# Management of Hypothermia

## *Impact of Lecture-Based Interactive Workshops on Training of Pediatric Nurses*

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**Abstract:** This study aimed to determine the efficacy of interactive workshop on the management of hypothermia and its impact on pediatric nurses' training. This is a pretest-to-posttest quasi-experimental descriptive study.

Thirty pediatric nurses attended an interactive lecture-based interactive workshop on the management of hypothermia. Participants had to accept an invitation to the presentation before the training event. They completed the lecture, and a multiple-choice question test before and after the lecture was given. There was a significant improvement in mean test scores after the lecture when compared with those before the lecture (mean [SD], 15.5 [1.3] vs 5.0 [1.7], $P < 0.001$).

The information gained in this study will be valuable as a baseline for further research and help guide improvements in the management of hypothermia with the ultimate goal of enhancing safe and quality patient care.

**Key Words:** management of hypothermia, pediatric nurses, test, knowledge, interactive workshop

(*Pediatr Emer Care* 2012;28: 455–459)

Body temperature is a vital sign, and 37°C (98.6°F) is the mean core temperature of a healthy human.[1] Human body temperature is regulated within a very narrow range. The body temperature ranged from 33.3 to 39.4°C, with a mean (SD) of 36.2°C (1.0°C). Temperature lower than 36.5°C is defined as hypothermia.[2] Mild hypothermia in patients has been defined as a body temperature between 32 and 35°C, whereas moderate hypothermia is defined as a temperature between 28 and 32°C. Severe hypothermia is defined as temperature below 28°C.[3] The incidence of hypothermia is highest (72.4%) among infants younger than 24 hours.[2] The incidence of hypothermia is also highest (93.3%) among very-low-birth-weight infants.[2] However, incidence in the hot season is also high; thus, year-round promotion of thermal care is required.[4] Hypothermia is a major contributor to early neonatal deaths especially in the developing world.[5] The prevalence of hypothermia is high among infants younger than 6 hours (80.6%), in preterm infants (88.9%), in low-birth-weight infants (89.1%), in infants with birth asphyxia (76.3%), in infants without recent oiling of the skin (90.6%), and in infants who had not been breastfed (79.2%).[5]

Hypothermia and management of hypothermia are some of the most common problems faced by parents and health professionals, in hospital, in pediatric, and primary health care settings.[6–16] The World Health Organization lists hypothermia as a "top killer" during the neonatal period and suggests that it is widely underreported and underestimated as a cause of death.[17] In the study by Zayeri et al,[15] more than 50% became hypothermic soon after birth. Moreover, half (48.6%) had moderate or severe hypothermia, and risk peaked in the first 24 to 72 hours of life. Mild or moderate hypothermia was nearly universal, with a substantially higher risk in the cold season.[16,17] Inadvertent hypothermia can have significant consequences in the perioperative setting. Knowing how to recognize and manage inadvertent hypothermia is an important aspect of perioperative nursing.[18] The problems of hypothermia in the perioperative period, which are one of the most important aspects in pediatric practice, in infants in particular, are solved by using a broad spectrum of methods for preventing and correcting the patient's thermal balance.[14] Also, hypothermia is one of the most common complications experienced by patients who underwent surgery.[13] All patients undergoing surgery are at risk for developing hypothermia; up to 70% develop hypothermia perioperatively.[11] Postoperative hypothermia occurs in 93% of patients who underwent surgery.[19]

Maintaining normal body temperatures in the pediatric setting is crucial.[6–8,20] Therefore, nurse's awareness, education, and understanding of the effects of hypothermia are necessary components to enhance the ways clinicians provide quality, cost-effective patient care. Nurses routinely identify and suggest patients to physicians for possible referral to hypothermia management and discuss potential referrals with families. Knowledge of hypothermia management is essential for nurses, especially in the pediatric setting. Pediatric nurses have the responsibility to be aware of the best practice to ensure that hypothermic patients receive the most appropriate information when caring for their hypothermia. Pediatric nurses should understand how to maintain normothermia, should understand the causes of hypothermia, and should understand the adverse outcomes that result from hypothermia. Nursing interventions to help prevent hypothermia can be implemented during each phase of pediatric care. Nurses should have the appropriate knowledge and skills in relation to caring for the patient with hypothermia and be aware of the complications and adverse patient outcomes.[11] Nursing interventions should be undertaken to prevent heat loss during caregiving procedures. Nurses must be improving the thermal environment for extremely low-birth-weight infants.[21] However, a number of studies have reported that nurses are not expert hypothermia managers. Results of these studies emphasize the need for regular education for nurses.[18,22–26]

Knowledge deficits influence the nurses' practice irrespective of additional pediatric nurses' education, pediatric or current experience, or level of practice. Continuing education is therefore needed for all pediatric nurses to ensure that the latest clear evidence available in the literature for best practice in hypothermia management is applied. Continuing professional education is essential for pediatric nurses to update their clinical

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ISSN: 0749-5161

**TABLE 1.** Prelecture and Postlecture Test Scores

| | Prelecture Test (n = 36) | Postlecture Test (n = 36) |
|---|---|---|
| Mean (SD) | 5.0 (1.7) | 15.5 (1.3) |
| 95% confidence interval | 4.3–5.6 | 15.0–15.9 |
| Kolmogorov-Smirnov test | 0.8 | 1.1 |
| Asymptotic significance | 0.5 | 0.1 |

Maximum test score = 18.
Paired-sample test (2-tailed) $t_{29} = -25.59$, $P < 0.001$.

and neonatal knowledge to meet the complex demands of current patient care. This education is "keeping up" with the new technological requirements and equipment in keeping infants in a neutral thermal environment.

This study aimed to assess the impact of an education program on Turkish pediatric nurses' knowledge and competence in identifying and managing children with hypothermia and compare findings with existing literature on hypothermia for pediatric nurses. A multifaceted approach to tackle current deficiencies in knowledge on the management of hypothermia should include the provision of evidence-based educational opportunities. The interactive workshops are generally perceived as useful for nurses. "Interactivity" led to effective learning only if learners were able to enter a dialog—with a lecture, with fellow students, or with virtual lectures—and gain formative feedback.

Therefore, the aim of this study was to evaluate the efficacy of interactive workshop on the management of hypothermia and its impact on pediatric nurses' training.

## METHODS

### Study Design and Sample

This pretest-to-posttest quasi-experimental descriptive study was conducted in an Ankara University Hospital in the Ankara city center in Turkey on November 2009.

This study was conducted using a convenience sample of nurses. Nurses working in a hospital (delivery, neonatal, and pediatric departments) participated in a teaching interactive workshop organized as part of an in-service training program. Participants had accepted an invitation to the presentation before the training event.

Participants attended a 3-hour, interactive, lecture-based workshop that was implemented by an investigator on hypothermia management.

### Instruments

A prelecture multiple-choice question (MCQ) test (Appendix A) was completed by the trainees to test their existing knowledge. The MCQs were derived from topics covered in the presentation. The MCQs validated were obtained from references in this article and from experts.

After the lecture, the MCQ test was repeated to assess retention and application of knowledge delivered in the interactive lecture. Participants were unaware that they would be tested with an MCQ before the lecture or that the MCQ would be repeated at the end of the workshop. The consent of each participant to use his/her answers for the purpose of this study was obtained.

### Statistical Methods

Statistical analysis was performed using SPSS for Windows (v. 15.0; SPSS, Inc, Chicago, Ill). The mean was used to determine test scores. The Kolmogorov-Smirnov test was used to determine whether data were normally distributed. The Student paired $t$ test was used to determine whether the differences between the prelecture and postlecture test results were significant. Differences were considered significant at $P < 0.05$.

## RESULTS

Thirty nurses participated in the interactive workshop. There was a statistically significant improvement in test scores after the lecture when compared with prelecture scores (Table 1 and Fig. 1). Data before and after the lecture (Table 1) according to the Kolmogorov-Smirnov test were normally distributed (asymptotic significance = 0.5, 0.1).

## DISCUSSION

Nurses are responsible for planning and implementing effective interventions that can contribute to minimize costs and, most importantly, reduce complications of hypothermia.[11,12,18,27]

This study was undertaken to evaluate the efficacy of an interactive workshop on the management of hypothermia and its impact on nurses' training. To assess knowledge, pretest and posttest were performed. Teaching behavior and learning environment were evaluated by questionnaires. Postgraduate training in general practice aims to develop clinical competence. However, little is known about its effect on trainees' development of competence. Nurses in this study were at nursing training grades and, having qualified 4 years earlier, would be expected to have a basic understanding of the best-practice technique in the management of hypothermia. However, the mean prelecture test score (5.0 [1.7]) was low. This indicates that it is not enough at nursing training grades.[22–25] Also, there is a huge difference between remembering something heard in a teaching session and actually "knowing" it. A more didactic form of teaching with explanation of the underlying concepts is required to improve knowledge and application of the best-practice technique in the management of hypothermia, as indicated by the significant improvement in postlecture test scores (15.5 [1.3], $t_{29} = -25.59$, $P < 0.001$). These results are similar to those found in similar studies of this theme.[22–25]

This study shows that using interactive sessions with lectures and MCQs leads to a higher level of nurses' knowledge on the management of hypothermia. Overall, nurses acknowledged the importance and relevance of the subject and felt that the workshop was worthwhile. A limitation of this study was the small number of nurses in this study, although they represented 45% of the nurses invited to attend this session. This study tested immediate recall of knowledge and it remains to be seen whether the knowledge gained since the event will be retained by the nurses

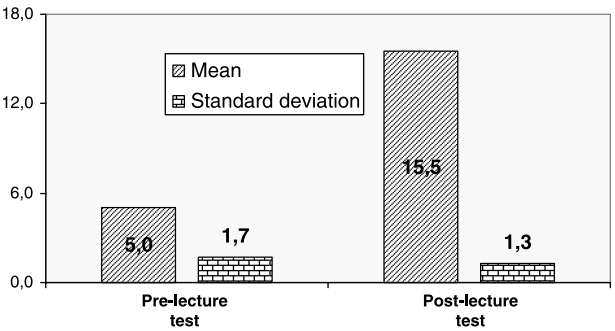


**FIGURE 1.** Prelecture and postlecture test scores.

and whether their application of best-practice technique in the management of hypothermia will be altered. It would be useful to examine the nurses' knowledge base and application of best-practice technique in the management of hypothermia habits sometime after such an event to determine the need for continued and repeated training on this important subject.

In addition, the improvement in the MCQ score could be at least partially attributed to an "order effect." It is possible that improvement in postlecture scores could have happened without the structured workshop simply because the nurses had the opportunity to think about the questions again and give a more considered answer. This could have been avoided if participants subjected to the MCQ test were randomized into no-intervention and structured learning groups.

## CONCLUSIONS

Pediatric nurses must know everything related to best-practice technique in the management of hypothermia and to complications caused by hypothermia including the ways to prevent and solve these complications. We need not forget that pediatric nurses are the ones mainly responsible for improving knowledge and applying the best-practice technique in the management of hypothermia. As nurses, we are responsible for maintaining our skills and knowledge in relation to all aspects of pediatric care. Better pediatric patient outcomes are achieved when normothermia is maintained.

The results of the study showed that, at the preprogram phase, nurses' knowledge in relation to the management of hypothermia was poor. The referenced study has shown that using interactive sessions with lectures and MCQs improved the nurses' knowledge on the topic. Many studies have shown that using interactive sessions with lectures and MCQs improved participants' knowledge on the topic. The findings of this study suggest that greater emphasis needs to be placed on pediatric nurses' education on the management of hypothermia. However, this is a critical issue in this study and we would argue that the lack of an examination of a change to the practice is a fundamental flaw that needs further explanation.

Providing nurses with information relating to management of hypothermia is essential, it can promote adherence to best practice, self-assessment, and self-reporting of the difficulties relating to the management of hypothermia. The results obtained in this study will be valuable as a baseline for further research and aid improvements in the management of hypothermia, with the ultimate goal of enhancing high-quality patient-centered care.

The literature suggests that to practice safety, nurses must have specific knowledge of the actions, benefits, and risks associated with management of hypothermia. Finally, they need to be able to appropriately document assessment findings, decide when signs and symptoms indicate the likelihood of complications, and implement appropriate actions if these complications arise. Thus, the main objectives of this research project were to describe pediatric nurses' knowledge and clinical skill performance regarding the management of hypothermia and to explore relationships between these variables and the education received by the nurses. Pediatric nurses in Turkey have a good level of baseline knowledge of hypothermia management. Nurses' training programs should be used to increase knowledge, which may subsequently lead to more referrals. The results of this study would guide educational planning on the management of hypothermia competencies.

We believe implementing workshops similar to this may be a feasible, effective way to enhance the knowledge and spread best practice of nurses on hypothermia management. In addition, it would be reasonable to assume that a similar method could be adopted to teach nursing students about management of hypothermia. The results of this study could be used to guide the development and implementation of continuing education programs for nursing staff to enhance the nurses' knowledge and skills on hypothermia management.

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## APPENDIX A

For each given question, select the single best answer from the choices provided (A–E).

1. The body loses heat by:
   A. Evaporation
   B. Convection
   C. Conduction
   D. Radiation
   E. All of above

2. The accuracy of temperature assessment depends on:
   A. Device type, body site, health care professionals' training, and patients' mental and functional competence
   B. Measurement technique, device type, body site, health care professionals' training, and patients' mental and functional competence
   C. Measurement technique, body site, health care professionals' training, and patients' mental and functional competence
   D. Measurement technique, device type, health care professionals' training, and patients' mental and functional competence
   E. Measurement technique, device type, body site, and patients' mental and functional competence

3. Temperature is most accurately measured by:
   A. External auditory canal
   B. Electronic probe orally
   C. Via the rectum
   D. Intravenous or bladder
   E. Pulmonary artery catheter

4. Which of the following statements about room temperature constantly maintained is true?
   A. 21°C
   B. 22°C
   C. 23°C
   D. 24°C
   E. 25°C

5. The delivery room should be kept at what temperature?
   A. 18°C
   B. 23°C
   C. 25°C
   D. 32°C
   E. 30°C

6. The mean core temperature of a healthy human is
   A. 36°C
   B. 36.5°C
   C. 37°C
   D. 37.5°C
   E. 38°C

7. Which of the following is the most reliable route on noninvasive temperature monitoring?
   A. The infrared ear
   B. The oral
   C. The axillary
   D. The rectal
   E. All of above

8. Which of the following is the most suitable route on temperature monitoring for all children?
   A. The oral
   B. The infrared ear (the tympanic site)
   C. The axillary
   D. The rectal
   E. All of above

9. Mild hypothermia is defined as a temperature ranging between:
   A. 28 and 32°C
   B. 32 and 35°C
   C. 35 and 36°C
   D. 36 and 37°C
   E. 37 and 38°C

10. Which of the following is a sign of moderate hypothermia?
    A. Increased blood pressure and heart rate
    B. Intense shivering
    C. Apathy or irritability
    D. Dehydration and signs of shock
    E. Cold skin and pallor

11. Which of the following is a sign of severe hypothermia?
    A. Slurred speech
    B. Hypnea
    C. Apnea
    D. Dehydration
    E. Intense shivering

12. Which of the following risk factors increase the risk of hypothermia?
    A. Intrauterine growth restriction, small-for-gestational-age infants, low ambient or environmental temperature, asphyxia, impaired central nervous system function, maternal temperature, open defects in the skin, and neural tube defects
    B. Prematurity, low birth weight, intrauterine growth restriction, small-for-gestational-age infants, low ambient

 

or environmental temperature, asphyxia, impaired central nervous system function, maternal temperature, open defects in the skin, and neural tube defects
C. Prematurity, low birth weight, intrauterine low ambient or environmental temperature, asphyxia, impaired central nervous system function, maternal temperature, open defects in the skin, and neural tube defects
D. Prematurity, low birth weight, intrauterine growth restriction, small-for-gestational-age infants, impaired central nervous system function, maternal temperature, open defects in the skin, and neural tube defects
E. Prematurity, low birth weight, intrauterine growth restriction, small-for-gestational-age infants, low ambient or environmental temperature, asphyxia, impaired central nervous system function, and maternal temperature

13. Cold stress is associated with:
A. lethargy, hypotonia, poor feeding, weight loss, abdominal distention, vomiting, restlessness, pallor, cool skin, tachypnea, respiratory distress, and a significantly reduced core temperature
B. lethargy, hypotonia, vomiting, restlessness, pallor, cool skin, tachypnea, respiratory distress, and a significantly reduced core temperature
C. lethargy, hypotonia, poor feeding, weight loss, abdominal distention, vomiting, tachypnea, respiratory distress, and a significantly reduced core temperature
D. lethargy, hypotonia, poor feeding, weight loss, abdominal distention, vomiting, restlessness, pallor, cool skin, and a significantly reduced core temperature
E. lethargy, hypotonia, poor feeding, weight loss, abdominal distention, vomiting, restlessness, pallor, cool skin, tachypnea, respiratory distress

14. Hypothermia has been related to:
A. hypoxia, metabolic acidosis, coagulation defects, and severe intraventricular hemorrhage
B. hypoglycemia, metabolic acidosis, coagulation defects, and severe intraventricular hemorrhage
C. hypoglycemia, hypoxia, coagulation defects, and severe intraventricular hemorrhage
D. hypoglycemia, hypoxia, metabolic acidosis, and severe intraventricular hemorrhage
E. hypoglycemia, hypoxia, metabolic acidosis, coagulation defects, and severe intraventricular hemorrhage

15. Which of the following effects of prolonged cold stress is true?
A. Reduces energy stores, leads to a cascade of events such as hypoglycemia, aggravates metabolic acidosis, which delays fetal transition
B. Reduces energy stores and aggravates metabolic acidosis, which delays fetal transition
C. Leads to a cascade of events such as hypoglycemia, aggravates metabolic acidosis, and delays fetal transition
D. Reduces energy stores and leads to a cascade of events such as hypoglycemia, which delays fetal transition
E. Reduces energy stores, leads to a cascade of events such as hypoglycemia, and aggravates metabolic acidosis

16. Which of the following statements is true?
A. Environmental humidity for low-birth-weight infants can help maintain body temperature.
B. A warm environment in the delivery suite in conjunction with prompts interventions of routine care.
C. Using polyethylene occlusive wraps for low-birth-weight infants can help maintain body temperature.
D. Infants lose a significant amount of heat from their heads.
E. All of above

17. In routine thermal care of an infant, temperature should be maintained above which of the following?
A. 18°C
B. 23°C
C. 25°C
D. 32°C
E. 30°C

18. To reduce evaporative heat loss of an infant, humidity should be maintained above which of the following?
A. 20%
B. 30%
C. 40%
D. 50%
E. 20%

Answers:

1. E
2. B
3. D
4. C
5. C
6. C
7. B
8. B
9. B
10. D
11. C
12. B
13. A
14. E
15. A
16. E
17. C
18. D