Post-Cardiac Arrest Therapeutic Hypothermia in New Jersey Hospitals: Analysis of Adoption and Implementation

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Background: While national guidelines recommend the use of therapeutic hypothermia (TH) for the treatment of out-of-hospital cardiac arrest (OHCA), adoption of the technique has been slow. In addition, little is known about how TH is applied in practice. This study sought to characterize the adoption and implementation of TH by acute care hospitals in the state of New Jersey.

Methods: A survey of all 73 acute care hospitals in New Jersey was conducted to solicit information about TH adoption, application, and methods. Additional information was gained through a review of 18 written TH protocols (covering 21 hospitals).

Results: After growing slowly from 2004 to 2008, TH use among New Jersey hospitals accelerated between 2009 and 2011. By 2011, 68.4% of New Jersey hospitals had a TH program in place, with an additional 13.6% indicating plans to begin one. Most hospitals indicated low volumes of OHCA patients (e.g., ≤10 per month). There was no relationship between OHCA volume and development of a TH program. The per hospital volume of OHCA patients receiving TH is even lower given the extensive patient exclusion criteria used by many facilities. TH hospitals vary widely in their TH exclusion criteria and cooling equipment and methods.

Discussion: The vast majority of New Jersey hospitals are now organized to implement national TH guidelines for initial survivors of OHCA. However, limited volumes of OHCA cases per hospital and lack of uniformity on how the guidelines are implemented raise new questions about the effectiveness of current practice in postarrest care. More detailed analysis of TH volumes versus outcomes and comparative studies of TH techniques are required to optimize postarrest care.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a major public health challenge afflicting 295,000 U.S. residents annually (WRITING MEMBERS GROUP et al., 2010). The incidence and survival from OHCA varies substantially across communities (Nichol et al., 2008). Survival also varies by hospital with the majority of that variation unexplained by patient characteristics (Herlitz et al., 2006; Liu et al., 2008; Carr et al., 2009b). Moreover, those who survive an OHCA often experience severe neurological impairment.

Therapeutic hypothermia (TH) is a fairly new and innovative procedure designed to improve neurologically intact survival from OHCA. The procedure involves reducing the body’s core temperature for an extended period of time (e.g., 12–24 hours) during postarrest treatment. Two randomized clinical trials (RCTs) (Bernard et al., 2002; HACA Study Group, 2002) and other observational studies (Hachimi-Idrissi et al., 2001; Zeiner et al., 2001; Langhelle et al., 2003; Holzer et al., 2005; Nielsen et al., 2009) have demonstrated the efficacy of TH for improving neurologically intact survival after OHCA.

National guidelines have called for the use of TH on initial survivors of OHCA (International Liaison Committee on Resuscitation, 2005; Peberdy et al., 2010). A variety of barriers, however, have limited the widespread adoption of TH. Some providers remain skeptical about the procedure’s effectiveness, while others believe it is too complex to implement successfully (Merchant et al., 2006; Brooks and Morrison, 2008). Other barriers include lack of knowledge, experience, personnel, resources, and infrastructure (Nichol et al., 2010).

Current descriptions of TH programs have been limited to individual centers or physicians, with little information regarding the regional adoption and implementation of TH (Seif and Henderson, 2011). This study characterizes the...
adoption and implementation of TH by general acute care hospitals in New Jersey.

Methods

Design

We conducted a cross-sectional study of TH adoption by hospitals in New Jersey. The study was approved by the Institutional Review Board of the lead author’s university.

Setting

New Jersey is a densely populated state of 8.8 million residents (U.S. Census Bureau, 2011). There are 73 acute care hospitals operating in New Jersey, all of which are required by state law to maintain a full-service emergency department (ED) 24 hours per day. The state’s prehospital emergency medical services (EMS) include a mix of career and volunteer basic life support (BLS) ambulance companies. In most communities, private or municipal BLS units are supplemented by 21 county-based advanced life support (ALS) units staffed by career paramedics.

Telephone survey

We developed a brief (approximately 5–10 minutes) telephone survey related to hospital adoption and implementation of TH. We administered the survey to the ED nurse manager (or designated individual) at all 73 acute care hospitals in New Jersey. After pretesting with two out-of-state hospitals, the survey was fielded from June through August 2011. We also created a shorter survey for hospitals that were unwilling to participate in the full interview.

All hospitals initially received an information packet by mail. Each packet included a letter requesting participation, a copy of the survey questionnaire, IRB information, and study endorsement letters from the New Jersey Hospital Association and the New Jersey State Nurses Association.

The survey instrument for the full interview (see Appendix 1) contained questions regarding the volume of OHCA patients, adoption of TH, number of years the TH program has been in place among adopters, and methods of TH implementation. In hospitals without a TH program, the respondent was asked whether the hospital had any plans to develop one in the near future. In hospitals without a TH program or plans to develop one, the respondent was asked for the reasons why they are not adopting the procedure.

Hospitals that were unwilling to complete the full survey were asked to provide brief answers to two questions: (1) does your hospital provide TH to OHCA patients; (2) if so, since when, and if not, do you have plans to do so in the near future?

Written TH protocols

All TH hospitals completing the full interview were asked to provide a copy of their written TH protocols. The study team systematically reviewed the received protocols to identify additional TH program information, including the duration and timing of patient cooling and the measurement and response to patient shivering during the procedure.

Analysis

We used descriptive statistics (i.e., frequencies, percentages) to characterize TH adoption and implementation. Using TH program start dates, we determined the number of New Jersey hospitals adopting TH over time. We also identified the characteristics of TH program configuration, equipment, practices, and protocols.

To determine whether TH adoption is related to hospital characteristics, we used information from the 2011 New Jersey B-2 Hospital Utilization Report, which is maintained for regulatory purposes by the New Jersey Department of Health and Senior Services. Hospital characteristics of interest included patient volumes, lengths of stay, bed counts, and occupancy rates. We used membership in the Council of Teaching Hospitals (COTH) as an indicator of hospital teaching status. We used chi-square tests for percentages and one-way analysis of variance tests for continuous variables.

Findings

Fifty-four hospitals completed the full interview, and the remaining 19 answered the two brief questions. Hospitals completing only the brief interview were more likely to be non-teaching institutions but otherwise had characteristics similar to those completing the full survey. Among the 54 full interviews, 38 were conducted with the ED nurse manager. The remaining interviewees included a variety of professional titles such as assistant ED director, clinical nurse specialist, critical care nurse specialist, and clinical educator. Professional title was not recorded for six individuals who provided a full interview, and no titles were recorded during the brief interviews.

After growing slowly between 2004 and 2008, TH use by New Jersey hospitals accelerated in 2009 (Fig. 1). By 2011, 50 (68.4%) of the state’s hospitals provided the procedure with

![FIG. 1. Growth in number of New Jersey hospitals providing therapeutic hypothermia (TH). Source: New Jersey Out-Of-Hospital Cardiac Arrest Study Telephone Questionnaire. Three additional hospitals provided TH in 2011 but could not report how long the TH program had been in place. Therefore, the total number of TH programs in 2011 is 50.](image-url)
an additional 10 (13.7%) reporting plans to develop a TH program (Table 1).

Most hospitals reported treating a limited number of OHCA patients annually, with 70% caring for 120 or fewer OHCA patients annually (i.e., 10 per month) and 20% caring for 60 or fewer OHCA patients annually (i.e., 5 per month). Variation in OHCA volume was not associated with adoption or plans to adopt TH. While there were slight differences in TH adoption by number of maintained beds and ED visits, TH adoption was unrelated to teaching status, patient volume, and occupancy rates (Table 2).

Among hospitals with TH programs, there was substantial variation in their patient selection criteria, cooling methods, and practices (Table 3). While TH was most commonly applied for VT cardiac arrest, its use was less common for other rhythms. Only 51.3% of TH hospitals surveyed provided TH to OHCA patients for all four initial ECG rhythms.

The application of TH patient exclusion criteria varied significantly across TH centers (Table 3). The largest variation involved age-related exclusions, with some facilities (n = 21, 53.8%) excluding pediatric patients and others excluding patients above an age threshold (n = 10, 25.6%). Even then, the age threshold may not be followed strictly, as one respondent noted that they would make an exception for a “good 75 year old,” referring to a patient whose overall medical history would allow TH to be used despite being above the age cutoff for that facility. In addition, 17.9% of TH hospitals applied all eight of the exclusions queried by the survey. Two-thirds of TH hospitals indicated other exclusion criteria including DNR status, terminal illness, preexisting coma, major trauma, and drug overdose/poisoning.

Eighteen of 39 hospitals with TH programs provided copies of their written protocols. Because some hospitals within the same system share the same protocol, the collected protocols apply to 21 hospitals. Among these hospitals, there was wide variation in the timing and duration of TH implementation (Table 4). Additional differences pertained to quantification and response to patient shivering. Across all of the protocol domains, details specified by some hospitals were not addressed by others.

Among the 13 hospitals that do not provide TH and have no plans to do so, eight completed a full interview. Two of them stated that their OHCA volume was insufficient to justify the procedure; two stated that TH is too resource intensive; and one indicated that hospital decision makers had doubts about the procedure’s effectiveness. Four of the eight respondents could not give a specific reason why TH is not planned or currently performed. (One respondent gave two reasons.)

**Discussion**

In this study, we observed that, after a period of slow proliferation, adoption of TH by New Jersey hospitals accelerated...
Cooling initiated in prehospital setting 35.9%

Cooling methods
- Blankets 51.3%
- Cold packs 59.0%
- IV fluids 74.4%
- Specialized systems 80.0%
- Others 2.6%

Exclusion criteria
- Awake with normal mental status 81.6%
- Age 71.8%
- Awake patient 71.1%
- Bleeding 68.4%
- Recent surgery 55.6%
- Infection/sepsis 50.0%
- Hypotension 44.7%
- Pregnancy 41.7%
- Others 62.2%

Inclusion criteria—initial ECG rhythms
- VT 91.9%
- VF 89.2%
- PEA 71.1%
- Asystole 65.8%

Cooling initiated in prehospital setting 35.9%

Table 3. Characteristics of Therapeutic Hypothermia (TH) Protocols

<table>
<thead>
<tr>
<th>Inclusion criteria—initial ECG rhythms</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT</td>
<td>91.9%</td>
</tr>
<tr>
<td>VF</td>
<td>89.2%</td>
</tr>
<tr>
<td>PEA</td>
<td>71.1%</td>
</tr>
<tr>
<td>Asystole</td>
<td>65.8%</td>
</tr>
</tbody>
</table>

Table 4. Details from Written Therapeutic Hypothermia (TH) Protocols

<table>
<thead>
<tr>
<th>Duration of TH</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hours</td>
<td>13 (72.2%)</td>
</tr>
<tr>
<td>12–24 hours</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>Otherb</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>3 (16.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defined start of TH duration</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation of cooling</td>
<td>6 (33.3%)</td>
</tr>
<tr>
<td>Once target temperature is reached</td>
<td>2 (11.1%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>9 (50.0%)</td>
</tr>
<tr>
<td>From ROSC</td>
<td>1 (5.6%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defined time for reaching target temperature</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hours</td>
<td>4 (22.2%)</td>
</tr>
<tr>
<td>6 hours</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>6–8 hours</td>
<td>3 (16.7%)</td>
</tr>
<tr>
<td>Varies by patient characteristicsf</td>
<td>2 (11.1%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>8 (44.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defined rewarming time</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6 hours</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>6–12 hours</td>
<td>4 (22.2%)</td>
</tr>
<tr>
<td>&gt;12 but &lt;24 hours</td>
<td>2 (11.1%)</td>
</tr>
<tr>
<td>24 hours</td>
<td>6 (33.3%)</td>
</tr>
<tr>
<td>Otherd</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>4 (22.2%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantification of shivering</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twitch response per Ramsay scale</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>ScV02 level, “facial tenseness,” ECG</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>14 (77.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response to patient shivering</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications</td>
<td>16 (88.9%)</td>
</tr>
<tr>
<td>Medications and blankets</td>
<td>3 (16.7%)</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>2 (11.1%)</td>
</tr>
</tbody>
</table>

Still, almost one-fifth of New Jersey’s hospitals has not adopted the procedure and has no plans to do so in the near future. Non-adopter of TH appears to be driven by organizational cultural or idiosyncratic factors that are unrelated to easily measured hospital characteristics such as teaching status, occupancy, or patient volume. Although some survey respondents (primarily ED nurse managers) cited insufficient OHCA volume, resource intensity, or doubts about the procedure’s effectiveness, others could not articulate a clear reason why their hospital was not providing TH. Although some hospitals view TH as a source of economic benefit, others may take the opposite view, particularly those with a large proportion of uninsured and Medicaid patients where the use of TH is likely to increase costs more than it increases revenue. Overall, the lack of TH use in these facilities raises questions about how and why some providers adopt new and recommended technologies while others do not.
Most survey respondents, regardless of TH adoption at their facility, reported fairly low OHCA volumes in their ED. Interestingly, many of the hospitals that plan to adopt TH in the near future currently see no more than a few TH patients per month. Given the complexity of TH implementation, this finding raises concern that many hospitals may not have a sufficient volume of patients to become proficient in the procedure. This issue is compounded by the fact that exclusion criteria for TH can be very stringent for some of these hospitals, limiting within-hospital TH volume even further.

The low volumes of OHCA patients seen by many New Jersey hospitals highlights the need to better understand whether there is a volume-outcome relationship for TH similar to that which has been demonstrated for other medical interventions, particularly those involving cardiac procedures (Canto et al., 2000; Nathens et al., 2001; Birkmeyer et al., 2003; Carr et al., 2009a). One recent study in particular finds that survival from OHCA is greatly reduced in hospitals that treat fewer than 40 cases per year (Callaway et al., 2010). Our analysis shows that more than 17% of New Jersey hospitals overall do not meet this 40-case threshold. Thus it might be beneficial to regionalize OHCA care, as the American Heart Association has recently advocated (Nichol et al., 2010).

Our finding of wide variation in TH implementation has important implications for patient care. First, differences in cooling methods and coordination with local EMS systems can lead to different rates of patient survival, neurological function, and resource use. Some of this variation is to be expected as equipment manufacturers innovate and improve TH technologies and hospitals using different combinations of equipment learn from experience. Nevertheless, rigorous evaluation is clearly needed to determine whether variation in TH practice is causing harm to certain groups of OHCA patients.

Second, the widely varying criteria for patient selection may create institutionalized treatment disparities where patients with the same presenting conditions can receive very different care based solely on the exclusion criteria of the admitting hospital. More broadly, variations in patient selection criteria raise the larger question of how hospitals develop their protocols—that is, independently or based on standards set by early adopters.

Our analysis is subject to some limitations. First, our findings are most directly relevant for New Jersey and other densely populated urban–suburban areas. In larger rural areas, the issues surrounding the adoption and implementation of TH may be quite different. Also, most of the data in our analysis come from the recollections of survey respondents. While these respondents (primarily ED nurse managers) are expected to be thoroughly knowledgeable, some answers, particularly those related to volume of OHCA patients seen may be imprecise. Nevertheless, exact counts of OHCA patient volumes would probably not change the qualitative nature of our findings. In addition, we were able to collect written TH protocols from only a subset of TH centers in New Jersey who offered them voluntarily. Thus we cannot be certain that these protocols are representative of TH practice statewide. The main finding from our protocol analysis, however, is the large variability in the details of TH implementation. It is not likely that this variability would be much less among TH centers that did not provide written protocols for our study.

The vast majority of New Jersey hospitals are now organized to implement national guidelines regarding the use of TH for initial survivors of OHCA. But limited volumes of OHCA cases per hospital and lack of uniformity on how the guidelines are implemented raise new questions about the effectiveness of current practice in postarrest care. More detailed analysis of TH volumes versus outcomes and comparative studies of TH techniques are required to optimize postarrest care.

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Disclosure Statement

No competing financial interests exist.

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Appendix

The Center for State Health Policy
Rutgers University
(Identifying information has been redacted)
New Jersey Out-of-Hospital Cardiac Arrest Study
Telephone Questionnaire

Before you ask any questions, you need to complete the Informed Consent form with the respondent.

Respondent Name __________________________________
Respondent Phone Number ________________________
Respondent Hospital Affiliation _______________________

Survey outcome:
Survey rescheduled to: ____________________________________________________
Survey partially completed, finish on: __________________________________________
Survey completed (enter date): ________________________________________________

Respondent refused to participate...5
[Explain __________________________________________]
Respondent unable to participate...6
[Explain __________________________________________]

INTERVIEWER-ONLY ITEMS
Interviewer:
• Name _______________ [name initials]
• Date _________

Data Entry:
• Name _______________
• Date _______________

Preamble/Consent
Greeting: Hello, my name is _____________. I am calling from Rutgers University. We are conducting a study of post-resuscitation care for initial survivors of out-of-hospital cardiac arrest (OHCA). For this, we are interviewing ER senior nurse managers from all hospitals in New Jersey. May I speak with [name/the ER senior nurse manager]?

[Respondent unavailable]: When would be a good time to reach him/her? [Record day/date/time, thank, and end interview]

[Respondent comes to phone]: Hello, my name is [interviewer name]. I am calling from Rutgers University. We are conducting a study of post-resuscitation care for initial survivors of out-of-hospital cardiac arrest (OHCA). For this, we are interviewing ER senior nurse managers from all hospitals in New Jersey. [Continue with text below]

[This is the respondent] The interview will take approximately 10–15 minutes. Your participation in this study is completely voluntary and confidential and there will be no penalty for not participating. If you participate, you may still choose not to answer any specific questions or withdraw from the study at any time.

The interview will be audio-recorded in order to verify the accuracy of the transcriptions. You do not have to agree to be recorded in order to participate in the study. The names of all the nurse managers and the hospitals will be kept confidential by Rutgers. Our report will include only aggregated information and no individual survey respondents or hospital names will be associated with specific responses. We will provide you with findings from our study once they become available. The information we collect will be used for further research, teaching, and presentation at scholarly conferences in the area of emergency medical care.

If you have any questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University. Rutgers University, the State University of New Jersey, Institutional Review Board for the Protection of Human Subjects, Office of Research and Sponsored Programs, 3 Rutgers Plaza, New Brunswick, NJ 08901-8559. Tel: 732-932-0150 ext. 2104, Email: humansubjects@orsp.rutgers.edu. If you have any questions or concerns after the interview, please call the Principal Investigator for this study, Derek Delia, at 848-932-4671.

May I proceed?
[If Yes] Interviewer signs consent below.
[If No] When would be a good time to call you back? ____________________
RESPONDENT/PROXY GAVE VERBAL CONSENT TO PROCEED WITH THE INTERVIEW:

[Interviewer’s signature] ___________________________ [Date: ____________]

[Interviewer’s printed name] ___________________________

May I audio-record this interview?
Yes/No [circle the appropriate response]
If Yes Interviewer signs consent below.
If No Proceed with interview but do not record it.

RESPONDENT/PROXY GAVE VERBAL CONSENT TO PROCEED WITH AUDIO-RECORDING:

[Signature] ___________________________ [Date: ____________]

[Interviewer’s printed name] ___________________________

[Begin Survey]

1. In a typical month, approximately how many out-of-hospital cardiac arrest (OHCA) patients do you treat in the ED?
   [Ask for annual count if small or unknown monthly]
   # of patients: ____________
   Monthly: _______ Annually: _______
   Don’t know/refused: ______
   Additional comments: ____________________________________________________

2. Does your hospital currently provide therapeutic hypothermia (TH) to any OHCA patients?
   Yes ______ No ______ [go to q2b] Don’t know/refused ______ [go to q2b]
   Additional comments: ____________________________________________________

2a. [If Yes] When did you begin implementation of your TH program? [Probe year and month if possible. Year/quarter is acceptable. Year only is the last option.]
   Month: __________________ Quarter: ____________ Year: ___________
   Don’t know/refused ______
   Additional comments: ____________________________________________________

2b. [If No to q2] Did you previously have a TH program?
   Yes ______ No ______ Don’t know/refused ______
   Additional comments: ____________________________________________________

[Go to Q3]

3. For which of the following initial ECG rhythms would you provide TH after return of spontaneous circulation?
   [Record all that apply]
   a. [Would you provide TH after return of spontaneous circulation] for ventricular fibrillation (VF)?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
   b. [Would you provide TH after return of spontaneous circulation] for ventricular tachycardia (VT)?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
   c. [Would you provide TH after return of spontaneous circulation] for pulseless electrical activity (PEA)?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
   d. [Would you provide TH after return of spontaneous circulation] for asystole?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________

4. Do you exclude OHCA patients from TH based on any of the following? [Record all that apply]
   a. [Do you exclude OHCA patients from TH based on] pregnancy?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
   b. [Do you exclude OHCA patients from TH based on] awake patient?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
   c. [Do you exclude OHCA patients from TH based on] awake with normal mental status?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________
d. [Do you exclude OHCA patients from TH based on] age?
   [If Yes] What are the exclusions?
   No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________

e. [Do you exclude OHCA patients from TH based on] bleeding?
   Yes ______ No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________

f. [Do you exclude OHCA patients from TH based on] patient had recent surgery?
   Yes ______ No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________

g. [Do you exclude OHCA patients from TH based on] hypotension (systolic pressure < 90)?
   Yes ______ No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________

h. [Do you exclude OHCA patients from TH based on] infection or sepsis?
   Yes ______ No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________
i. [Do you exclude OHCA patients from TH based on] any other reason?
   [If Yes] What are the exclusions?
   No ______ Don’t know/refused ______
   Additional comments: __________________________________________________________

5. Which of the following methods do you use to provide TH? [Record all that apply]
   a. [Do you use] cold IV fluids [to provide TH]?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________

   a1. [If yes] Where is cooling usually initiated? [Check all that apply]
      ED: ______ ICU/CCU: ______ Other [specify]: ______________________

   b. [Do you use] cold packs [to provide TH]?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________

   b1. [If Yes] Where is cooling usually initiated? [Check all that apply]
      ED: ______ ICU/CCU: ______ Other [specify]: ______________________

   c. [Do you use] water-circulating blanket (e.g., standard operating room blanket) [to provide TH]?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________

   c1. [If Yes] Where is cooling usually initiated? [Check all that apply]
      ED: ______ ICU/CCU: ______ Other [specify]: ______________________

   d. [Do you use] specialized external cooling system (e.g., Arctic Sun, Sub-Zero Kool Kit) [to provide TH]?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________

   d1. [If Yes] Where is cooling usually initiated? [Check all that apply]
      ED: ______ ICU/CCU: ______ Other [specify]: ______________________

   e. [Do you use] endovascular catheter system (e.g., Alsius catheter) [to provide TH]?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________

   e1. [If Yes] Where is cooling usually initiated? [Check all that apply]
      ED: ______ ICU/CCU: ______ Other, specify: ______________________

   f. [Do you use] any other method [to provide TH]?
      f1. [If Yes] What methods do you use?
         No ______ Don’t know/refused ______
         Additional comments: __________________________________________________________

      f1. For each method used, where is cooling usually initiated? [Check all that apply]
         ED: ______ ICU/CCU: ______ Other, specify: ______________________

6. For how long do you typically provide TH?
   12 hours ______ 24 hours ______ Other, specify: ______________________

   6a. Does it vary by patient or circumstances?
      Yes ______ No ______ Don’t know/refused ______
      Additional comments: __________________________________________________________
6a1. [If Yes] For what patients or circumstances? __________________________
No ______ Don’t know/refused ______

7. Do any EMS agencies initiate TH in the prehospital setting for your OHCA patients?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

[Go to Q9]

8. Do you have plans to begin using TH?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

8a. [If Yes] When? _______________________________________________________
Additional comments: _____________________________________________________

8a1. Are there any specific barriers that you face to develop your TH program?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

8a2. [If Yes] What are the barriers? [Check all that apply]
   a. _____ Never considered
   b. _____ Doubts about its effectiveness/lack of adequate evidence
   c. _____ Lack of knowledge to develop a program
   d. _____ Too complex
   e. _____ Low volume
   f. _____ Lack of resources. [Probe: Equipment, institutional support/interest]
   g. _____ Other [specify]: _______________________________________________
   h. _____ Don’t know/refused

8b. [If No to q8] Why not? [Check all that apply]
   i. _____ Never considered
   j. _____ Doubts about its effectiveness/lack of adequate evidence
   k. _____ Lack of knowledge to develop a program
   l. _____ Too complex
   m. _____ Low volume
   n. _____ Lack of resources. [Probe: Equipment, institutional support/interest]
   o. _____ Other [specify]: _______________________________________________
   p. _____ Don’t know/refused

9. Does your hospital have 24/7 intensivist coverage in units that care for OHCA patients?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

9a. [If No] Do you have any intensivist coverage in units that care for OHCA patients?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

10. Does your hospital operate an emergency medicine residency program?
Yes ______ No ______ Don’t know/refused ______
Additional comments: _____________________________________________________

10a. [If Yes] In what fields? _______________________________________________
10b. Approximately how many residents will rotate through this year?
   Number of residents: ________________________________________________
   Don’t know/refused ______
   Additional comments: _____________________________________________________

11. Does your hospital operate a critical care fellowship program?
   Yes _____ No _____ Don’t know/refused _____
   Additional comments: _____________________________________________________

11a. [If Yes] In what fields? _______________________________________________
11b. Approximately how many fellows will rotate through this year?
   Number of fellows: ________________________________________________
   Don’t know/refused _____
   Additional comments: _____________________________________________________

12. Does your hospital have a written protocol for the provision of TH?
   Yes _____ No ____ Don’t know/refused _____
   Additional comments: _____________________________________________________
12a. [If Yes] Can you make a copy available for our study? We will not share the protocol with anyone outside of the study team or identify your facility in any publicly available materials.
Yes ______ No ______ Don’t know/refused ______
Additional comments: ____________________________________________________

12b. [If Yes] Please send the protocol by e-mail, mail, or fax to:
NJ Out-of-Hospital Cardiac Arrest Study
Email: magrawal@ifh.rutgers.edu
Fax: 732-932-0069
Mailing address: 112 Paterson Street, 5th Floor
New Brunswick, NJ 08901

13. Is there anything else you think we should know about therapeutic hypothermia or post-resuscitation care for cardiac arrest patients?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
No other comments: ______

Thank you for your participation.
We will provide you with findings from our study once they become available.

Where/to whom do we send these findings?
Name: __________________________________________________________________
E-mail: ______
Address 1: ______________________________________________________________
Address 2: ______________________________________________________________
City: ___________________________________________________________________
State: _______
Zip: ___________________
Not interested in receiving them: ______
Additional comments: _____________________________________________________

15. Thanks again. Goodbye. [Hang up]

16. Interviewer: Do you need to go back and edit any answers?
[If Yes] Proceed backwards in survey to questions you need to revise.
[If No] ______ [End Survey]