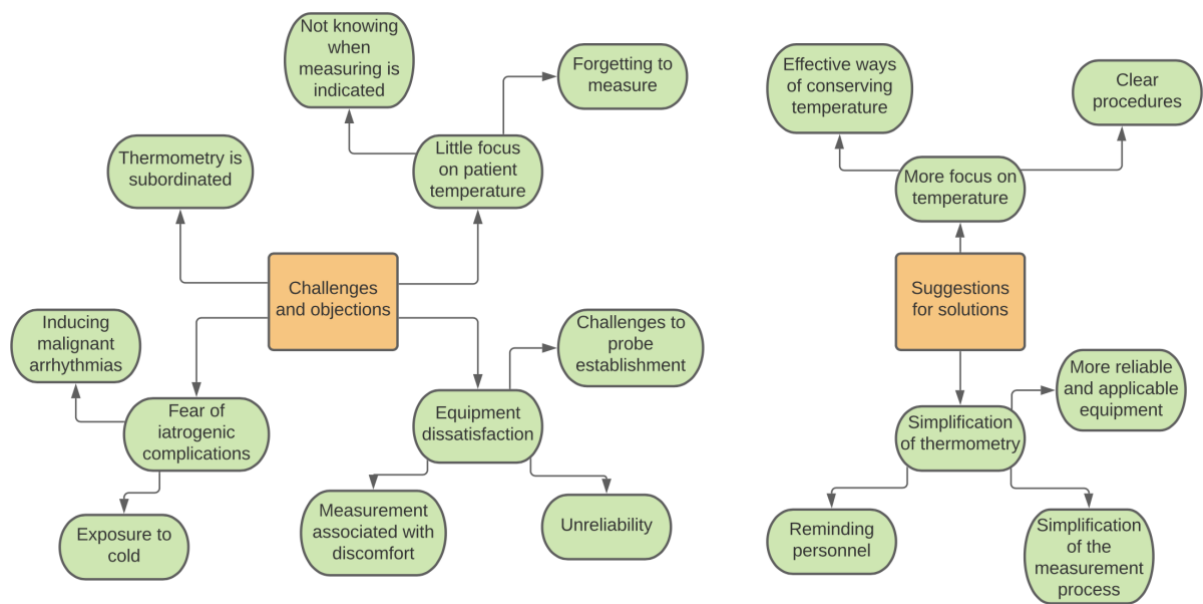
This table shows the overall top 10 ranked challenges with, and objections to, pre-hospital temperature measurement, as ranked by the participants. For the individually submitted rankings, ten points were awarded to the highest ranked suggestion, nine points to rank two, and so on. In addition, two points were awarded whenever a suggestion was included in a participant's top ten list.

Table IIb. Top 5 suggestions for each occupational group

	Rank	Challenge/objection
GA	1	Axillary thermometer is inaccurate and difficult to establish properly, especially in a moving vehicle
	2	Undressing patients for rectal measurement exposes them too cold
	3	Difficulties establishing the equipment for measurement
	4	Thermometry is forgotten or omitted due to lack of time and/or it being subordinated other measures
	5	Personnel experience high threshold for establishing a rectal probe
FW	1	Thermometry is forgotten or omitted due to lack of time and/or it being subordinated other measures
	2	Negligence of the potential importance of temperature measurement in seemingly healthy patients
	3	Temperature measurement may be omitted in favor of a subjective evaluation
	4	Difficulties establishing the equipment for measurement
	5	Patient and personnel might perceive the ambient temperature differently*
HEMS	1	Available equipment for measuring is considered unreliable and/or inconvenient
	2	Thermometry is forgotten or omitted due to lack of time and/or it being subordinated other measures
	3	Equipment for measuring ear temperature is perceived as inaccurate*
	4	Difficulties establishing the equipment for measurement
	5	Temperature measurement may be omitted in favor of a subjective evaluation

The top 5 suggestions within each participant group. Highly ranked suggestions not included in the overall top 10 are marked with an asterisk. GA: Ground ambulance, FW: fixed wing (ambulance) and HEMS: Helicopter emergency medical service.

Figure I. Themes and subthemes emerged from the thematic analysis.



Overview of themes and subthemes from the inductive thematic analysis, split in challenges and objections, and suggestions for solutions, respectively. The main categories are displayed as orange squares, while related themes and subthemes are shown in green rounded boxes.