

Target Normothermia: A Global Survey on Hypothermia Rates

Summary Report

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INTRODUCTION

Despite widespread international agreement regarding the benefits of perioperative normothermia, a very large percentage of surgical patients still endure prolonged perioperative hypothermia. The reasons for this dilemma are numerous and include failure to estimate core body temperature with an appropriate thermometer, failure to anticipate significantly decreased core temperature following anesthetic induction, and a mistaken sense that perioperative core temperature is relatively unimportant.

The Target Normothermia project was initiated to provide participating clinics with a standardized technique and case report form to record perioperative temperatures in patients undergoing major surgical procedures. Forty-nine hospitals participated in the project; six of the hospitals were in the United States. Target Normothermia was a quality improvement program in the sense that it provided participating clinics with a standardized tool to document perioperative temperatures; however, no new interventions or improvements to current practices were recommended. Patients in whom estimated core temperature was less than 36.0 °C at the end of surgery were considered hypothermic, regardless of their other intra- or postoperative temperatures.

METHODS

The Target Normothermia project was conducted in collaboration with the Department of Outcomes Research, Anesthesiology Institute, at the Cleveland Clinic Foundation. Participating hospitals used the same case report form to enforce standardization during the project, and the

forms were sent periodically by the participating clinics to the Outcomes Research department at the Cleveland Clinic Foundation, which served as the data repository. The data were checked for completeness and errors in a standard manner; imputation was not used to replace missing data. Individual hospital hypothermia rates were reported to the respective hospitals.

Hypothermia rates were computed by counting the number of patients who had an estimated core temperature <36.0 °C at the end of surgery and dividing by the total number of patients. Only patients receiving general anesthesia and who had temperature monitored at the nasopharynx, esophagus, tympanum (direct contact), or pulmonary artery were included in the Target Normothermia project.

RESULTS

Forty-nine hospitals participated in the survey, and they contributed data from 9274 subjects. The median hospital population contribution and hypothermia rates were 211 subjects and 26%, respectively. Individual institutional recruitment varied from 20 to 417 patients, and hypothermia rates varied from 98 to 0%. The overall hypothermia rate for all patients was 32%. There were no apparent relationships between geographic location and hypothermia rates. Hypothermia rates by clinic location are shown in Figure 1. The data collection period started in March, 2013 and ended in March, 2015.

Approximately 20% of all subjects were prewarmed prior to anesthesia, and Table 1 summarizes the hypothermia rates between pre- and non-prewarmed subjects.

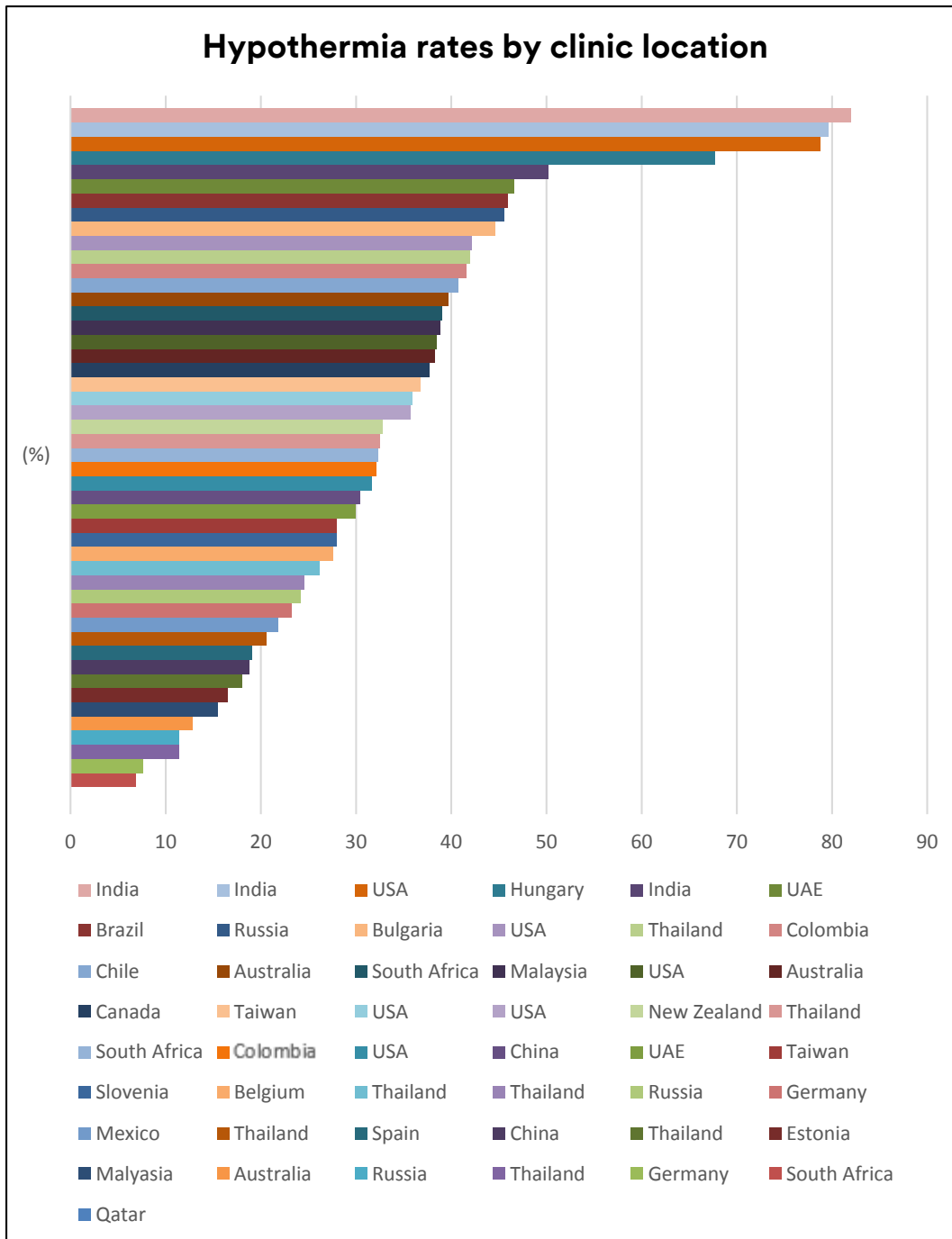


Fig. 1-Hypothermia rates and corresponding geographic location of the reporting clinic

Table 1 – Prewarmed versus non-prewarmed hypothermia rates

Warming status	Hypothermia rate (%)	N
Prewarmed	19	1557
Non-prewarmed	33	7717

It is interesting to compare the distribution of temperatures between prewarmed and non-prewarmed patients as shown in Figures 2 and 3. Prewarming is associated with clear skewing of the temperature distribution toward higher core

temperatures and fewer hypothermic patients at the end of surgery. The yellow bar in the histogram is the threshold for normothermic core temperatures.

Temperature	Frequency	Cumulative	%	Cumulative %
39.2 - 39.0	0	0	0.0	0
38.9 - 38.7	0	0	0.0	0
38.6 - 38.4	0	0	0.0	0
38.3 - 38.1	3	3	0.2	0
38.0 - 37.8	4	7	0.3	0
37.7 - 37.5	25	32	1.6	2
37.4 - 37.2	73	105	4.7	7
37.1 - 36.9	204	309	13.1	20
36.8 - 36.6	293	602	18.8	39
36.5 - 36.3	349	951	22.4	61
36.2 - 36.0	306	1257	19.7	81
35.9 - 35.7	131	1388	8.4	89
35.6 - 35.4	72	1460	4.6	94
35.3 - 35.1	42	1502	2.7	97
35.0 - 34.8	27	1529	1.7	98
34.7 - 34.5	11	1540	0.7	99
34.4 - 34.2	3	1543	0.2	99
34.1 - 33.9	3	1546	0.2	99
33.8 - 33.6	5	1551	0.3	100
33.5 - 33.3	1	1552	0.1	100
33.2 - 33.0	0	1552	0.0	100
32.9 - 32.7	1	1553	0.1	100
32.6 - 32.4	2	1555	0.1	100
32.3 - 32.1	0	1555	0.0	100

Fig. 2 - Frequency distribution of end-of-surgery temperatures in prewarmed patients

Temperature	Frequency	Cumulative	%	Cumulative %
39.2 - 39.0	1	1	0.0	0
38.9 - 38.7	3	4	0.0	0
38.6 - 38.4	5	9	0.1	0
38.3 - 38.1	4	13	0.1	0
38.0 - 37.8	34	47	0.4	1
37.7 - 37.5	97	144	1.3	2
37.4 - 37.2	292	436	3.8	6
37.1 - 36.9	619	1055	8.0	14
36.8 - 36.6	982	2037	12.7	26
36.5 - 36.3	1513	3550	19.6	46
36.2 - 36.0	1601	5151	20.8	67
35.9 - 35.7	861	6012	11.2	78
35.6 - 35.4	679	6691	8.8	87
35.3 - 35.1	469	7160	6.1	93
35.0 - 34.8	297	7457	3.9	97
34.7 - 34.5	127	7584	1.6	98
34.4 - 34.2	55	7639	0.7	99
34.1 - 33.9	39	7678	0.5	100
33.8 - 33.6	7	7685	0.1	100
33.5 - 33.3	9	7694	0.1	100
33.2 - 33.0	10	7704	0.1	100
32.9 - 32.7	2	7706	0.0	100
32.6 - 32.4	2	7708	0.0	100
32.3 - 32.1	1	7709	0.0	100

Fig. 3 - Frequency distribution of end-of-surgery temperatures in non-prewarmed patients

Table 2 - Hypothermia rates and different warming technologies

Warming Type	Hypothermia rate (%)	n
Forced-air	28	5983
Water mattress	41	250
Electric mattress	57	183
Other	39	297
None	38	2213
Overall	32	8926

Hypothermia rates corresponding to each type of warming technology were also computed and are reported in Table 2. End-of-surgery temperatures from patients undergoing intentional hypothermia during cardiac surgery (n=348) were excluded from these calculations.

DISCUSSION

Target Normothermia was an international, prospective, observational cohort survey project. Its purpose was to characterize the enrolled populations at each clinic. The study population was broad and included patients having many types of surgery within different countries and in widely different healthcare environments. Results in other types of patients and healthcare settings may, of course, differ from those reported here. As with any observational study, causal inferences should be made cautiously; however, the pooled data provide some interesting descriptive information that is consistent with other clinical studies and suggests possible hypotheses for future research.

Forced-air warming systems were by far the most common technology used to warm patients in this study, although only approximately 20% of subjects were prewarmed. The median anesthesia time was 140 minutes, and the beneficial effect of prewarming appears durable and substantial, even after relatively lengthy operative procedures. Prewarming favorably alters the distribution of core temperature in this patient population.

Forced-air warming appears to perform substantially better than any of the other active or heat preservation methods, although the 28% hypothermia rate corresponding to warming by forced air suggests there is still room for improvements in its performance and use.

The overall rate of hypothermia observed in this study is substantially less than that reported in other surveys and suggests a successful improvement in efforts made to manage the perioperative temperature of surgical patients in this population.