

# Effect of Designed Guidelines on Nurses' Performance to Prevent Preterm Infants' Hypothermia

**Abdel Rasoul GM<sup>1</sup>, Zein El Dein NA<sup>2\*</sup>, Khalaf SM<sup>3</sup> and Ibrahim ASH<sup>4</sup>**

<sup>1</sup>Faculty of Medicine, Menoufia University, Egypt

<sup>2</sup>Faculty of Nursing, Menoufia University, Egypt

<sup>3</sup>Faculty of Nursing, Benha University, Egypt

<sup>4</sup>B.Sc. in Nursing Science, Egypt

**\*Corresponding author:** Nagwa A Zein El Dein, Professor of Pediatric Nursing, Faculty of Nursing, Menoufia University, Egypt, Tel: 01092602001 /0225243536; Email: Nagwa\_ahmedzin@ymail.com

## Research article

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## Abstract

Hypothermia is a major factor causing neonatal morbidity and mortality in developing countries. Maintaining normal body temperatures in the pediatric setting is crucial. Therefore, nurse's awareness, education and understanding of the effects of hypothermia are a necessary component. So,

**Aim of this study:** was to assess the effect of designed guidelines on nurses' performance to prevent preterm infants' hypothermia.

**Design:** Quasi-experimental design was used to conduct the study.

**Setting:** The study was carried out at neonatal intensive care units (NICU) of Benha University Hospital, Benha Teaching Hospital and Specialized Pediatric Hospital at Benha city.

**Sample:** A convenient sample was comprised of 60 preterm infants admitted to the NICU and 60 nurses in the previously mentioned settings.

**Tools of data collection:** Three tools were used: tool (1) interviewing questionnaire including two parts for assessment of biosocial characteristic of nurses and neonates, tool (2) knowledge assessment sheet, it was adopted from Insaf and Ali, (2012) [1] and tool (3) observational check list, it was adopted from Ruth and Jane, (2008) [2].

**Results:** showed that, total knowledge and performance were higher on post and follow up test than pretest. There were a statistical significance correlation between total nurses' knowledge and their total performance on post and follow up test ( $p < 0.001$ ). Neonates' temperature regulations after care were higher on posttest and follow up test.

**Conclusion:** The study concluded that, the designed guidelines were effective in improving nurses' knowledge and performance regarding prevention of preterm infants' hypothermia which affected positively in regulating temperature of neonates.

**Recommendations:** The study recommended that nurses need continuous training programs to improve their knowledge and practice regarding neonatal hypothermia.

**Keywords:** Designed Guidelines; Nurses' Performance; Hypothermia; Preterm infants

## Introduction

Preterm infants, those born before 38 weeks of gestation, are at risk because their organ systems are immature and they lack of adequate physiologic reserves to function in an extra uterine environment. The range of birth weight and physiologic problems varies widely among preterm infants as a result of increase survivability among those who weigh less than 1000 gm. However, the lower weight and gestational age produce lower chances of survival among those infants. Preterm birth is responsible for almost two thirds of infants' deaths. The cause of preterm birth is largely unknown; however, the incidence of preterm birth is highest among neonates, which is likely a result of hypothermia and the lack of comprehensive health care [3].

The maintenance of a constant body temperature is important to all humans but even more so for newborn babies, especially those who born pre-term. Because accurate measurement of body temperature is an important component of thermoregulation management is critical in the neonatal intensive care unit (NICU) [4].

Heat loss can occur even in normal newborn infants. However, it is more significant in preterm infants because of thin skin, superficial blood vessels and less of subcutaneous fat, especially brown fat. Normal newborn maintain heat by flexion of extremities but the limb extended body of the preterm promotes heat loss as it exposes large surface area. Term babies can increase metabolism to produce heat but preterm babies are less able to do so [5].

Hypothermia is serious but potentially preventable if nurses do how to manage. Studies have shown that for

## Aim of the Study

This study aimed to access the effect of designed guidelines on nurses' performance to prevent preterm infants' hypothermia each 1°C decrease in admission temperature below 36°C; there is an increase in mortality by 28%. Hypothermia also is associated with hypoglycemia, respiratory distress, and metabolic acidosis. The incidence of hypothermia is between 31% - 78% for those with birth weight less than 1500 gm. Moreover, infants less than 38 weeks' gestations have the highest incidence of hypothermia. The skin temperature of an exposed preterm infant will drop at a rate of approximately 0.5°C to 1.0°C per minute. So, both physical characteristics and environmental factors

predispose the preterm infant to consequences of hypothermia [6].

This study aimed to assess the effect of designed guidelines on nurses' performance to prevent preterm infants' hypothermia each 1°C decrease in admission temperature below 36°C; there is an increase in mortality by 28%. Hypothermia also is associated with hypoglycemia, respiratory distress, and metabolic acidosis. The incidence of hypothermia is between 31% - 78% for those with birth weight less than 1500 gm. Moreover, infants less than 38 weeks' gestations have the highest incidence of hypothermia. The skin temperature of an exposed preterm infant will drop at a rate of approximately 0.5°C to 1.0°C per minute. So, both physical characteristics and environmental factors predispose the preterm infant to consequences of hypothermia [6].

Once the infant has been transferred to neonatal intensive care unit (NICU), it is vital that the correct thermal environment is provided. So, the neonatal nurse has responsibility to ensure that heat loss is minimized and the thermal conditions are stable for infant [7].

Maintaining normal body temperatures in the pediatric setting is crucial. Therefore, nurse's awareness, education, and understanding of the effects of hypothermia are necessary components. Pediatric nurses should understand how to maintain normothermia, the causes of hypothermia, and the adverse outcomes that may result from hypothermia. Nursing interventions to prevent hypothermia can be implemented during each phase of pediatric care. In addition, nursing interventions should be undertaken to prevent heat loss during care giving procedures. As well as, nurses must maintain a suitable environment for extremely low-birth-weight infants [1].

## Research Hypothesis

Nurses receiving predesigned guidelines for prevention of hypothermia will get better performance than before.

## Subjects and Method

**Design:** Quasi-experimental Design was used to fulfill the aim of this study.

**Settings:** This study was carried out at Neonatal Intensive Care Units of Benha University Hospital, Benha Teaching Hospital and Specialized Pediatric Hospital at Benha city.

### Study Sample

1. A convenient sample were comprised of all the available (60) preterm infants admitted to the Neonatal Intensive Care Unit (NICU) from May 2014 to October 2014.
2. All the available (60) nurses in the previously mentioned settings.

### Selection criteria

- A. Criteria of preterm infants:** Both sexes of preterm neonates were included, Gestational age was less than 37 weeks, stable, free from any physical condition leading to hypothermia (e.g. infection), free from any congenital anomalies or birth injuries.
- B. Criteria of the studied nurses:** All nurses available in the neonatal intensive care units were included in the study regardless their age or years of experience.

### Tools of data collection

Data were collected through the following tools:-

**Tool I:** Interviewing questionnaire:

It was designed by the researcher after reviewing related literatures, it composed of two parts:-

**Part I-** Personal characteristics of nurses such as; age, educational level and years of experience.

**Part II** -Socio-demographic data of the studied neonates from record sheet and data about the general physical condition of the neonates includes: (age, gender, gestational age and birth weight).

**Tool II:** Knowledge assessment sheet, it includes a multiple choice question sheet adopted from [1] and modified by the researcher to suite the study subjects to assess knowledge of studied nurses about hypothermia, causes, manifestation, classification and management.

**Tool III:** Observational check list to asses methods of heating loss, it was adopted by the researcher from [2] and it includes two parts:

**Part 1:** observational check list to assess infants' environmental temperature loss through Radiation and convection.

**Part II:** observational check list during different procedures to assess methods of temperature loss done by nurses.

### (A) Evaporation and Conduction

**Evaporation:** it consists of eight items, each item responded by done or not done, the done scored by 1 and the not done scored by 0.

**Conduction:** it includes 6 items assed by the researcher during different procedures for their warmth or coldness e.g. during weight the baby, the scale was warm or cold, handling the baby put him in warm or cold mattress or linens, as well as during examining the baby or doing x-ray.

**(B)** An observational check list to assess nurses dealing with incubator to assess incubator door opening or window, degree of water temperature used for hand washing, frequency of hand washing, hand drying and hand friction.(during feeding & baby bath).

**(C)** Temperature Assessment Sheet to assess room temperature and humidity as well as incubator and baby temperature before and after giving nursing care to the neonates.

### A Written Permission

An official permission was obtained from the dean of Benha Nursing Faculty and directed to hospitals' administrators of the previously mentioned settings examining the purpose of the study and methods of data collection.

### Ethical Considerations

The researcher explained the aim of the study to the nurses and the neonates' parents. They were informed that the study is harmless. The researcher secured that all of the gathered data are confidential and used for the research purpose only. The nurses were informed that they are optionally allowed either to participate or not in the study and they have the right to withdraw at any time. An oral consent was taken from the nurses and the neonate's' parents

### Data Collection Procedure

At first, the researcher assessed the body temperature of neonates as a base line using thermometer to measure axillary temperature of neonates and then observed incubators (set, room temperature, and humidity). Then, the researcher observed methods of heat loss during nurses provided different nursing care. The tools were filled individually by the researcher. Data were collected for a period of 6 months starting from May 2014 to October 2014. It was done on three days per week and four hours / day. Data collection procedure: At first, the researcher assessed the body temperature of neonates as a base line using thermometer to

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### a) Assessment phase

1. The researcher began to assess nurses' knowledge about neonatal hypothermia.
2. The researcher began to observe nurses' performance for malpractices lead to hypothermia.
3. The researcher assessed needs of nurses' knowledge and performance about neonatal hypothermia to design guidelines for prevention of neonatal hypothermia according to the following general objectives:
  - Provide nurses with knowledge about neonatal hypothermia and its sequel.
  - Perform available methods and procedures to eliminate neonates' exposure to hypothermic episodes.

The following specific objectives were developed to:

- Determine methods of heating loss among neonates.
- Assess signs and symptoms of heating loss among neonates.
- Determine environmental factors leading to heating loss.
- Determine different methods of heat loss during different nursing procedures.
- Identify potential factors leading to neonatal hypothermia.
- Discuss methods of eliminating heating loss among neonates.
- Provide designed guidelines to prevent neonatal hypothermia.

### b) Planning phase

After determining the needed knowledge and performance, the researcher designed guidelines about deficient knowledge and performance instructed for nurses regarding methods of preventing preterm infants' hypothermia adopted from Practical guide [8].

### c) Implementation phase

The designed guidelines were implemented in neonatal intensive care unit (NICU) at Benha University Hospital, Benha Teaching Hospital and Specialized Pediatric Hospital at Benha city. A booklet was designed and included a teaching module. It contained; definition of hypothermia, methods of heating loss, causes, manifestation, complications, classification and nursing management.

Nine teaching sessions were conducted by the researcher focusing on information included in the booklet. Each session lasted for 60 minutes and each session contained a number of 6-7 nurses. Teaching methods used were discussion, lectures, demonstration and re-demonstration.

### d) Evaluation phase

After implementation, the post test was carried out to assess nurses' knowledge and performance, using the same forms of the pretest. This helped to evaluate the effect of the implemented guidelines. An immediate follow up for evaluation of nurses' knowledge and performance was conducted immediately after the intervention. Follow up test was conducted after three months based on assessment of neonates' condition of recurrence rate of hypothermia.

### Statistical Design

Data were coded and transformed into specially designed form to be suitable for computer data entry process. Data were manipulated and analyzed using SPSS (Statistical Package for Social Science) version 20. Graphics were done by using Excel program. Quantitative data were presented by mean and standard deviation. Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by Chi- squared test ( $X^2$ ) and Z test (test of proportion). The paired t-test was used for comparison of two means of the same dependent group. Correlation analysis between quantitative variables was achieved through calculation of Pearson's correlation coefficient (r-value). A significant difference was considered when ( $p < 0.05$ ).

## Results

Personal Characteristics		No.	%
Age (Years)	20 < 30	51	85
	30 < 40	8	13.3
	40 < 50	1	1.7
X±SD= 26.93± 4.45			
Qualifications	Bachelor degree in nursing	13	21.7
	Clinical Nursing Institute	15	25
	Secondary school diploma	32	53.3
Experience (Years)	≤10 years	44	73.3
	>10 years	16	26.7
X±SD= 6.40 ±4.42			
Training Courses Regarding Hypothermia	Yes	0	0
	No	60	100.0

Table 1: Distribution of the studied nurses according to their personal characteristics (n=60).

As illustrated in table (1) the majority of nurses ages were between 20 <30 years (85.0%) with the mean age range of 26.93±4.45. More than half of them (53.3%) had secondary school diploma in nursing and nearly more than two third (73.3%) of them had > 10 years of experience. In addition, none of them receive hypothermia training courses

Characteristics	No.	%
Gestational age (weeks) - 26-29	6	10
-63	19	31.7
-71	35	58.3
X±SD=33.66±2.83		
Weight (gm) - Up to 1500	33	55
- >1500 - 2000	19	31.7
- > 2000	8	13.3
X±SD=1411.83±389.96		
Gender: - Male	33	55
- Female	27	45

Table 2: Distribution of preterm neonates characteristics (n=60).

As shown in table (2) more than half of studied preterm neonates' age (58.3%) were ranged between 34 - 37 weeks of gestation. Regarding preterm birth weight, 55.0% were up to 1500 gm and male gender distribution constituted (55.0%) of the total sample of the neonates.

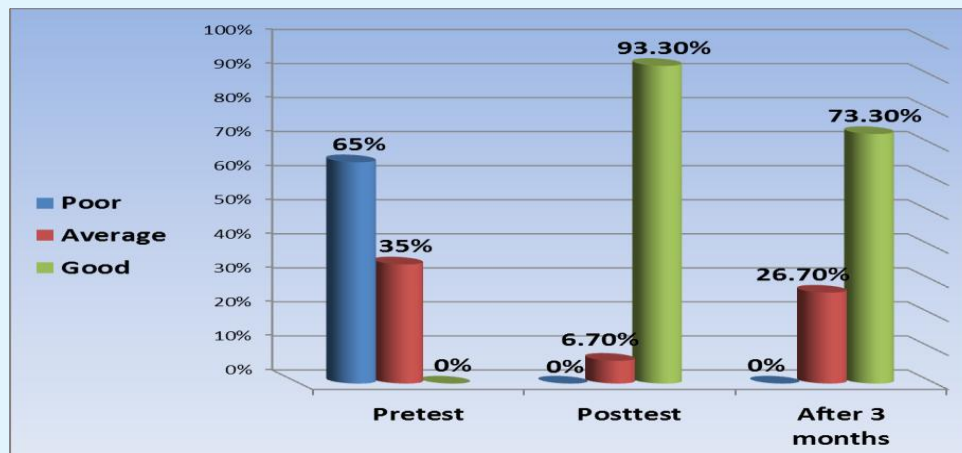


Figure 1: Distribution of nurses' total knowledge scores about neonatal hypothermia on pre, post and follow up test (after three months) (n=60).

Figure 1 illustrated that more than half (65.0%) of nurses had poor knowledge on pretest, while nearby one third (35.0%) had average and good knowledge on pretest. On the other hand nurses' knowledge changed to

good level on posttest improved by majority of them (93.3%). Moreover, none of nurses has poor knowledge on posttest (0%), while after three months, nurses' knowledge had slightly declined

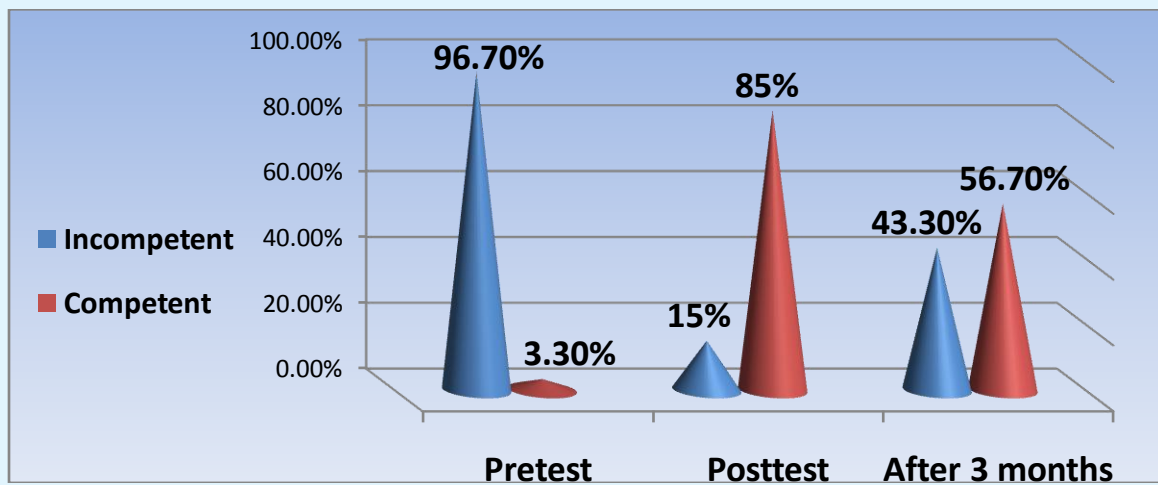


Figure 2: Distribution of studied nurses according to their total performance on pre, posttest and follow up test (after three months n=60).

Most of nurses were incompetent in their performance to eliminate heat loss on pretest, majority of them become

competent at posttest, then their performance become decline to more than half of them after 3 months.

Total Performance	Pretest		Post test		Follow UP		X <sup>2</sup>	X <sup>2</sup>
	No.	%	No.	%	No.	%	(p-value)	(p-value)
							pre- post	pre- FU
Competent (>80%)	2	3.3	51	85	34	56.7	81.13	40.63
Incompetent (<80%)	58	96.7	9	15	26	43.3	(<0 .001)	(<0 .001)

Table 3: Distribution of studied nurses according to their total performance on pre, posttest and follow up test (n=60).

Table (3) illustrated that most (96.7%) of nurses had incompetent performance at pretest. While, in posttest majority of nurses (85%) became competent in their performance. Then, their performance declined to be only more than half of them (56.7%) who had competent

performance on follow up test. Meanwhile, there was a statistical significant difference ( $p < 0.001$ ) for level of nurses' performance on posttest and follow up test than on pretest

variables	Pre test		Post test		Follow Up Test	
	r	p	R	P	r	p
Total Knowledge & total performance	0.633**	< 0.001	0.631**	< 0.001	0.775**	< 0.001

Table 4: Correlation between nurses' total knowledge about neonatal hypothermia and their performance (n=60).

Table (4) revealed that, there was a statistical significant correlation between total nurses' knowledge

and their total performance on pre, post and follow up test.

Items	Before Care X+SD	After Care X+SD	Paired t-test	P- value
Neonates temperature	36.92±0.22	36.28±0.24	21.92	<0.001
Incubator temperature	34.341±1.202	35.008±1.322	8.85	<0.001

Table 5: Comparison between preterm body temperature loss, and incubator temperature before and after nursing care on pretest (n=60).

Table (5) revealed that the neonates' temperature decreased after nursing care and the difference detected was statistically significant (t= 21.92 at p<0.001). After

the nursing care, nurses elevating incubator temperature and the difference was statistically significant (t= 8.85 at p< 0.001).

Neonates' Temperature	Pretest After Care X +SD	Posttest After Care X+SD	Follow Up Test After Care X+ SD	Paired t-test (p-value) pre-post	Paired t- test (p-value) pre-Follow up
Neonates' temperature C	36.283±0.240	36.64±0.214	36.52±0.19	14.31 (<0.001)	9.18 (<0.001)

Table 6: Comparison between mean and Standard deviation of neonates' temperature after care on pre, post and follow up test: (n=60).

Table 6 illustrated that neonates' temperature after caring based on guidelines was higher than on pre guidelines explained (36.64±0.214Vs 36.283±0.240). Meanwhile, neonates' temperature after care based on guidelines on follow up test was slightly declined (36.52±0.19). Therefore, there was a statistical significant difference (p <0.001) at pre, post and follow up test.

## Discussion

More than sixty years have lapsed since Silverman and colleagues (1958) first showed neonatal hypothermia is associated with increased mortality among preterm neonates. So, thermal stability for premature infants in the neonatal unit continues to be a problem requiring constant attention. Researchers continue to search for optimal thermal practices to prevent cold stress, ensure thermal stability, and minimize energy expenditures in the premature infant. However, there are very few evidenced based standards to use as guidelines for nurses caring for infants in the NICU [9].

The present study revealed that, the mean age and standard deviation of studied nurses were 26.93±4.45. Also, all of the studied nurses were females. Meanwhile, more than half of them (53.3%) had secondary school diploma in nursing and nearby more than one third of them(35.0%)had >5 to 10 years of experience. These findings supported by Abdel-Aziz [10], in a study about quality of nursing care for neonates with respiratory distress syndrome, who found in her study that the majority of nurses had secondary school diploma in

nursing and (38.6%) of nurses had ≥ 9 years experiences in NICU.

The present study illustrated that all of the studied nurses didn't receive previous training courses in the field of preventing preterm infants' hypothermia at NICU. This rendered them inexperienced in preventing preterm infants' hypothermia. These findings supported by Mohammed [11], in a study about "quality of nurses' performance in neonatal intensive care units", who found that the majority of nurses didn't attend training courses in NICU. This revealed that nurses in both settings in intense need for training in this area.

Concerning the personal characteristics of the studied neonates, it was noted that the mean of their gestational age were 33.66±2.83 weeks and their birth weight, for more than half (55%) up to 1500 gm. Also, more than half (58%) of them were small for gestational age (SGA) as well as 55.0% of them were males. These findings agreed with Abdel-Aziz [10], who found that the mean gestational age of neonates was 32.4±2.44 weeks and slightly more than half of the neonates were males (54.3%).

Regarding knowledge of the studied nurses about neonatal hypothermia, majority of nurses had inadequate knowledge about neonatal hypothermia. This could be attributed to the fact that majority of nurses didn't receive any training programs about neonatal hypothermia as well as they didn't develop themselves with updated knowledge. While, on posttest and follow up test, it was noted that nurses had more adequate knowledge about

neonatal hypothermia. This could be attributed to the effect of guidelines discussed with them.

Regarding the comparison between pretest, posttest and follow up test nurses' knowledge about neonatal hypothermia, the present study revealed that there was a statistical significant difference between pretest, posttest and follow up test. This is supported the effect of the guidelines on their knowledge improvement. Moreover, Thukral et al. [12] in a study entitled "evaluation of an educational program for essential newborn care in resource-limited settings: "Essential Care for Every Baby" reported that, educational program designed to increase cognitive knowledge and develop skills of health care professionals is essential newborn care. Also, it was obvious that their score of corrected knowledge was the least on pretest. This might be due to either lack of medical knowledge about neonatal hypothermia in nursing curriculum or lack of staff development and education programs in these settings.

In relation to the comparison between total knowledge level of nurses about neonatal hypothermia in pre, post and follow up test, the results of the current study illustrated that, nurses had better knowledge and provided more standardized nursing care for neonates. Meanwhile, there was a statistical significant difference ( $p < 0.001$ ). These results were similar to Insafand Ali [1] in a study about "management of hypothermia, impact of lecture-based interactive workshops on training of pediatric nurses" who found that, there was a statistical significant difference ( $p < 0.001$ ) between pretest, posttest and follow up test of nurses knowledge. So, there were no nurses having poor knowledge regarding this issue in posttest and follow up test which reflects the importance of illustrated guideline for every nursing procedure to represent how they can eliminate hypothermia during every nursing procedure.

In relation to nurses' performance provided in pretest, posttest and follow up test for neonates, the present study revealed an improvement in nurses' performance on post and follow up test. This could be attributed to the effect of guidelines. These results were supported by Knobel and Davis [13], who recommended that understanding the ways in which infants lose heat from their bodies is important in order to develop nursing interventions to prevent cold stress.

Regarding comparison between baby body temperature loss and incubator temperature before and after care was also discussed in the present study. Results

illustrated that, the baby's temperature decreased after nursing care and the difference detected was a statistically significant. These results were in agreement with Witt [14] in a study about "thermoregulation, Back to Basics who mentioned that

### Conclusion

In the light of the study findings, it was concluded that, designed guidelines were effective in improving nurses' knowledge and performance regarding prevention of preterm infants' hypothermia as shown on post and follow up test than pretest.

### Recommendation

Guideline standards of care must be available in the NICUs and department for nursing staff in the hospital, to help them to improve nursing care.

Update the nurses' knowledge and practice regarding neonatal hypothermia.

Continuous follow up within the neonatal intensive care units including hypothermia happened during stabilization and during routine caregiver procedures. Moreover, Waldron and Mackinnon [15] in a study about "neonatal thermoregulation infant" mentioned that hypothermia can also occur during routine care.

Regarding comparison between mean score of the neonates' temperature after different procedure care on pre, post and follow up test, it was clear that neonates' temperature after care on post and follow up test were higher than on pretest. Therefore, there was a statistical significant difference ( $p < 0.001$ ). This revealed that educating nurses has an impact on their performance in eliminating preterm infants' hypothermia.

In the current study, correlation between total nurses' knowledge about neonatal hypothermia and their practice on pre, post and follow up test, the study results illustrated that, knowledge and performance of nurses were poor before implementation of the guidelines in pretest. While, in post and follow up test, knowledge and performance of nurses were improved due to implementation of the guidelines. Insaf and Ali, [1] recommended that 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 room temperature and



humidity, as easily preventable methods to decrease heat loss during handling of neonates must be implemented.

Incubators' temperature should be monitored regularly using calibrated temperature monitoring devices, and the effect of frequently opening and closing the incubator door determined.

### Recommendations for Further Researches

Further studies should be conducted to replicate the study on a larger sample of neonates and nurses for generalization of results.

Search for appropriate methods to be applied to eliminate neonatal hypothermia at NICUs.

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