International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Effectiveness of Planned Teaching on Knowledge Regarding Warm Chain in Prevention of Hypothermia in Newborn Babies among Fourth-Year Basic B.Sc. Nursing Students: A Pre-Experimental Study

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Abstract: ***Background: Hypothermia is a preventable contributor to neonatal morbidity and mortality, and the WHO "warm chain", a set of ten interlinked procedures, minimises heat loss in newborns. Nursing students' knowledge of the warm chain is essential for safe newborn care. Objectives: To evaluate the effectiveness of planned teaching on knowledge regarding the warm chain in prevention of hypothermia in newborn babies among fourth-year basic B.Sc. nursing students, and to associate knowledge with selected demographic variables. Methods: A quantitative approach with a pre-experimental one-group pre-test post-test design was used. Eighty students from selected nursing colleges were selected by non-probability convenience sampling. Knowledge was measured with a 33-item multiple-choice questionnaire (maximum score 33) before, and seven days after, a 45-minute planned teaching session. Data were analysed using descriptive statistics, paired t-test and chi-square test. Results: The mean knowledge score increased from 19.35 ± 3.64 in the pre-test to 21.05 ± 4.15 in the post-test (mean difference 1.7; paired $t = 11.76$, $p < 0.05$), and the proportion of students with excellent knowledge rose from 10% to 25%. Knowledge was not significantly associated with age, gender, area of residence, previous knowledge or source of information. Conclusion: Planned teaching produced a statistically significant, though modest, improvement in students' knowledge of the warm chain. Controlled studies with larger samples and practice-based outcomes are recommended.***

Keywords: Warm chain, Neonatal hypothermia, Planned teaching, Nursing students, Knowledge, Pre-experimental study

1. Introduction

Hypothermia in the newborn, commonly defined as a body temperature below 36.5 °C against a normal range of 36.5–37.5 °C, is a serious but largely preventable cause of neonatal illness and death in developing countries [1, 2]. Immediately after birth the newborn passes from the warm environment of the womb into a much colder one, and immature thermoregulation, low birth weight and prematurity increase the risk of heat loss. Hypothermia at birth has been associated with respiratory distress, jaundice, hypoglycaemia, metabolic acidosis and death [3].

The WHO "warm chain" is a set of ten interlinked procedures carried out at birth and during the following hours and days to minimise heat loss in all newborns [4]. The ten steps are: a warm delivery room, immediate drying, skin-to-skin contact, breastfeeding, postponing bathing and weighing, appropriate clothing and bedding, keeping mother and baby together, warm transportation, warm resuscitation, and training and awareness raising. Failure to carry out any one step breaks the chain and puts the baby at risk of becoming cold.

Nurses implement these measures at the bedside, so their knowledge is central to newborn survival. Knowledge deficits among health workers have been identified as a continuing driver of neonatal hypothermia in low-resource settings [1, 2, 5]. During clinical postings in the labour room, the investigator observed that newborn temperature was not consistently maintained after delivery. Final-year nursing students are about to enter clinical practice, which makes them an appropriate group for focused teaching. This study therefore evaluated the effectiveness of planned teaching on the warm chain among fourth-year basic B.Sc. nursing students.

1.1 Objectives and hypotheses

The primary objective was to evaluate the effectiveness of planned teaching on knowledge regarding the warm chain in prevention of hypothermia in newborn babies among fourth-year basic B.Sc. nursing students in selected colleges. The secondary objectives were (i) to assess existing knowledge and (ii) to associate post-intervention knowledge with selected demographic variables (age, gender, area of residence, previous knowledge and source of information).

$\mathbf{H}^0$: There is no significant difference between pre-test and post-test knowledge scores at the 0.05 level. $\mathbf{H}^1$: There is a significant difference between pre-test and post-test knowledge scores at the 0.05 level. $\mathbf{H}^2$: There is a significant association between knowledge and selected demographic variables.

2. Review of Literature

Burden and risk factors. Hospital-based studies report a high burden of newborn hypothermia: 64% of neonates admitted to neonatal intensive care units in Addis Ababa [6], 50.3% in Southwest Ethiopia [7], 43% in a medical college hospital in Uttar Pradesh [8] and 44.1% among term

neonates in a South Indian city [9]. In a Ugandan peri-urban hospital hypothermia occurred in eight of ten newborns, which the authors linked partly to staff unawareness and failure to maintain the warm chain [10]. Low birth weight, delayed initiation of breastfeeding, early bathing and lack of skin-to-skin contact are recurring risk factors [2, 7, 11].

Prevention. Skin-to-skin contact after caesarean delivery was found feasible and the newborns were not prone to hypothermia [12], and a quality-improvement protocol reduced admission hypothermia among very-low-birth-weight infants from 68% to 41% [13].

Knowledge and teaching. Knowledge gaps among health workers are well documented, for example in immediate newborn care in Tigray [5] and in neonatal resuscitation among midwives in Tamale, where 98.1% had insufficient knowledge [14]. Teaching programmes have improved knowledge of hypothermia prevention: neonatal nurses showed a significant pre–post gain after heat-loss prevention education [15]; mean knowledge scores of nursing personnel in Ambala rose from 22.08 to 39.83 after a structured teaching programme [16]; scores of mothers of preterm babies rose from 10.91 to 20.36 [17]; and the overall mean score of mothers in Odisha rose from 19.55% to 87.8% [18]. Planned teaching also improved maternal knowledge in Belgaum [19, 20]. Most of the reviewed studies involved mothers or practising nursing personnel; the present study addresses final-year nursing students.

3. Materials and Methods

3.1 Research approach and design

A quantitative research approach and a pre-experimental one-group pre-test post-test design (without a control group) were used. A pre-test (O^1) was administered on day 1, the planned teaching (X) was given on the same day, and a post-test (O^2) using the same questionnaire was administered on day 7. The independent variable was the planned teaching on the warm chain; the dependent variable was knowledge regarding the warm chain in prevention of hypothermia in newborn babies. In this study, hypothermia referred to a body temperature below 36 °C (96.8 °F).

3.2 Setting, population and sample

The study was conducted in selected nursing colleges, chosen for ease of access, familiarity with the setting, and the cooperation and availability of participants. The target population was fourth-year basic B.Sc. nursing students. The sample comprised 80 students selected by non-probability convenience sampling. Students who were present during data collection and willing to participate were included; those absent or unwilling were excluded.

3.3 Data collection tool

The tool had two sections. Section A recorded demographic data (age, gender, area of residence, previous knowledge and source of information). Section B was a structured knowledge questionnaire of 33 multiple-choice items with four options each, developed from a literature review, a blueprint and expert consultation. Each correct answer scored 1 and each incorrect or unanswered item scored 0 (maximum 33). Scores were graded as poor (1–8), satisfactory (9–16), good (17–24) and excellent (25–33).

3.4 Planned teaching

The planned teaching was developed from the objectives, literature review and expert opinion and covered the ten steps of the warm chain. It was delivered in English as a 45-minute lecture-cum-discussion supported by audio-visual aids.

3.5 Validity, reliability and pilot study

Content validity was established by submitting the tool to 11 experts, of whom nine returned validated comments; their suggestions were incorporated into the final tool and teaching plan. Reliability by the split-half method gave a coefficient of $r = 0.73$, indicating that the tool was reliable. A pilot study was conducted from 2 to 7 September 2019 on ten students selected by the same sampling technique; it found the study feasible, and these students were excluded from the main study.

3.6 Data collection and ethical considerations

Main data collection took place from 5 to 12 December 2019. Permission was obtained from the college authorities and the institutional ethical committee, written informed consent was obtained from every participant, and anonymity was maintained by coding. Completing the questionnaire took about 30 minutes.

3.7 Data analysis

Frequency and percentage described the demographic variables; mean and standard deviation described knowledge scores; the paired t-test tested the difference between pre-test and post-test scores; and the chi-square test examined association between knowledge and demographic variables. Significance was set at $p < 0.05$.

4. Results

4.1 Characteristics of participants

Most of the 80 participants were aged 21–22 years (93.75%), female (88.75%) and from urban areas (85%). All reported previous knowledge of hypothermia in newborns; books (60%) and teachers (35%) were the commonest sources (Table 1).

Table 1: Distribution of participants by demographic variables (n = 80)

Variable	f	%
Age (years)		
21–22	75	93.75
23–24	5	6.25
25–26	0	0
Gender		
Male	9	11.25
Female	71	88.75
Area of residence		

Urban	68	85
Rural	12	15
Previous knowledge of hypothermia		
Yes	80	100
No	0	0
Source of information		
Family	4	5
Teacher	28	35
Television	0	0
Newspaper	0	0
Books	48	60

4.2 Pre-test and post-test knowledge

In the pre-test, 15% of students had satisfactory, 75% good and 10% excellent knowledge, and none had poor knowledge. After the planned teaching, 13.75% had satisfactory, 61.25% good and 25% excellent knowledge (Table 2, Figure 1).

Table 2: Level of knowledge before and after planned teaching (n = 80)

Knowledge level	Score	Pre-test f (%)	Post-test f (%)
Poor	1–8	0 (0)	0 (0)
Satisfactory	9–16	12 (15.00)	11 (13.75)
Good	17–24	60 (75.00)	49 (61.25)
Excellent	25–33	8 (10.00)	20 (25.00)
Mean ± SD		19.35 ± 3.64	21.05 ± 4.15

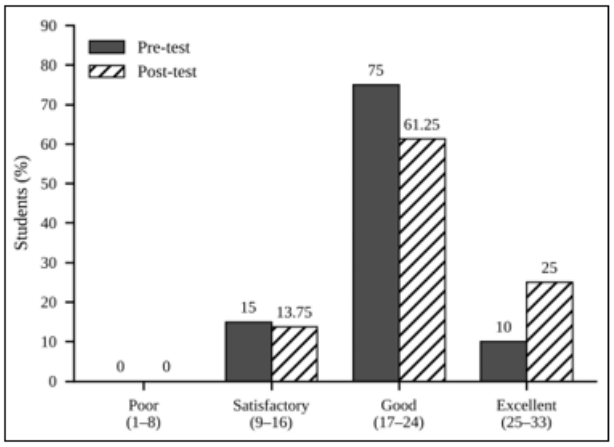


Figure 1: Pre-test and post-test knowledge levels (%)

4.3 Effectiveness of planned teaching

The mean post-test score (21.05 ± 4.15) was higher than the mean pre-test score (19.35 ± 3.64), a mean difference of 1.7 points. This corresponds to 58.6% and 63.8% of the maximum score of 33 respectively. The paired t-test gave t = 11.76 (df = 79), which exceeded the tabulated value at the 5% level ($p < 0.05$); H^0 was rejected and H^1 accepted (Table 3).

Table 3: Paired t-test of pre-test and post-test knowledge scores (n = 80)

Test	Mean	SD	Mean diff.	Paired t
Pre-test	19.35	3.64	1.7	11.76†
Post-test	21.05	4.15		

† Significant at $p < 0.05$.

4.4 Association with demographic variables

Chi-square tests showed no significant association between knowledge level and age, gender, area of residence, previous knowledge or source of information (all $p > 0.05$; Table 4). H^2 was therefore not supported.

Table 4: Association between knowledge level and demographic variables

Variable	χ^2	Inference
Age	3.57	Not significant
Gender	2.77	Not significant
Area of residence	0.76	Not significant
Previous knowledge	0	Not significant
Source of information	1.3	Not significant

All participants reported previous knowledge, so that variable did not vary.

5. Discussion

This study found a statistically significant increase in fourth-year nursing students' knowledge of the warm chain after a single 45-minute planned teaching session. The mean score rose by 1.7 points, and the share of students with excellent knowledge rose from 10% to 25%. The gain is consistent in direction with earlier teaching-programme studies on hypothermia prevention among nursing personnel [15, 16] and mothers [17, 18, 19, 20].

The size of the gain was, however, small compared with those studies. Nursing personnel in Ambala improved from 22.08 to 39.83 [16] and mothers of preterm babies from 10.91 to 20.36 [17], whereas the present increase was 1.7 points on a 33-point scale. Baseline knowledge in this sample was already fairly high: no student had poor knowledge, 85% were in the good or excellent categories, and every student reported previous knowledge. Students may already have covered the topic in their curriculum, which would leave less room for improvement. A single session and the short interval between teaching and post-test may also have limited the gain. The statistical significance should therefore be read alongside its modest practical size.

No association was found between knowledge and the demographic variables studied. The sample was largely homogeneous (94% aged 21–22 years, 85% urban, all with previous knowledge), and several cells in the cross-tabulations were small, so the study had limited ability to detect associations. Other teaching studies have reported associations with variables such as education, residence, previous knowledge and source of information [17] or with age and religion [19], but those samples were mothers, not students.

6. Limitations

The study used a one-group design without a control group, so improvement cannot be attributed with certainty to the teaching alone; the same questionnaire was used at pre-test and post-test, which may have introduced a test-retest effect. Participants were 80 fourth-year students from selected colleges chosen by convenience sampling, which limits

generalisation. Only knowledge, not clinical practice or neonatal outcomes, was measured, and retention beyond seven days was not assessed. Several chi-square cells had small counts, so the association results should be interpreted cautiously.

7. Implications

Nursing education: brief planned teaching can reinforce warm chain content in the final year, and curricula can emphasise early identification and prevention of newborn hypothermia. *Nursing service and administration:* the teaching plan can support in-service education and workshops for staff and students in labour rooms and newborn units. *Nursing research:* the tool and teaching plan can be adapted and tested in controlled designs and with practice-based outcomes.

8. Conclusion

Planned teaching on the warm chain produced a statistically significant improvement in the knowledge of fourth-year basic B.Sc. nursing students (mean 19.35 to 21.05; paired $t = 11.76$, $p < 0.05$), although the absolute gain was modest and baseline knowledge was already good. Knowledge was not associated with the demographic variables studied. Similar studies with larger samples, control groups and measures of practice are recommended, along with studies on thermal protection teaching and on the prevalence and incidence of hypothermia in newborns.

Acknowledgement
[To be completed by the authors: guide, participating colleges, experts who validated the tool, and the students who took part.]

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