Original Article

Thermographic visualization of facial vasoconstriction is associated with 30-day all-cause mortality in medical patients; prospective observational two-site cohort study

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Abstract

Introduction: *Quick and reliable assessment of acute patients is required for accurate triage. The temperature gradient between core and peripheral temperature could possibly instantly provide information on circulatory status.*
Methods: *Adult medical patients, who did not receive supplementary oxygen, attending two emergency departments, had a thermographic image taken on arrival. The association between 30-day mortality and gradients was tested using logistic regression.*
Results: *726 patients were studied, median age was 64 years and 14 (1.9%) died within 30 days. There was a significant association between mortality and temperature gradient, comparable to vital signs, age, and clinical intuition.*
Conclusion: *Temperature gradient between nose and eye had an acceptable discriminatory power for 30-day all-cause mortality.*

Keywords

Risk stratification, Infrared thermography, Mortality, Vital signs, Clinical intuition

Key Points

- Identification of patients at risk is difficult
- Vital signs are normally used for this, but are not truly sensitive or specific
- Infrared thermography can identify variations in skin perfusion non-invasively
- The temperature differences between core temperature and the tip of the nose is associated with 30-day all-cause mortality for acutely admitted patients
- Temperature differences is as good a marker as vital signs and the intuition of experienced physicians

Introduction

One of the core tasks of healthcare personnel, especially in the acute care setting, is to identify patients at increased risk of poor outcome. Traditionally, this has been done using vital signs,[1] but clinical intuition is also often used. While vital signs are perceived as being reliable, large multicenter studies examining resuscitation interventions based on vital signs have not been able to confirm their accuracy.[2] Although clinical intuition can identify subtle markers of potential deterioration not reflected in vital signs, it highly depends on the individual clinician and is subject to inter-observer variation.[3, 4] Most illnesses start with what may initially be considered trivial symptoms, and the time period, before vital sign derangement can be detected, is very variable. Therefore, an earlier marker of potential deterioration, which precedes deterioration of vital signs and obvious clinical evidence of severe illness, is needed. As some patients deteriorate, their circulation changes and blood flow is directed to maintain vital organ function. This is reflected in the peripheral circulation by arterioles constricting, reduced blood flow in the dermis, and decreased skin temperature. We speculate that this could be used to identify patients at risk of deterioration in general. In a small pilot study, Holm et al. showed an association between short-term mortality and the gradient between core temperature (measured in the inner canthus of the eye) and the peripheral temperature (measured at the tip of the nose).[5] These findings suggest that the gradient between core and peripheral temperature could be an early marker of clinical deterioration.

This study was designed to validate these findings in a larger two-center cohort of acutely admitted medical patients, by examining the association between this core-peripheral temperature gradient and 30-day

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all-cause mortality. The core-peripheral gradient's ability to predict mortality was also compared to other information almost readily available when patients arrive in hospital. These include age, vital signs (aggregated as the United Kingdom's National Early Warning Score[6]), and the clinical intuition of the treating physician.

Methods

Setting and participants

The study included consecutive adult (i.e. aged ≥18 years) medical patients, who could give informed consent, admitted to hospital from the emergency departments (ED) at the Odense University Hospital (October 2016 to May 2017) and Hospital of South West Jutland, Esbjerg (30 January to 13 March 2017). Odense University Hospital serves a population of 288,000 and Hospital of South West Jutland 260,000 people. Data from Odense was collected from Monday to Friday from 9am to 8pm, and Esbjerg Monday to Friday from 7am to 2pm.

The ED at Odense University Hospital treats all medical patients except patients with pre-hospital identified cardiac, pediatric, renal, oncologic, hematologic, and/or obstetric conditions. The ED at Hospital of South West Jutland treats all medical conditions and presentations, regardless of specialty.

Approximately 30 minutes after arrival (and no later than 3 hours), standardized infrared thermographic images of the face and hand were taken. The emergency room was air-conditioned and its temperature controlled by thermostat to 22 ± 2 degrees.[7]

Exclusion criteria

Patients, who were unwilling or unable to give informed consent, were excluded from the study. Since the purpose of the study was to detect patients before other signs of severe illness manifested, patients in the highest triage category (red) and/or showing signs of severe illness were excluded (identified as being treated in the resuscitation section of the department). In addition, patients receiving supplemental oxygen could not be included in the study, as oxygen flow delivered by either mask or nasal prongs alters the temperature of the nose, and thus the core to nose temperature gradient. However, as supplementary oxygen should not affect temperature of ear and finger, these were included in the full sample size analyses as gradients to core temperature (presented in the supplementary material).

Data collection

Four points from each patient's image were noted; inner canthus of the eye (core point) and nose tip, earlobe, and fingertip of the middle finger (peripheral points). The main analysis, based on the prior study by Holm et al.,[5] was on the core to nose temperature gradient. The gradients between core and finger and core and ear were considered secondary analyses. Previous studies have shown that the inner canthus temperature has a good correlation with core temperature measured with traditional thermometry.[7, 8] The nose gradient was chosen as primary analysis as the authors expect to be able to develop a device that automatically can calculate the gradient why having both points of measurement in the same image would make sense. All pictures were taken with a Testo 882 handheld thermal imager (Buhl & Bønsøe A/S, Smørum, Denmark) and analyzed with Testo IRSoft (version 4.1; Testo SE & Co. Germany).

Handling of missing data

Patients, who we could not follow up on or who's thermal images were of a poor quality, were excluded from the study. Only one otherwise included patient was lost to follow up because of an unreadable identification number: there was 100% follow-up of the remaining patients by the Danish Central Personal Register.[9]

Sample size calculation

A mortality of 3% was anticipated in patients with normal temperature gradient and 10% in patients with increased gradient.[5] Therefore, a total sample size of 476 patients was calculated to yield a result with a power of 80% and an alpha of 0.05.

Statistics and analysis plan

The temperature gradients between core temperature (inner canthus) and peripheral temperatures (inner canthus and earlobe (ΔE), inner canthus and nose (ΔN), and inner canthus and finger (ΔF)) were calculated for each patient.

From the hospital records, we retrieved information on mortality, sex, smoking history, discharge diagnosis, and vital signs. Vital signs were aggregated as the UK National Early Warning Score (NEWS), which has been validated as a reliable predictor of short-term mortality.[6] To assess the clinical intuition of the treating physician, all physicians were asked (immediately after their first encounter with the patient) what their perceived risk of mortality for the patient was on a scale from 0 to 100. The clinical information, which was available to the physician at this point, was not recorded.

Data is presented descriptively with continuous data as median (interquartile range) and categorical data as proportions (95% confidence intervals (CI)). The associations between endpoint and gradients were tested using logistic regression. The discriminatory

power (ability to differentiate between survivors and non-survivors) of the temperature gradient, age, NEWS, and clinical intuition were compared using the area under the receiver operating characteristics curve (AUROC) calculated according to the method of Hanley and McNeil.[10] Calibration (precision of the prediction) was assessed according to the Hosmer-Lemeshow goodness of fit test. Difference between groups was compared using Wilcoxon sign rank test. As a supplementary analysis, the gradient between core temperature and ear and finger temperatures were calculated for all patients, regardless of use of supplementary oxygen. Stata/IC version 15.1 (StataCorp., Texas, USA) was used for analysis.

Ethics

All patients were asked to sign an informed consent before inclusion. The study was conducted in accordance with the ethics principles of Declaration of Helsinki. According to Danish law, observational studies are exempt for the need for approval by an ethics committee and the Regional Scientific Ethical Committees for Southern Denmark waived the need for approval. Thermography is non-invasive and free of radiation and therefore poses no harm for patients. The study is reported according to the TRIPOD and STROBE guidelines.[11]

Results

We screened 1,489 patients and included 726 (48.8%): 541 (74.5%) in Odense and 185 (25.5%) in Esbjerg, Figure 1.

The median age was 64 (48-77) years and 370 (51.0%) were male, Table 1. A total of 14 (1.9%, 95% CI 1.1-3.2%) patients died within 30 days, some within few days, see Supplementary Table 1.

If the data from both patient settings were combined, there were significant differences between survivors and non-survivors in the core-nose temperature gradient, NEWS, age, and clinical intuition, Table 2. There was little difference between the temperature gradient for ear and finger in either setting, Table II. In crude logistic regression analyses, only the temperature gradient between the nose and core, NEWS, age, and clinical intuition were significantly associated with 30-day all-cause mortality, Table 3.

The discriminatory power was acceptable for the temperature difference between nose and core as well as for NEWS, age, and clinical intuition, Table IV. Calibration was acceptable for all except clinical intuition, Table IV. The discriminatory power could be compared for 477 patients where all information on all modalities was available and found age (0.832, 95% CI 0.726-0.938) and clinical intuition (0.831, 95% CI 0.728-0.934) to have higher areas under the curve than the temperature gradients between nose and core (0.731, 95% CI 0.568-0.895) and NEWS (0.754, 95% CI 0.641-0.867), however, not statistically significantly different ($p = 0.47$). Patients on supplementary oxygen had a significantly higher 30-day all-cause mortality (9.6%, 95% CI 5.7-15.6%) than patients that did not receive supplementary oxygen (1.9%, 95% CI 1.1-3.2%).

In our supplementary analyses, we analyzed the difference between core and eye and core and finger temperatures in all patients, and found that neither have clinical value, see Supplementary Tables 2-5.

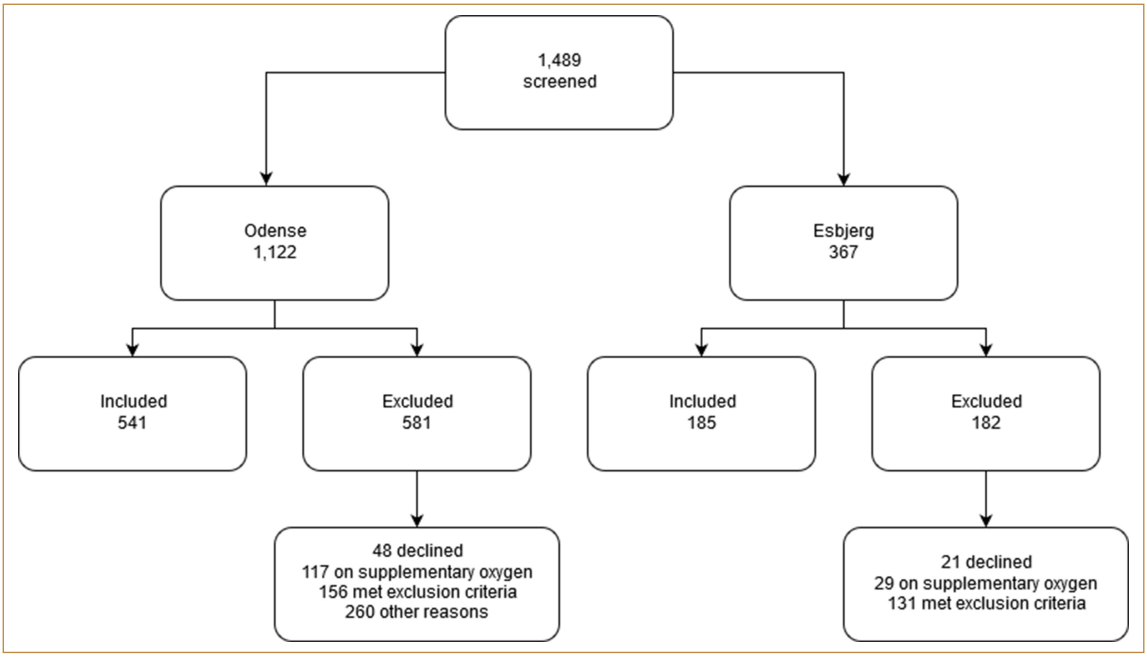

Figure 1. Inclusion and exclusion of study participants at both sites

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Table 1. Details of the participants, combined and at the two sites.

	All	Odense	Esbjerg
Number, n (%)	726 (100%)	541 (74.5%)	185 (25.5%)
Age, median (IQR)	64 (48-77)	61 (46-76)	68 (54-78)
Male, n (%)	370 (51.0%)	268 (49.5%)	102 (55.1%)
Triage category **Green, n (%)** **Yellow, n (%)** **Orange, n (%)** **Red, n (%)** **Unknown, n (%)**	 276 (38.0%) 320 (44.1%) 107 (14.7%) 0 (0.0%) 22 (3.0%)	 148 (27.4%) 276 (51.0%) 95 (17.6%) 0 (0.0%) 22 (4.1%)	 128 (69.2%) 44 (23.8%) 12 (6.5%) 0 (0.0%) 0 (0.0%)
NEWS, median (IQR)	1 (0.2)	1 (0-3)	1 (0-2)
Per cent perceived risk of mortality, median (IQR)	0 (0-2)	0 (0-3)	0 (0-1)
Nose temperature gradient, median degrees Celsius (IQR)	3.9 (2-7.3)	3.9 (2-7.2)	4.1 (1.9-7.6)
Smoking status **Never, n (%)** **Previous, n (%)** **Current, n (%)** **Unknown, n (%)**	 213 (29.3%) 249 (34.3%) 38 (26.5%) 72 (9.9%)	 155 (28.7%) 166 (30.7%) 154 (28.5%) 66 (12.2%)	 58 (31.3%) 83 (44.9%) 38 (20.5%) 6 (3.2%)
30-day all-cause mortality, n (%)	14 (1.9%)	11 (2.0%)	3 (1.6%)

N = number, IQR = inter quartile range, NEWS = National Early Warning Score, IQR = interquartile range.

Table 2. Temperature difference between core temperature and nose for all and each site differentiated on 30-day all-cause mortality as well as National Early Warning Score (NEWS), clinical intuition and age for all-comers, all presented as median (inter quartile range).

	All			Odense			Esbjerg		
	Survivors	Non-survivors	P value	Survivors	Non-survivors	P value	Survivors	Non-survivors	P value
TΔ for nose	3.9 (1.9-7.2)	7.85 (3.7-9.7)	p < 0.01	3.9 (2-7.2)	7.3 (2.8-9.7)	p = 0.03	3.9 (1.9-7.5)	8.8 (6.3-9.8)	p = 0.07
NEWS	1 (0-2)	3 (2-4)	p < 0.01	1 (0-2.5)	2.5 (2-4)	p = 0.01	1 (0-2)	3 (3-3)	p = 0.22
Age	64 (48-77)	81.5 (67-87)	p < 0.01	61 (46-76)	79 (62-87)	p < 0.01	68 (54-78)	87 (67-89)	p = 0.08
Clinical intuition	0 (0-2)	6 (1-10)	p < 0.001	0 (0-3)	7 (1-10)	p < 0.001	0 (0-1)	5 (0-35)	p = 0.07

Table 3. The association between the temperature gradient between core and nose, National Early Warning Score (NEWS), age, and clinical intuition and 30-day all-cause mortality assessed using crude logistic regression analysis. Results are presented as odd ratios (OR) and 95% confidence intervals

	All	Odense	Esbjerg
Nose temperature gradient, degrees Celsius	1.25 (1.06-1.48)*	1.22 (1.01-1.47)*	1.39 (0.94-2.05)
NEWS, score	1.32 (1.03-1.69)*	1.28 (0.99-1.65)	1.60 (0.64-4.05)
Age, years	1.06 (1.02-1.10)*	1.05 (1.01-1.10)*	1.11 (0.97-1.27)
Clinical intuition, %	1.06 (1.02-1.09)*	1.07 (1.03-1.11)*	1.04 (0.99-1.08)

* = p < 0.05

Table 4. Discriminatory power and calibration for temperature difference between nose and core as well as National Early Warning Score, age, and clinical intuition for 30-day all-cause mortality.

	All		Odense		Esbjerg	
	Discriminatory power	Calibration	Discriminatory power	Calibration	Discriminatory power	Calibration
Nose temperature gradient, degrees Celsius	0.713 (0.585-0.841)	0.76	0.687 (0.529-0.845)	0.47	0.809 (0.671-0.946)	0.93
NEWS, score	0.746 (0.641-0.850)	0.21	0.726 (0.610-0.842)	0.16	0.786 (0.722-0.850)	0.34
Age, years	0.751 (0.626-0.875)	0.96	0.744 (0.605-0.882)	0.99	0.793 (0.458-1.000)	0.50
Clinical intuition, %	0.798 (0.682-0.914)	0.01	0.800 (0.687-0.914)	<0.001	0.749 (0.352-1.000)	0.26

N = patients in the sample

Discussion

In this two-center prospective observational study on patients, who were acutely admitted to an emergency department and not on supplementary oxygen, we found that the temperature gradient between nose and core was an acceptable predictor for 30-day all-cause mortality, comparable to age, vital signs (aggregated as the UK National Early Warning Score), and clinical intuition of the treating physician. Patients placed on supplementary oxygen have already been deemed at increased risk, an assumption confirmed by their significantly higher 30-day mortality.

This study confirms the pilot study by Holm et al.,[5] which found a significant association between the core to nose temperature gradient and mortality, but a weak association between that and core to ear and core to finger temperature gradients. However, the discriminatory power and odds ratios of the nose-core temperature gradient, Holm et al. found, were higher. This might be consequential of our larger sample, data collected over a longer period of time, and inclusion of more patients with a lower triage classification. Moreover, the proportion of patients on supplementary oxygen in the study of Holm et al. was not documented. Use of supplementary oxygen through a nasal prong will cool the skin and thus reduce the usability of a nose gradient. So, if only few patients received supplementary oxygen in the Holm et al. study, this might explain the differences between the findings of the two studies.

There is a need for the rapid identification of patients at risk of deterioration in an acute care setting. Although vital sign derangement predicts short-term mortality, it takes a few minutes to determine as the physiological parameters must be measured, and they must be accurate and aggregated correctly.[12] Moreover, interventions based on vital sign abnormalities may not improve outcomes,[2] and some patients in this study with normal vital signs died within a few days of arrival (Supplementary table 1).

Death can happen at any age (Supplementary table I), and age can therefore not be used a sole predictor of mortality. Although intuition seems to be a powerful predictor of poor outcome,[3] it is highly dependent on the physician's experience. In the current study, a specialist physician was only available to assess 31% of the patients.

Three patients died within two days of arrival at the emergency department. Two of them had a very high temperature gradient (even though they were on supplementary oxygen), one had a high NEWS (and one missing), two were older than 80 years, and two had a perceived risk of more than 10% (supplementary table 1). None of the variables would have identified all three fatalities, but temperature gradient is the only variable that can be fully automated to produce a risk estimate immediately on arrival without inter-observer reliability or other human factors.

Our study has strengths. We included patients consecutively and prospectively at two centers, had complete follow-up through the Danish registries[13] and more than reached our desired sample size. However, as with any study, it has its limitations. We were unable to include patients 24 hours a day, and thus primarily included patients during normal business hours. Additionally, some data was missing, principally on NEWS and clinical intuition. Since patients were all included at two Danish hospitals, they must be regarded as homogenous compared to the rest of the world. While we did reach our sample size, the event rate was lower than expected. This induces the risk of a type 1 error. The uncertainty of our results is reflected in the wide confidence interval we report. A last limitation is that it is still unclear how dependent the gradient is on the ambient temperature, and the influence of changes in core body temperature such as occurs in hypothermia, febrile illness, and hyperthermia.

The concept of using automated thermography at the door of the emergency department to rapidly assess patients is attractive. Our findings suggest that patients with a high risk of early mortality may present with a high nose-core temperature gradient, and that a change in this temperature gradient may occur before vital signs change. However, a considerable amount of research and development is required to assess if our observations have practical clinical value, such as determining the optimal time and environment in which to measure the gradient.

Conclusion

We found that the temperature gradient between nose and core had an acceptable discriminatory power for 30-day all-cause mortality, provided that patients were not receiving supplemental oxygen. The predictive abilities of age and vital signs (aggregated as the National Early Warning Score) were comparable. Clinical intuition also predicted outcomes, but depended on the clinical experience of the practitioner.

Conflict of interests

The authors declare that they have no conflict of interest regarding this publication.

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Supplementary tables

Supplementary table 1. Detailed data on the patients that died within 30 days of inclusion.

Age	Sex	Nose	NEWS	Clinical intuition	Smoking status	Supplementary oxygen	Day of death
51	Female	7.3	-	6%	Never	No	11
57	Male	2.8	2	-	Previous	No	23
62	Male	2.4	1	10%	Previous	No	2
67	Male	9.8	-	5%	Never	No	5
73	Male	2	2	1%	Previous	No	19
78	Female	7.2	4	60%	Previous	No	20
79	Female	9.7	4	8%	-	No	21
84	Female	10	5	10%	Never	No	22
84	Male	8.4	2	1%	Previous	No	26
87	Female	9.5	4	1%	Never	No	16
87	Male	8.8	3	35%	Current	No	9
89	Male	6.3	-	0%	Never	No	3
93	Female	10.1	3	1%	Never	No	13
94	Female	3.7	1	50%	-	No	22
60	Female	2.9	-	-	Never	Yes	17
63	Male	2.3	6	3%	Previous	Yes	25
64	Male	1.7	11	40%	Current	Yes	13
71	Male	10.7	7	55%	Previous	Yes	9
73	Male	2.1	-	1%	Previous	Yes	3
78	Male	1.2	4	5%	Previous	Yes	11
79	Male	8.5	6	15%	Previous	Yes	18
82	Male	11.2	-	25%	Previous	Yes	1
86	Female	3.5	7	-	Previous	Yes	5
86	Female	5.8	7	0%	Previous	Yes	21
86	Female	11.5	12	70%	Never	Yes	1
86	Male	2.7	6	0%	Current	Yes	14
92	Female	1	6	0%	Previous	Yes	4
94	Female	7.7	3	-	Never	Yes	7

Nose = temperature gradient between nose and core, NEWS = National Early Warning Score, Clinical intuition = perceived risk in per cent of mortality by treating physician, Day of death = number of days from inclusion to death, - = data missing.

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Supplementary table 2. Demographic details of all, regardless of use of supplementary oxygen, participants in total and at the two sites.

	All	Odense	Esbjerg
Number, n (%)	872 (100%)	658 (75.5%)	214 (24.5%)
Age, median (IQR)	67 (51-78)	65 (49-78)	69 (57-79)
Male, n (%)	435 (49.9%)	323 (49.1%)	112 (52.3%)
Triage category **Green, n (%)** **Yellow, n (%)** **Orange, n (%)** **Red, n (%)** **Unknown, n (%)**	 299 (35.3%) 401 (47.4%) 144 (17.0%) 1 (0.1%) 1 (0.1%)	 161 (25.5%) 347 (54.9%) 124 (19.6%) 0 (0.0%) 0 (0.0%)	 138 (64.5%) 54 (25.2%) 20 (9.4%) 1 (0.5%) 1 (0.5%)
NEWS, median (IQR)	2 (0-3)	2 (0-4)	1 (0-3)
Per cent perceived risk of mortality, median (IQR)	0 (0-3)	1 (0-5)	0 (0-2)
Finger temperature gradient, median degrees Celsius (IQR)	6 (3.5-9.1)	6.2 (3.7-9.3)	5.4 (3.1-8.5)
Ear temperature gradient, median degrees Celsius (IQR)	4 (2.7-5.0)	4.1 (2.8-5.0)	3.9 (2.5-4.9)
Smoking status **Never, n (%)** **Previous, n (%)** **Current, n (%)** **Unknown, n (%)**	 237 (27.2%) 326 (37.4%) 222 (25.5%) 87 (10.0%)	 174 (26.4%) 227 (34.5%) 176 (26.8%) 81 (12.3%)	 63 (29.4%) 99 (46.3%) 46 (21.5%) 6 (2.8%)
Patients on supplementary oxygen, n (%)	146 (16.7%)	117 (17.7%)	29 (13.6%)
30-day all-cause mortality, n (%)	28 (3.2%)	23 (3.5%)	5 (2.3%)

N = number, IQR = inter quartile range, NEWS = National Early Warning Score.

Supplementary table 3. Temperature difference between core temperature and ear and finger for all and each site differentiated on 30-day all-cause mortality as well as National Early Warning Score (NEWS), clinical intuition and age for all-comers, all presented as median (inter quartile range).

	All			Odense			Esbjerg		
	Survivors	Non-survivors	P value	Survivors	Non-survivors	P value	Survivors	Non-survivors	P value
TΔ for nose	3.9 (2-7.3)	6.8 (2.6-9.6)	p = 0.03	3.7 (2-7.2)	7.2 (2.3-9.7)	p = 0.09	4.5 (2-8)	6.3 (5.8-8.8)	p = 0.16
TΔ for ear	4 (2.7-5)	4 (2.9-5.6)	p = 0.78	4.1 (2.8-5)	4.1 (2.9-5.6)	p = 0.64	3.9 (2.5-4.9)	3.2 (1.5-5.5)	p = 0.61
TΔ for finger	6 (3.5-9.1)	5.7 (1.8-9.1)	p = 0.31	6.4 (3.7-9.3)	5.8 (2.1-9.1)	p = 0.50	5.5 (3.2-8.5)	3.1 (1.3-6.4)	p = 0.29
NEWS	1 (0-3)	4 (3-6)	p < 0.001	2 (0-3)	4 (2-6)	p = 0.001	1 (0-3)	7 (3-7)	p = 0.02
Age	66 (50-78)	80.5 (69-66.5)	p < 0.001	64 (49-77)	79 (64-86)	p = 0.002	69 (56-78)	86 (86-87)	p = 0.009
Clinical intuition	0 (0-3)	5.5 (1-30)	p < 0.001	1 (0-4)	7 (1-32.5)	p < 0.001	0 (0-2)	2.5 (0-20)	p = 0.27

Supplementary table 4. The association between the temperature gradient between core and nose, ear and finger as well as National Early Warning Score (NEWS), age and clinical intuition and 30-day all-cause mortality assessed using crude logistic regression analysis for all-comers. Results are presented as odd ratios (OR) and 95% confidence intervals.

	All	Odense	Esbjerg
Nose temperature gradient, degrees Celsius	1.14 (1.02-1.28)	1.14 (1.00-1.29)	1.18 (0.90-1.53)
Ear temperature gradient, degrees Celsius	1.04 (0.84-1.30)	1.06 (0.83-1.35)	0.93 (0.54-1.60)
Finger temperature gradient, degrees Celsius	0.94 (0.84-1.06)	0.96 (0.85-1.09)	0.83 (0.61-1.13)
NEWS, score	1.38 (1.21-1.58)	1.33 (1.15-1.53)	1.75 (1.11-2.77)
Age, years	1.06 (1.03-1.09)	1.05 (1.02-1.09)	1.13 (1.01-1.26)
Clinical intuition, %	1.06 (1.03-1.08)	1.06 (1.04-1.09)	1.03 (0.99-1.08)

Supplementary table 5. Discriminatory power and calibration for temperature difference between nose, ear, finger and core as well as National Early Warning Score, age and clinical intuition for 30-day all-cause mortality for all-comers.

	All		Odense		Esbjerg	
	Discriminatory power	**Calibration**	**Discriminatory power**	**Calibration**	**Discriminatory power**	**Calibration**
Nose temperature gradient, degrees Celsius	0.619 (0.506-0.732), n = 872	P = 0.38	0.606 (0.472-0.739), n = 658	P = 0.33	0.686 (0.522-0.850), n = 214	P = 0.33
Ear temperature gradient, degrees Celsius	0.516 (0.397-0.634), n = 838	P = 0.78	0.529 (0.405-0.653), n = 651	P = 0.95	0.425 (0.020-0.830), n = 187	P = 0.19
Finger temperature gradient, degrees Celsius	0.443 (0.314-0.571), n = 861	P = 0.08	0.458 (0.318-0.598), n = 654	P = 0.16	0.361 (0.022-0.699), n = 207	P = 0.20
NEWS, score	0.789 (0.712-0.866), n = 742	P = 0.37	0.763 (0.674-0.852), n = 547	P = 0.27	0.896 (0.775-1.000), n = 195	P = 0.48
Age, years	0.741 (0.657-0.856), n = 872	P = 0.71	0.726 (0.635-0.817), n = 658	P = 0.59	0.841 (0.642-1.000), n = 214	P = 0.41
Clinical intuition, %	0.747 (0.641-0.853), n = 666	P = 0.02	0.758 (0.647-0.868), n = 474	P = 0.003	0.635 (0.289-0.981), n = 192	P = 0.60

N = patients in the sample