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Prevalence and factors associated with neonatal hypothermia: a cross-sectional study among healthy term neonates in a peri-urban hospital in Northern Uganda

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Abstract

Background Neonatal hypothermia is highly prevalent even in warm tropical countries. Neonatal hypothermia increases the risk of morbidity and mortality. In Uganda, the prevalence of hypothermia is not known among healthy term neonates.

Objective To determine the prevalence of neonatal hypothermia and the associated factors in Lira Regional Referral Hospital.

Methods Hospital-based cross-sectional study was conducted in Northern Uganda. The interviewer-administered questionnaires and direct observations used to determine the initiation of warm-chain practices after delivery for 271 newborns. The axillary temperature of neonates was measured at intervals of 10 min, 30 min, one hour, and 2 h after birth. The multivariate binary logistic regression was done. The 95% confidence interval (CI) and p-value < 0.05 used to identify factors significantly associated with neonatal hypothermia.

Results Neonatal hypothermia was 67.6% during the first two hours postnatal. Neonatal hypothermia was 64.5% at 10 min, 81% at 30 min, 76% at one hour and 49% at two hours postnatal. Hypothermia was significantly associated with low birth weight (Adjusted odds ratio (AOR) = 2.78; 95% CI: 1.01–7.62); male sex (AOR = 1.69; 95% CI: 1.04–3.33), not drying the newborn (AOR = 3.06, 95% CI: 1.64–5.72); no skin to skin contact within five minutes postnatal (AOR = 2.17, 95% CI: 1.15–4.10); and low maternal body temperature (AOR = 2.70, 95% CI: 1.49–4.76).

Conclusions The prevalence of neonatal hypothermia was high in the first two hours. Neonates who were more likely to have hypothermia were male, not dried properly, low birth weight, no skin-to-skin contacts, and low maternal body temperature. Proper drying of the newborn and skin-to-skin contact can reduce the burden of neonatal hypothermia. There is a need to train the midwives on proper drying of the newborn, keeping the mother warm, and the importance of skin-to-skin contact in prevention of neonatal hypothermia among male and low birth neonates.

Keywords Neonatal hypothermia, Neonates, Warm chain practices, Skin to skin contact

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Background

The World Health Organization (WHO) has defined neonatal hypothermia as a newborn's temperature of lower than 36.5 degrees Celsius [1]. Neonatal hypothermia is a significant contributor to neonatal morbidity and mortality [2–5]. The case fatality rate of neonatal hypothermia reaches up to 52% [3]. The risk of neonatal mortality increases by 80% for every decrease in one degree Celsius body temperature [4]. Neonates with hypothermia are five times more likely to die than neonates with normothermia [2, 4]. The risk of neonatal mortality is further increased given that neonatal hypothermia is often a complication of severe sepsis, prematurity, and birth asphyxia, the leading causes of neonatal deaths [3].

Neonatal hypothermia is widely common even in countries with warm tropical climates [3, 5]. The global prevalence of neonatal hypothermia in hospital-based studies ranges from 32 to 85%, while it varies from 11 to 92% in studies that were conducted in home-based deliveries [3]. In the relatively warmer tropical sub-Saharan Africa, some studies have cited 60–85% prevalence of neonatal hypothermia [5]. A systematic review comprising 12 studies in East Africa, found 57.2% pool prevalence of neonatal hypothermia [6]. In Uganda, 79% prevalence of neonatal hypothermia has been reported at two hours after birth in peri-urban health facility [7].

The risk factors for neonatal hypothermia have been classified into four categories which include environmental, physiological, behavioral and socio-economic factors [8]. The ambient temperature of approximately 20 to 30 degrees Celsius in most parts of sub-Saharan Africa overwhelms the thermoregulatory mechanisms of the newborn, thereby increasing their risk of neonatal hypothermia [5, 8]. Premature and low birth weight neonates have increased risk of neonatal hypothermia compared to term newborns [8]. The high risk of neonatal hypothermia in sub-Saharan Africa has been partly attributed to the modifiable behavioral practices [5]. In Africa, the common practices of early bathing of the newborn and delayed initiation of breastfeeding predispose newborns to hypothermia [5, 9]. More so, the odds of neonatal hypothermia are increased by the inadequate knowledge even among the healthcare providers regarding the increased likelihood of the newborn to suffer from hypothermia [5].

The WHO has included thermal care as a component of the essential newborn care [1]because of the adverse effects associated with neonatal hypothermia [4]. The WHO developed 10 warm chain practices in a conscious effort to prevent and manage neonatal hypothermia [1]. The warm chain practices including immediate skin to skin contact (SSC), drying and wrapping the newborn, early breastfeeding, delayed bathing and weighing of the newborn have been adopted into the Uganda Ministry of Health guidelines [1, 10]. The extent, however, with adherence to the guidelines regarding warm chain practices has not been determined.

In sub-Saharan Africa, including Uganda, the temperatures of the neonates are not routinely taken during the immediate postnatal period [5]. In Uganda, only two studies have determined the prevalence and the likely factors associated with hypothermia [7, 9]. These studies [7, 9], conducted nearly two decades ago, were conducted in central Uganda, a region with a relatively lower temperature than the rest of the country. We conducted this study in Northern Uganda, which is relatively warmer than other parts of the country. The study, conducted in the dry hot months of December to February, determined the prevalence and the factors associated with neonatal hypothermia in a peri-urban health facility in Northern Uganda.

Methods and materials

Study design and setting

This was a descriptive cross-sectional study. The midwives were directly observed while conducting delivery. The direct observation allowed correct documentation of the warm chain practices that midwives initiated following delivery. The study was conducted in Lira Regional Referral Hospital (LRRH). This is a peri-urban health facility that is located in Lira district in Northern Uganda. Being a regional referral hospital, it has an average annual number of 5200 deliveries on average. The hospital has a maternity ward and a Neonatal Intensive Care Unit. The neonatal intensive care unit has five functional incubators and one infant warmer. The hospital has a total of 14 midwives deployed in the maternity ward.

Study population, sample size and sampling procedure

The midwives and the mother-baby pairs were the study participants. Neonates delivered normally by spontaneous vertex delivery or Caesarian section were included in the study. Healthy term or near-term newborns with a body weight of 1800 grams or more, and APGAR score of at least seven out of ten at five minutes were included in the study. All midwives who were involved in conducting delivery and offering immediate newborn care were observed. The midwives were aware that they were being observed. Direct observation of midwives' practices occurred during day and night in the morning, evening, and night shifts. This was a total of 271 observations which was commensurate with the study sample size. Continued and repetitive observations over time eliminated the Hawthorne effect [11]. The sample size of the study was 271 mother-baby pairs. The sample size was calculated using the Kish-Leslie formula using the 80% prevalence of neonatal hypothermia from a study conducted in central Uganda and the absolute precision of

5% [7]. A sample size of 246 participants was realized, and considering a 10% non-response and missing data, the final sample size for this study was 271 participants. The consecutive sampling method was used to select the study participants [11].

Data collection

Semi-structured questionnaire was used to collect data from the mother-baby pairs. The socio-demographic characteristics of the women were collected from the client's case files after informed consent was obtained. The axillary body temperature was measured using a digital thermometer (model TH3302). This thermometer measures temperature from 32.0 °C to 42.9 °C (89.6 °F to 109.9 °F) with absolute accuracy of ± 0.1 °C. The axillary body temperature of each newborn was measured at the regular time intervals of 10, 30, 60 min, and two hours postnatal. Hypothermia in this study was considered to be body temperature of less than 36.5 °C at any of the time readings. Hypothermia was divided into mild (36.0–36.4 °C °C), moderate (32.0 to 35.9 °C), and severe (less than 32.0 °C) hypothermia [13]. The thermometer was disinfected using 70% ethyl alcohol pads after each measurement of axillary temperature. For babies who were enrolled in the study, the axillary body temperature of their mothers was measured within five minutes of childbirth. The room temperature of the maternity delivery room, where the mother-baby pairs stayed, was measured every day at regular intervals after every six hours. The indoor Digital LCD Hygrometer thermometer was used to measure room temperature with alarm clock, which measures temperature from – 0 °C to 50 °C (–32 °F to 122 °F).

The standardized checklist was used to observe the warm chain practices which were initiated by the midwives for the immediate care of the newborns. The warm chain practices included drying and wrapping the newborn with appropriate clothing, immediate initiation of skin-to-skin contact within 5 min and practice for at least one hour; early initiation of breastfeeding started within half an hour after birth, and bathing of the newborn should be delayed for at least 24 hours. The self-administered questionnaire was used to collect the socio-demographic characteristics of the midwives. The socio-demographic information collected from the midwives included their age, the training qualifications, work experience, and in-service training on prevention of neonatal hypothermia.

Data analysis

The data were analyzed using SPSS computer software package (version 23). Frequencies and percentages were used to describe categorical variables. Continuous variables were assessed for normality. We used the mean and standard deviations (SD) to describe the age of the study participants and room temperature since they were normally distributed. The prevalence of neonatal hypothermia was determined by dividing the number of newborns with hypothermia by the sample size of newborns. Bivariate and multivariate logistic regression were used to identify the independent factors associated with neonatal hypothermia. Variables whose p-value was less than 0.15 at bivariate analyses were imported for multivariate logistic regression. Variables which were significant at bivariate analyses were imported for multivariate logistic regression. The factors with a p-value of less than 0.05 at the 95% confidence interval were considered to be significantly associated with neonatal hypothermia at the multivariate analyses.

Ethical considerations

This study was approved by the Research and Ethics Committee Makerere University School of Health Sciences. The introduction letter was obtained from the Chair of the Department of Nursing to seek permission to conduct research in Lira Regional Referral Hospital. Permission to carry out the study was obtained from the LRRH and the in-charges of the Maternity ward. Written informed consents were obtained from both the midwives and the mothers before enrolling them into the study. Midwives were consented before they were observed, while participants were assured that records would not bear any identification apart from the study code, and there would be strict observation of confidentiality at all levels of the study.

Results

Socio-demographic characteristics

Out of the 285 eligible participants, 271 mother-baby pairs were enrolled in the study. The 13 mother-baby pairs were missed because of more than two simultaneous deliveries, while one woman declined to consent to the study. We observed 14 midwives where their mean age was 29.78 years (SD ± 8.78) with a range of 21 to 49 years. The majority of the midwives had either an enrolled certificate 7(50%), diploma 6(42.9%), or bachelor's 1(7.1%) level of education. Nearly three-quarters 10(71.4%) of the midwives had work experience in the maternity ward for more than a year. The majority 12(86%) of the midwives had no formal in-service training on the WHO warm chain practices. The mean age of mothers was 24.88 years (SD ± 5.88) (Table 1).

Newborn characteristics

The mean gestational age was 38.54 (SD ± 1.56 weeks). The majority 238(88.2%) of the newborns weighed at least 2500 g. The delivery room temperature varied from

Table 1 Socio-demographic characteristics of mothers [*n* = 271]

Characteristics	Frequency (%)
Mean maternal age, year (SD	24.88(5.88)
Maternal age (years)	
<19	57 (21.0)
20–34	191(70.5)
>34	23 (8.5)
Maternal parity	
Primiparous	100 (36.9)
Multipara	171 (63.1)
Occupation	
House wife	80 (29.5)
Government Employee	29 (10.7)
Private Business	69 (25.5)
Peasant Farmer	87 (32.1)
Student	6 (2.2)
Level of education	
Primary	152(56.1)
Secondary	81 (29.9)
Tertiary	27(10.0)
Illiterate	11(4.0)
Marital status	
Married	253 (93.4)
Divorced/Separated	3 (1.1)
Single	15 (5.5)
Maternal temperature	
<36.5 °C	114 (42.1)
≥36.5 °C	157(57.9)

Table 2 Characteristics of the newborns [*n* = 271]

Characteristics	Frequency (%)	Mean (SD)
Time of delivery		
Day	156 (57.6)	
Night	115 (42.4)	
Mode of delivery		
Spontaneous vaginal delivery	203 (74.9)	
Caesarean Section	68 (25.1)	
Sex of the newborn		
Female	142 (52.4)	
Male	129(47.6)	
Gestational age (in weeks)		38.54(1.56)
30–36	16 (5.9)	
≥ 37	254 (93.7)	
> 42	1 (0.4)	
Birth weight (in grams)		3094.2(461.85)
< 2500	32 (11.8)	
≥ 2500	238 (88.2)	
Temperature of delivery room (^{O}C)		29.19 (1.39)
25–26 °C	14 (5.20)	
≥ 27 °C	257 (94.9)	

Table 3 The prevalence of neonatal hypothermia [*n* = 271]

Temperature (°C)	10 min	30 min	1 h	2 h
	N (%)	N (%)	N (%)	N (%)
Normothermic (36.5–37.5 °C)	96 (35.5)	52 (19.2)	65 (24.0)	138 (50.9)
Hypothermia (< 36.4^{0}C)	**175 (64.5)**	**219 (80.8)**	**206(76.0)**	**133 (49)**
Mild hypothermia (36.0 to 36.4 °C)	101(37.3)	108 (39.9)	104(38.4)	84 (31.0)
Moderate hypothermia (32.0–35.9 °C)	74 (27.2)	111(40.9)	102(37.6)	49 (18.1)
Severe hypothermia (< 32 °C)	0 (0.0)	0(0.0)	0 (0.0)	0 (0.0)

25.8 °C to 32.9 °C, with an average of 29.19 °C (SD ± 1.39). See Table 2.

Newborn hypothermia

The prevalence of neonatal hypothermia was high (Table 3). Overall, more than two-thirds (67.6%) of the neonates had hypothermia at one point in time in the first two hours postnatal. Nearly two-thirds 175 (65%) of the neonates had neonatal hypothermia at 10 min, which increased to 219(81%) at 30 min after childbirth. After one hour postnatal, 76% of the neonates had neonatal hypothermia, while 133(49%) had neonatal hypothermia at 2 h after birth. See Table 3.

Warm-chain practices initiated by the midwives and mothers

More than one-quarter of the neonates were not dried and covered properly: either head or skin folds were still wet; covered with wet towel; and some were left exposed after drying. More than three-quarters 207(76.4%) of the neonates were not initiated on skin to skin contact within the first five minutes after birth. Nearly one-quarter 62(22.9%) of the neonates were breastfed within the first hour after birth. The majority of the newborns were bathed after six hours of delivery (Fig. 1).

Practice to initiate on skin-to-skin contacts

A total of 64 out of 271(23.6%) neonates were initiated on skin-to-skin contact. However, inappropriate practices were observed in more than half of the cases, 28 out of 64 (43.75%) had good practices while 36 out of 64(56.25%) of the newborns initiated on SSC had inappropriate practices. The inappropriate practices included a duration less than one hour 160(59) which was varying from four to 45 min. and 4(11%) was covered with wet towel used for drying the baby, wrapping the newborn in clothing and placed on mother's chest instead of SSC 4(11%); and initiating skin-to-skin contact only after weighing and tying of the cord 21(8%) (Fig. 2).

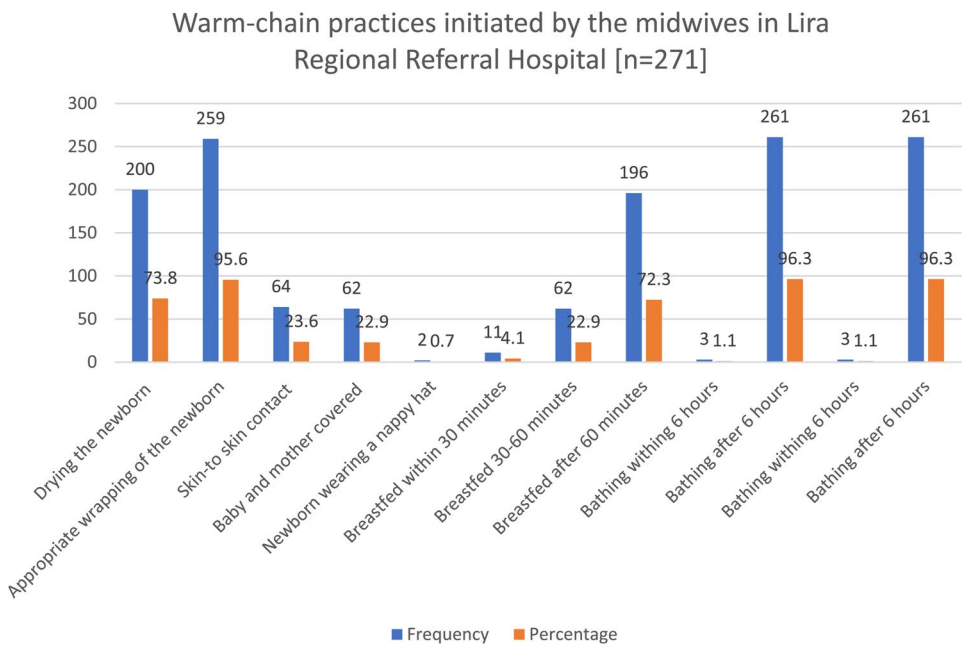

Fig. 1 Warm-chain practices initiated by the midwives

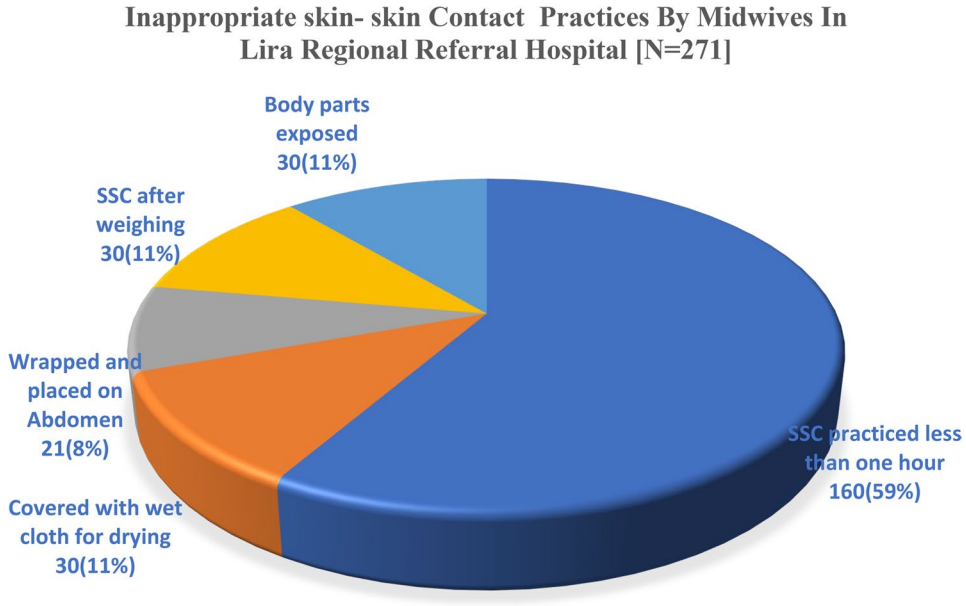

Fig. 2 Inappropriate skin to skin practices by midwives in Lira regional referral hospital 2019

Factors associated with neonatal hypothermia at two hours postnatal

In bivariate analyses, the following warm chain practices were found to be significantly associated with the occurrence of hypothermia: birth weight, drying, sex of the newborn, skin to skin contact, room temperature of the delivery room, and maternal temperature were significantly associated with neonatal hypothermia (Table 4).

After adjusting for confounding factors, low birth weight, not drying the neonate, male sex and low maternal temperature were independently associated with neonatal hypothermia at two hours postnatal (Table 5).

Discussion

In this study, the average delivery room temperature was 29.9 °C (SD ± 1.39) which varied from 25.8 °C to 32.9 °C. Despite the relatively warm ambient temperature in this study, more than two-thirds (67.6%) of neonates were found to have neonatal hypothermia at one point in time

Table 4 Bivariate analysis of warm chain practices among neonates [*n* = 271]

Variables	Hypothermia	Normothermia	COR (95% CI)	*P*-Value
Birth weight (grams)				**0.040***
< 2500	16(69.6)	7 (30.4)	2.56 (1.02, 6.43)	
≥ 2500	117(47.2)	131 (52.8)	1.000	
Gestational age (weeks)				0.94
< 37	8(50.0)	8(50.0)	0.96 (0.35, 2.64)	
≥ 37	125(49.0)	130(51.0)	1000	
Sex of the newborn				**0.034***
Male	72(55.8)	57 (44.2)	1.68 (1.04, 2.71)	
Female	61(43.0)	81(57.0)	1.000	
Drying after birth				**0.000***
Yes	81(40.5)	119(59.5)	1.000	
No	52(73.2)	19(26.8)	4.02 (2.21, 7.30)	
Skin to skin contact initiated within 5 min				**0.003***
Yes	21(32.8)	43(67.2)	1.000	
No	112(54.1)	95(45.9)	2.41(1.34, 4.53)	
Initiation of Breastfeeding within 30 min				0.68
Yes	29(46.8)	33(53.2)	0.89 (0.50, 1.57)	
No	104(49.8)	105 (50.2)	1.000	
Mode of delivery				
Spontaneous vaginal delivery	100(49.0)	104(51.0)	0.87 (0.49, 1.53)	0.6
Caesarean Section	33(49.30)	34(50.70)	1.000	
Temperature of delivery room				**0.034***
< 27 °C	11(78.6)	3(21.4)	1.000	
≥ 27 °C	122(47.5)	135(52.5)	0.242 (0.07, 0.89)	
Maternal Temperature				**0.000***
< 36.5 °C	104(57.1)	78(42.9)	2.78 (1.61, 4.76)	
≥ 36.5 °C	29(32.6)	60(67.4)	1.000	
Time of delivery				**0.17**
Day	71(45.5)	85(54.5)	1.000	
Night	62(53.9)	53(46.1)	1.400 (0.86, 2.29)	

CI denotes confidence interval COR denotes crudes odds ratios* denotes statistical significance ($p < 0.05$).

Table 5 Multivariate analyses of factors associated with neonatal hypothermia 2 h after birth [*n* = 271]

Variable	COR	*p*-value	AOR	*p*-value
Birth weight(grams)		**0.046**		**0.047***
< 2500	2.56(1.02, 6.43)		2.78 (1.01, 7.62)	
≥ 2500	1.000		1.000	
Sex of the newborn		**0.034**		**0.035***
Male	1.68(1.04, 2.71)		1.69 (1.04, 3.33)	
Female	1.000		1.000	
Drying		**0.000**		**0.000***
Yes	4.02(2.21,7.30)		3.06 (1.64, 5.72)	
No	1.000		1.000	
Skin to skin contact		**0.003**		**0.017***
Yes	2.41(1.34, 4.35)		2.17 (1.15, 4.10)	
No	1.000		1.000	
Maternal Temperature		**0.000**		**0.001***
< 36.5 °C	2.78 (1.61, 4.76)		2.70 (1.49, 4.76)	
≥ 36.5 °C	1.000		1.000	

AOR: adjusted odds ratio; * statistical significance ($p < 0.05$)

during the first two hours after delivery. The finding in this study was within 32–85% range reported in a systematic review study [3]. The 67.6% prevalence was similar to the 64–69% in Ethiopia [6, 14, 15] and 62% in Nigeria (62%) [12]. The prevalence in this study, however, was lower than 83% in Uganda, 81–85% in Nepal and 88% in Turkey but higher than 44–51% in Zambia and 2.9%–45% in India [7, 8]. The wide variation in the prevalence in this study from that of other studies may be attributable to the differences in the study methods used across studies [4]. These include the cut-offs for hypothermia, gestational age and weight distribution of the sample, the season the study was conducted, inclusion of sick neonates, axillary versus rectal or tympanic temperature and the time temperature of the neonate was measured during postnatal period [4, 6, 14–16]. The prevalence of neonatal hypothermia was high, although it was conducted during the hot season. This validates findings from similar studies which have indicated a high prevalence of neonatal hypothermia even during the hot seasons in warm tropical countries [5, 8]. While we did not study the impact of hypothermia on the newborn, previous studies have cited increased risk of neonatal morbidity and mortality among neonates with hypothermia [2, 4, 17]. The practices of not initiating SSC within five minutes, male sex, low maternal temperature, not properly drying the newborn and low birth weight were partly likely to explain the high prevalence of neonatal hypothermia reported in this study.

In this study, only 24% of the neonates were immediately initiated on SSC within five minutes of delivery. SSC, however, was not maintained for one hour even among the few neonates who were initially on SSC. The discontinuation of SSC was related to the midwives' perceived need to urgently weigh the neonates immediately after delivery. A similar study in Uganda has cited the common midwifery practices of weighing, Vitamin K administration and assessment of the newborn as one of the major barriers to uninterrupted SSC in the first one hour after birth [18]. The interrupted SSC increases the associated likelihood of developing neonatal hypothermia [8]. Consistent with findings from previous studies [5, 14, 19], the practice of not initiating SSC within five minutes of delivery, in this study, was strongly associated with increased odds of neonatal hypothermia among term healthy neonates. The plausible explanation for reduced odds of hypothermia is related to the facilitated heat conduction transfer from the mother to the newborn during SSC [8]. Besides, SSC promotes early initiation of breastfeeding which altogether fosters attachment and close contact with the mother thereby reducing the risk of neonatal hypothermia [8, 20].

In this study, low birth weight was significantly associated with increased odds of neonatal hypothermia. This is consistent with studies from Ethiopia [21], Nigeria [22]. The increased predisposition to neonatal hypothermia could be attributed to the thin subcutaneous tissue and large surface area to body mass ratio in neonates with low birth weight [23]. The WHO has recommended immediate drying of the newborn to prevent heat loss by evaporation [1]. After drying, placing newborns on SSC with their mothers and covering both of them with a heavy clean dry cloth helps to prevent further heat loss [1, 13]. In this study, however, the urgency to administer oxytocin and deliver the placenta meant that more than one-quarter (26%) of the neonates were not dried. This correlates with a common practice in Zambia for the midwives to care for the baby only after the placenta is delivered [8]. This partly accounts for the high prevalence (81%) of neonatal hypothermia at 30 min postnatal. As a result, we found that newborns who were not dried were more likely than dried neonates to have neonatal hypothermia. Proper drying and covering of the newborn prevent hypothermia through the four mechanisms of heat loss including evaporation, conduction, convection and radiation [8].

Implications for policy and practices

Our study underscores poor practices to keep the newborn ward including inappropriate skin to skin practices. These resulted in high neontal hypothermia in a setting which is traditioanlly warm tropical climate. There is need to improve basic routine practices of warm chain by health care providers. This may include providing mentorship and periodic in-service training to enable midwives to practices appropriate interventions to keep the newborns warm and prevent neonatal hypothermia. There is also need to integrate warm chain practices into essential newborn care and educational training for midwives.

Strengths and limitations of the study

Unlike the majority of the studies [6, 8, 15], which focused on premature neonates, low birth weight and neonates admitted in neonatal units, this study was conducted exclusively among healthy near term and term newborns. The study, therefore, provides the burden and the predisposing factors of neonatal hypothermia among term and near newborns. Secondly, we used observation to document the actual warm chain practices that were initiated by the midwives in the immediate postnatal period.

The study findings need to be interpreted in light of the inherent limitations present in the study methods. Causality cannot be determined in the study as it was cross-sectional, while the findings may only be generalizable to similar settings. The midwives could have modified their midwifery practices of warm chain practice following

their awareness that they were being observed [11]. However, we had prolonged observations of midwives' practices which could have reduced their likelihood to modify their behaviors. The axillary temperature of the newborn was taken at the 10-minute, 30-minute, one hour and two hours interval postnatal. As such, we could not determine if hypothermia continued after the two-hours postnatal. Thirdly, continuous follow-up of the neonates with hypothermia in the community would have helped to shed some light on the prevalence of hypothermia in the community after discharge from the hospital but would have also shown the impact of hypothermia on the well-being of the newborn.

Conclusion

The prevalence of neonatal hypothermia was high in the first two hours. More than two-thirds of the newborns had hypothermia at one point in time during the first two hours postnatal. Low birth weight, no SSC, no drying, male sex and low maternal temperature were significantly associated with increased odds of neonatal hypothermia at two hours postnatal. Proper drying of the newborn and skin to skin contact can reduce the burden of neonatal hypothermia. Therefore, there is need to train the midwives on proper drying of the newborn, keeping the mother warm and the importance of skin-to-skin contact in prevention of neonatal hypothermia.

Abbreviations

AOR Adjusted odds ratios
CI Confidence intervals
COR Crude odds ratios
WHO World Health Organization
SD Standard deviation
SSC Skin to skin contact

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-025-06123-4.

Supplementary material 1.

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Authors' contributions

MGA was involved in the conceptualization of the study. MG designed the study, collected, analysed the data and edit the drafted manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Research and Ethics Committee of Makerere University School of Health Sciences (reference number: 2018-053). We obtained additional permission from Lira Regional Referral Hospital administration that allowed us to conduct the study in the hospital. Prior to inclusion into the study, written informed consent has been obtained from midwives and mothers and legally authorized representatives in this study.

Competing interests

The authors declare no competing interests.

Consent for publication

N/A.

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