

Perceived barriers to therapeutic hypothermia for patients resuscitated from cardiac arrest: A qualitative study of emergency department and critical care workers*

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Objective: To identify the barriers to implementation of mild therapeutic hypothermia for adult survivors of cardiac arrest. Despite scientific evidence to support therapeutic hypothermia for resuscitated cardiac arrest patients, it is inconsistently and at times inadequately used.

Design: Qualitative study, using semistructured interviews.

Setting: A stratified random sample of 14 sites from an established network of 43 hospitals, including both community and tertiary care centers in Southern Ontario, Canada.

Participants: Twenty-one intensive care unit and emergency department physicians and nurses.

Interventions: None.

Measurements and Main Results: Purposive sampling was used to interview individuals who were most likely to be involved in the implementation and evaluation of the hypothermia protocol. All interviews were conducted by telephone by a clinician and a qualitative researcher. Interviews were recorded electronically and transcribed unless the participant declined to have the interview recorded. Untranscribed interviews were recorded as field notes and as direct quotations. New interviews were conducted until thematic saturation occurred. The analysis was completed

through three phases of coding. Respondents identified lack of familiarity and availability of concrete therapeutic hypothermia protocols and process issues as the most frequent barriers. Process concerns included availability of equipment, equipment costs, and high workload demands for emergency nurses. Other barriers identified were variable nursing awareness, variable staff uptake, lack of agreement with supporting evidence, lack of interdisciplinary collaboration between the intensive care unit and emergency department, lack of interprofessional education between nurses and physicians, and challenges inherent in applying an intervention infrequently.

Conclusions: This study demonstrated that the systematic adoption of a new intervention, therapeutic hypothermia, is met with interdependent generic, local, and individual barriers. A working awareness of the types of barriers that exist at multiple sites will assist in targeting specific knowledge translation strategies to improve adherence to evidence-based practice. (*Crit Care Med* 2010; 38:504–509)

KEY WORDS: hypothermia; induced; cardiac arrest; cardiopulmonary resuscitation; heart arrest; critical care; emergency department

One of the 2010 Impact Goals of the Emergency Cardiac Care Committee of the American Heart Association is to double survival from cardiac arrest. In the past, Emergency Cardiac Care efforts have primarily focused on how best to achieve return of spontaneous circulation after cardiac arrest. However, approximately 60% of adults and 50% of

pediatric patients who regain spontaneous circulation die before leaving the hospital (1, 2). The focus has now evolved to include post arrest care as a key component to improving survival.

Several observational studies (3–7) have demonstrated differences in survival rates between hospitals with variable approaches to postresuscitative care. More specifically, randomized trials (8–10) and subsequent

registries with unselected patients (11, 12) demonstrated significant benefit from mild therapeutic hypothermia (TH), improving neurologically intact survival to hospital discharge. TH has a protective effect on the heart, brain, and other organs after ischemic injury sustained during cardiac arrest and subsequent reperfusion (8–10, 13–17). A meta-analysis by Holzer and colleagues demonstrated that only six patients needed to be treated with hypothermia to save one neurologically intact survivor (18). TH has been incorporated into a number of international resuscitation council guidelines, including those of the American Heart Association (19, 20), which recommends cooling comatose patients after cardiac arrest to a temperature of 32°C to 24°C for 12 hrs to 24 hrs. Despite the strong evidence for its efficacy, hypothermia is delivered inconsistently, incompletely, and with undue delay in hospitals receiving resusci-

*See also p. 711.

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tated patients (21–23). Only 26% of physicians (22) (United States and Canada) and 26% of hospitals (23) (United Kingdom) regularly institute a hypothermia protocol. Despite the fact that recent academic interest in TH has undoubtedly increased awareness and adoption from these prior published levels, considerable challenges to systematic implementation continue to exist.

There are many well-recognized types of barriers to the implementation of research into practice (24). In general, barriers may be related to changing clinician knowledge, attitudes, or behavior. More specifically, barriers may be related to individual clinicians, the intervention itself, the clinical environment, or the organizational structure. Studies of barriers to the implementation of a specific interventions (25, 26) point to the importance of understanding these barriers before and during the application of intervention strategies aimed to improve adherence to guidelines intervening with knowledge translation strategies.

Previous research into the use of TH utilization (21–23) has relied on survey data to inform adoption strategies and has not focused on understanding the complex competing demands that dictate changes in practice. The purpose of this study is to use qualitative research methods to investigate more thoroughly perceived barriers to the implementation of mild TH guidelines for adult survivors of cardiac arrest.

METHODS

Participants and Settings

Barriers were identified through a qualitative study design, using in-depth semistructured, personal interviews conducted over a 3-month period. Individual interviews were chosen as the method of inquiry to evoke personal perspectives and perceptions with the use of TH and allow comparison along interdisciplinary and interprofessional grounds. The sampling frame consisted of a stratified random sample of clinicians based at 14 different hospital sites. These sites were chosen from an already established network of 43 hospitals that have agreed to participate in future interventional studies to improve survival from cardiac arrest. This network of hospitals included both small community hospitals and large urban, tertiary care centers. Purposive sampling was used to interview individuals, who were most likely to be involved in the implementation and evaluation of a hypothermia protocol and/or who have had experience with the actual practice (27). A greater number of nurses and emergency physicians were

Table 1. Interview guide

Knowledge	
Main:	How would you describe your current knowledge or level of understanding of mild TH for post resuscitator care of post cardiac arrest patients?
Probes:	Are you aware of the guidelines for TH? How did you become aware? How would you describe the knowledge level of your colleagues in ICU/ER/etc? Has your institution provided training on the use of TH?
Main:	What is your reading of the attitudes of your colleagues (of nurses? physicians? in the ICU/ER) regarding TH?
Attitudes	
Main:	What are your current views on the use of TH for cardiac arrest patients?
Probes:	What is the evidence? What are the outcomes? In your view, how feasible is the use of TH in your hospital? Are the guidelines applicable? Are there any cost issues?
Practices	
Main:	Is TH currently in use at your institution?
Probes:	If so, to what extent has it been implemented systematically? If not, was it considered and decided against? Not considered? Will be considered?
Main:	How would you describe your experience with TH?
Probes:	How do you use it in your practice? How are patients cooled in your institution?
Main:	Studies have indicated low uptake of TH. In your view, what are the barriers to its use?
Probes:	Are there limited resources? Time barriers? Patient barriers? Staff barriers? Now thinking specifically about your practice/department/hospital, what are the barriers you've encountered? What would facilitate the use of TH in your practice/department/hospital?

TH, therapeutic hypothermia; ICU, intensive care unit; ER, emergency room.

selected in response to the analysis of early interviews, which identified that most barriers were present at the nursing level and in the emergency department environment. Occasionally, snowball sampling, in which selected study subjects refer additional subjects, was used to explore areas where further investigation was necessary to explain experiences and dynamics of a particular situation. Subjects were invited to participate by a letter sent via electronic mail. Participation in the study was voluntary and written consent was obtained before all interviews. Confidentiality measures, including anonymity of study responses, were assured and reviewed with each participant at the time of the interview.

Data Collection

All interviews were conducted by telephone by a clinician (A.T.) and a qualitative researcher (C.M.B.). Interviews were recorded electronically and transcribed verbatim, unless the participant declined to do so. C.M.B. verified the accuracy of the transcription and

clarified any inaudible passages. Untranscribed interviews were recorded as field notes and as direct quotations. The sample size for this study was determined, using the concept of thematic saturation. Thematic saturation is a standard qualitative methodology term, which describes the point at which themes are fully accounted for, understood by, and agreed on by the researchers, and no new concepts emerge from successive interviews (28, 29).

The interview guide was developed with assistance from local experts in qualitative design and TH and was based on the framework for identifying barriers to changes in practice proposed by Cabana et al (24). The interview guide (Table 1) was piloted with local physicians, who were not part of the study sampling frame, and revised where indicated.

Data Analysis

Data analysis proceeded simultaneously with data collection, using the constant comparative method (30). We were thus able to begin data analysis and identify emerging

themes after the first interview and subsequently used these themes to inform future interviews. The analysis was completed through three phases of coding (31). During the first phase, open coding, transcripts were reviewed repeatedly and the text was divided into distinct ideas or concepts. The second phase, axial coding, consisted of comparing for consistency within and between the transcripts and relating ideas to each other via a combination of inductive and deductive reasoning to create a basic frame of overarching themes or context conditions. These were then further reviewed and developed for completion and to eliminate redundancy. In the third phase, selective coding, the central themes were identified and conceptual supporting categories were organized around these. To reach trustworthiness, areas of disagreement were resolved by mutual consent and the coding was revised as needed.

Research validity was enhanced through a number of different methods. Triangulation techniques (32) were used in the form of multiple data sources (i.e., physicians and nurses from both intensive care unit [ICU] and emergency department [ED] settings) and analysis from different disciplinary perspectives of the researchers (clinician and qualitative researcher). Analysis was also independently completed by other members of the research team to confirm the accuracy of the coding scheme and reduce the influence of experience and preconception in the final framework. Through theory triangulation, which aims to place findings in the context of social theory, the authors found that the results emerging from the interviews best fit the model of behavioral change documented by Pathman et al (33), based on which they categorized the data into themes along the sequential spectrum of awareness-agreement-adoption-adherence. The Pathman model aims to describe the sequence of cognitive steps associated with adherence to a new practice guideline.

This study was approved by the Sunnybrook Health Sciences Centre Research Ethics Board.

Findings

Participants

Thematic saturation occurred after a total of 21 interviews with previously identified site contacts including four ICU physicians, seven ED physicians, and ten nurses. All interviews were included in the final analysis. Two interviews were not recorded and transcribed, one due to participant preference and one due to technical problems with the recording equipment. Data from both of these interviews were analyzed from field notes taken during the interview.

Current Knowledge

Respondents felt that they had a good understanding of TH and were aware of the guidelines regarding its use. This knowledge came from personal reading, informal discussion with colleagues, and professional rounds. There was general agreement that this awareness of TH extended to the majority of other staff in the same institution.

Practices

Most respondents had personal experience with cooling patients at their center. Methods of cooling varied among different hospitals; however, the use of ice and cooling blankets were the most common modalities.

Barriers to Using Therapeutic Hypothermia

Awareness

A number of respondents identified a complete lack of awareness of TH among some nurses in smaller community hospitals. "... emer[gency department] has high turnover, not all the nurses have a critical care background . . . they do not know what to do."

Agreement

Several physicians expressed concern over the limited, randomized trial data that were informing the adoption of TH and called for additional trials to further validate initial study findings. The study populations were thought to not necessarily be reflective of the local population and a need for collection of local data and outcome analysis was identified. There was particular concern over the cardiovascular impact of TH. "The benefit from those two studies seems fairly marginal. I mean, it's not a dramatic benefit for an intervention that is quite labor intensive and carries a number of risks." "The [cardiology group] have concerns that it increases workload on the heart, so normally you would be doing afterload reduction, reducing workload on the heart. And you know, here we tend to be increasing the workload on the heart with the hypothermia, so that is not 100% clear to me, how we should deal with that."

Adoption/Adherence

Variable Adoption. It was apparent that adoption of TH had taken place on some level at all centers that were interviewed. Adoption from an individual level was not, however, felt to be universal. Ad hoc adoption that was staff dependent was thought to have been due to physician diversity. This was especially true in EDs that relied on temporary staff with varying experience and qualifications. The avail-

ability of a protocol was identified as a means to target the uncertainty among nurses and physicians with specific pragmatic aspects of cooling. When questioned about what would assist in improving the use of TH, one respondent answered with the following statement: "Clarity around various aspects of it, so clarity around the logistics of how to achieve hypothermia from a very practical perspective and then secondly, just the equipment needs, in my own specific department, for instance; where is the ice machine?, are there enough bags?, how is it actually going to work?, where do the bags go . . .?"

TH was consistently seen as an ICU practice. Some centers described a reluctance to initiate TH in the ED due to time and resource concerns. The need for interdisciplinary collaboration between the ICU and the ED was seen as paramount to providing effective, timely application of TH. "I do not think we have a formal policy to say that Emerg cannot cool, but the structures are set up that it be very difficult to cool independently of ICU . . . they have no incentives for the Emerg docs to cool patients in Emerg because it blocks a stretcher in Emerg . . ."

Interprofessional collaboration between nursing and physician staff was also seen as an integral part of the uptake process. Successful application of TH was often seen as a nursing issue by physicians. A lack of physician guidance and nursing awareness regarding the practical application of TH have contributed to inconsistent use of TH. As one respondent stated, "I think the education piece really needs to be addressed as well. I think not just from a nursing perspective but from a physician perspective as well. You know, not all physicians are as comfortable initiating it if they're not familiar with it, so I think that piece needs to be addressed because there needs to be some standardization as well in terms of how people are educated with respect to this . . . The education piece will come a long way as well because they have to buy into the idea that it works, right?"

Process Issues

Access to cooling resources was identified as a barrier to initiating and maintaining TH. The most common method of cooling with ice bags was often found to be labor intensive and inefficient: "They've had concerns about risks to the patient and the nurse, with water everywhere . . . The concern came with just pools of water on the floor and the risk of slipping and injuring or worried about electrically cardioverting a patient when there are puddles of water all around." Most centers had shared access to a cooling blanket but access to more sophisticated cooling equipment was rare, as was experience with cold IV saline infusions. A lack of temperature probes, which are required for accurate monitoring during the cooling process, has also led to reluctance

in initiating TH due to uncertainty in how to guide therapy. "I think the greatest barrier right now that we can foresee is the method of cooling and access to a device that would allow you to cool in a relatively easy and quick manner."

Cost was recognized as a prohibitive factor in obtaining adequate equipment for cooling. There was a general lack of support from hospital administration with regard to investing in equipment that may be rarely used for what is often still seen as an emerging/experimental practice.

Unique to the ED was the issue of increased workload in the setting of limited nursing resources. This was felt to be the most significant barrier to initiation and maintenance of TH and was universally cited by participants. "I think it's a workload issue. It's a lot of work when you initially start cooling somebody and again, if you're not comfortable with the process it's easier not to do it than to do it, right?" "... it's a high intensity, a high workload, something that [the ED is] not accustomed to doing. Emerg is treat and go, right? So they're not used to going past the, okay, we've resuscitated, now we're just waiting for an ICU bed; that's their mentality as opposed to now, let's treat and then get to an ICU bed."

Rare Event

The small number of patients who qualify for this intervention results in a lack of familiarity with the method of cooling, difficulty in remembering to initiate cooling in eligible patients, and difficulty in convincing administration to invest in equipment needs. "... it's not a large segment of the population. That's the thing I think—I think it's good and bad. We wouldn't be doing it a lot so it would be a big learning curve kind of regularly..." "Without [a protocol], [the nurses] are lost. They do not really know what to anticipate or what they're supposed to be doing because they do not do it often enough obviously."

A number of participants discussed the possibility of involving prehospital care paramedics in the initiation of TH as an intervention that may improve uptake of TH in community hospitals where the number of eligible patients is small. "The likelihood of the application [of this practice] on a regular basis is very low because there are other things going on and because of that there is a lack of ability and a deficit in knowledge of when to use it and how. It is very significant to implement something like this in a community-based hospital where there is a large diverse group of physicians. Emergency medical services are the only ones that can do this well."

DISCUSSION

We have identified a number of potential barriers to the successful implementation of TH for comatose patients after cardiac arrest. These empirical data enhance previous work by Brooks and Morrison (34), who used theoretical frameworks to hypothesize about potential barriers to implementing TH and proposed key interventions and strategies for overcoming these barriers. In their discussion, the authors used the Cabana framework (21) to identify barriers to the complex task of changing knowledge, attitudes, and behavior as they relate to implementation of TH guidelines. This framework was used to inform our interview guide as a starting point from which to explore emerging themes.

Our analysis uses the model for behavioral change developed by Pathman et al (33) to organize our findings into categorical themes. This sequential model begins with the individual becoming aware of the guideline (awareness), agreeing with it (agreement), deciding to adopt it in practice (adoption), and finally, being able to use the guideline consistently and appropriately (adherence). Our findings demonstrate that perceived barriers are categorically found along the spectrum of this theoretical model. Other qualitative research focused on evidence uptake has generated similar models that highlight interactive influences of cognitive, behavioral, and administrative factors on practice patterns (35).

Although most study participants had adopted TH as part of their practice at some level, they varied in their self-reported adherence for various reasons. As previously reported by Pathman et al (33), the model does not necessarily function sequentially such that in a subset of practitioners, adoption and/or adherence may have occurred without agreement. This demonstrates that the contextual pressures within which behavioral change occurs may have a significant impact on whether or not an intervention is adopted. Knowledge translation strategies, which follow a sequential model of implementation interventions aimed at initially improving awareness and agreement, may not be the most efficient method of ensuring behavioral change; and a multifaceted approach, which also targets system-based barriers, may be more efficacious.

One of the unique barriers to initiation of TH was the perception of this

practice by both ICU and ED staff as an ICU intervention. From an ED perspective, there was a reluctance to initiate TH in the emergency setting without ICU involvement due to a strain on nursing resources and questionable self-efficacy. From an ICU perspective, there was a general bias that the ED was not capable of initiating and maintaining TH effectively and, therefore, a lack of support toward improving ED implementation. This potential barrier may need to be specifically targeted with urgency should future human studies support animal data, showing that efficacy of TH decreases with delay to induction of hypothermia (36, 37).

There was general agreement that the successful uptake of this intervention requires cooperation from the ED, the ICU, and hospital administration. Interprofessional (physician-nurse) and interdisciplinary (ICU-ED) education will be required to coordinate implementation efforts and ensure a unified approach. Barrier research in the area of protocol-based sepsis resuscitation (25) demonstrated a similar focus on interdisciplinary collaboration as a major barrier to the implementation of a strategy that requires critical care delivery in the ED setting where resources are limited in terms of both nursing staff and equipment. Clinicians looking to improve adherence to a particular intervention may draw from previous barrier research to address these interprofessional and interdisciplinary barriers more efficiently and effectively.

Further, one of the overriding themes that emerged from this study was that these process and system issues were not unique to TH, but rather they were reflective of barriers to any systematic implementation strategy for a new intervention. This finding reinforces previous research that found that barriers to implementing complex interventions, such as sepsis resuscitation and TH, pose their own unique challenges. In contrast to studies looking at simpler interventions, such as semirecumbency for pneumonia prevention (35), complex tasks introduce more complex interactions, which predispose the intervention to additional barriers on an organizational and systemic level (25, 26).

Recent survey data demonstrated that use of TH has greatly improved with rates of adoption of 63% in Canadian hospitals among ED and ICU physicians (38). Considering this growing trend of adoption, a

Careful analysis of adherence issues is now prudent. Integral to ensuring adherence is an understanding of system-based barriers from both a physician perspective and a nursing perspective, which prevent the practical application of TH. However, surveys thus far have not included nurses as respondents and have therefore not reflected on adherence barriers from a nursing perspective. Our data suggest that TH is a nursing-intensive practice and that this may be a major barrier to adherence. This should therefore be a significant focus on implementation strategies through protocol and order set creation, cooling modality training, and equipment choice based on ease of use.

Our study has several limitations. We avoided using any proportions or percentages to report our findings because that would invoke generalizability, which is not the goal of qualitative inquiry. Although this means that our findings may not be directly generalizable to the implementation of other new interventions, this is consistent with the goal of qualitative research, which aims to describe and understand behavior in a particular setting. Our study sample included uneven distributions of participants from different interdisciplinary and interprofessional groups. This imbalance was purposeful in accordance with standards of purposive sampling (27), in that we discovered from early interview analysis that most of the barriers to implementation were thought to be nursing and ED issues. This directed, *post hoc* sampling technique is routine in this type of investigation and aims to evaluate the theoretical representativeness of participants, rather than quantitative or demographic representativeness (27). Clinicians should interpret our findings cautiously and apply them to their local settings only after considering the differences inherent in their own practice environment.

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CONCLUSION

This study demonstrated that the systematic adoption of a new intervention, TH, is met with a number of interdependent generic, local, and individual barriers. Our findings can be used to inform the design of protocol implementation,

educational strategies, and audit and feedback loops for TH after cardiac arrest. Future research should aim to determine which implementation strategies are most effective in overcoming these barriers to improve the uptake of TH and ultimately improve outcomes for patients who suffer cardiac arrest.

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