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CLINICAL REVIEW

A low-cost intervention to promote immediate skin-to-skin contact and improve temperature regulation in Northern Uganda

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Abstract

Background Uninterrupted skin-to-skin contact between mothers and newborns during the first hour after birth has been reported to be 2% in Uganda.

Aims To investigate if a low-cost intervention targeting the behaviors of hospital staff would increase skin-to-skin contact and to investigate whether skin-to-skin contact stabilised temperature in the newborn.

Methods The study had a quasi-experimental, before and after design. The sample included 110 in the pre-intervention group, and 93 in the post-intervention group. Data collection included observations of skin-to-skin contact and temperature measurements. Data were also collected from medical records and interviews.

Findings No infants had skin-to-skin contact before the intervention, whereas the proportion was 54.8% after the intervention. Infants who received skin-to-skin contact (*n*=51) and infants who did not receive skin-to-skin contact (*n*=146) increased in temperature; however, infants who received skin-to-skin contact were significantly warmer after 5 minutes and remained so at 60 minutes.

Conclusions The intervention increased the practice of skin-to-skin contact, which was found to be safe in regard to temperature stabilisation.

Key words: ■ Low-cost intervention ■ Newborn temperature ■ Observation ■ Skin-to-skin contact ■ Uganda

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Safe, uninterrupted skin-to-skin contact during the first hour after birth has positive and well-documented health outcomes for both mothers and their infants (Moore et al, 2016). To adapt to the cold temperature outside the womb immediately after birth, the infant must produce heat, which is mainly accomplished by non-shivering thermogenesis at large energy costs (Asakura, 2004). Skin-to-skin contact results in a more optimal thermoregulation (Bystrova et al, 2003), which may continue over the first days of life (Beiranvand et al, 2014). If an infant receives skin-to-skin contact, its temperature will increase (Christensson et al, 1992; Puig and Sguassero, 2007; Mori et al, 2010). This increase in temperature may be caused by transfer of heat

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from the mother's chest and abdomen (Christensson et al, 1992; Byaruhanga et al, 2005) or by reduced heat loss (Karlsson, 1996).

Skin-to-skin contact is also recommended by the World Health Organization (WHO) (2018) to prevent heat loss, as hypothermia is one of the major causes of mortality in newborns (Darmstadt, 2006; Lunze et al, 2013). Up to 83% of infants born in hospitals in Uganda have hypothermia (Byaruhanga et al, 2005). Hypothermia is the leading cause of perinatal death and constitutes 39% of the causes (Ministry of Health Uganda, 2016a).

Uninterrupted skin-to-skin contact for 1 hour after birth is not directly recommended in Uganda (Ministry of Health Uganda, 2016b),which might explain why only 2% of mothers and infants experience skin-to-skin contact after birth (Waiswa et al, 2010). A low-cost intervention to increase the number of newborns having uninterrupted skin-to-skin contact for 1 hour after birth was introduced in 2018 (Mbalinda et al, 2018).

AIMS

To explore if a low-cost intervention targeting hospital staff behaviour would increase skin-to-skin contact and to explore whether the practice stabilised temperature in the newborn.

METHODS

Study setting

The study was conducted in northern Uganda at the delivery ward at Gulu Hospital, a government general hospital with approximately 4200 births per year, according to hospital records. The delivery ward had five wide delivery beds with vertically adjustable headboards. The beds could be separated by curtains to allow privacy. The routine care for newborns involved wrapping them in blankets and putting them on a table beside the resuscitation table.

Intervention

Details of the intervention have been described by Mbalinda et al (2018) and included the following steps:

- To gain support from the hospital management to conduct the project aimed at implementing skin-to-skin contact
- To show a DVD entitled, *Skin to skin in the first hour after birth: Practical advice after vaginal and caesarean birth* (Brimdyr et al, 2011) to staff, who were also informed in a lecture about the health benefits of skin-to-skin contact and breastfeeding
- To distribute pamphlets produced for the project to health professionals, with details of how to practice skin-to-skin contact
- To hang a poster describing the nine stages of starting breastfeeding in the first hour after birth (Widström et al, 2011) on the walls of the maternal unit
- To conduct focus group and individual interviews with the staff to explore what they perceived as factors that encouraged or hindered skin-to-skin contact
- To distribute 'skin-to-skin contact ambassador cards' to those who participated in interviews.

Data collection

A quasi-experimental design to collect data collection before and after the intervention. Before the intervention, staff and hospital management were informed that the aim

of the study was to investigate caring practices around birth with focus on infant skin temperature and feeding procedures. Pre-intervention data collection took place from October 2015–January 2016. Post-intervention data collection took place between from February–April 2016.

Instruments for data collection

An observation protocol for the first hour after birth was developed by the authors to record caring routines and to find out if the baby had had either immediate, uninterrupted skin-to-skin contact for 60 minutes after birth; if the skin-to-skin contact was interrupted; or if there was no skin-to-skin contact.

A research assistant measured the temperature between the baby's scapulae from a distance of approximately 30 cm at 5 and 60 minutes after birth. The temperature on the wall 1m above the infant's head, and the temperature of the mother's right and left breast were measured at the same time intervals. The temperature measurement was conducted using a non-contact thermometer with an accuracy of ±1% at 23 °C. This device was chosen as it was suitable for use in the present study setting and because similar thermometers are used in clinical settings. Medical data were collected from the birth records. The mothers were also interviewed before discharge from the hospital and sociodemographic background variables were recorded. The interview was translated into the Acholi dialect by an authorised translator at Makerere University Department of Languages, Uganda.

Four local research assistants collected data. Before the data collection, they completed a 1-week course that included training on basic research methodology, research ethics and the newborn's innate behaviour. They were also trained in observation and interview techniques, in using the observation protocol as well as in entering data directly on iPads. The authors (SB, EN and AH) and a data consultant trained the research assistants. The observation protocol and the interview guide were tested for accuracy and were found feasible for the study.

Study participants

Primiparous women in active labour who were admitted to the delivery ward at Gulu Regional Referral Hospital were informed verbally and in writing about the project by a research assistant. They were informed that participation was voluntary, that they could withdraw from the study at any point, and that this would not affect the overall care they would receive. Those who agreed to participate signed an informed consent from.

Before birth, women were included if they were primiparous, with a full-term normal pregnancy, and one live fetus. Women were included if the birth was anticipated to be an uncomplicated vaginal birth and the infant healthy. After birth, women were included if they had had a normal birth and no need of resuscitation of the infant. Participants were excluded if the mother and the infant were separated due to medical reasons.

A power calculation was performed to detect an increase in skin-to-skin contact by 10% (from 2–12%). With a sample of 50 in each group the β value would be 0.91 at an α level of 0.05. Thus, it was estimated that approximately 50 mother–infant pairs would be needed before the intervention and another 50 mother–infant pairs after the intervention. Participants were added due to an unknown attrition rate.

Before the intervention, 300 women were admitted to the delivery ward while the research assistants were on duty. Of those, 132 women were eligible, and 110 participated. After the intervention, 236 women were admitted to the delivery ward while the research assistants were on duty. Of those,118 women were eligible, and 93 women participated (*Figure 1*).

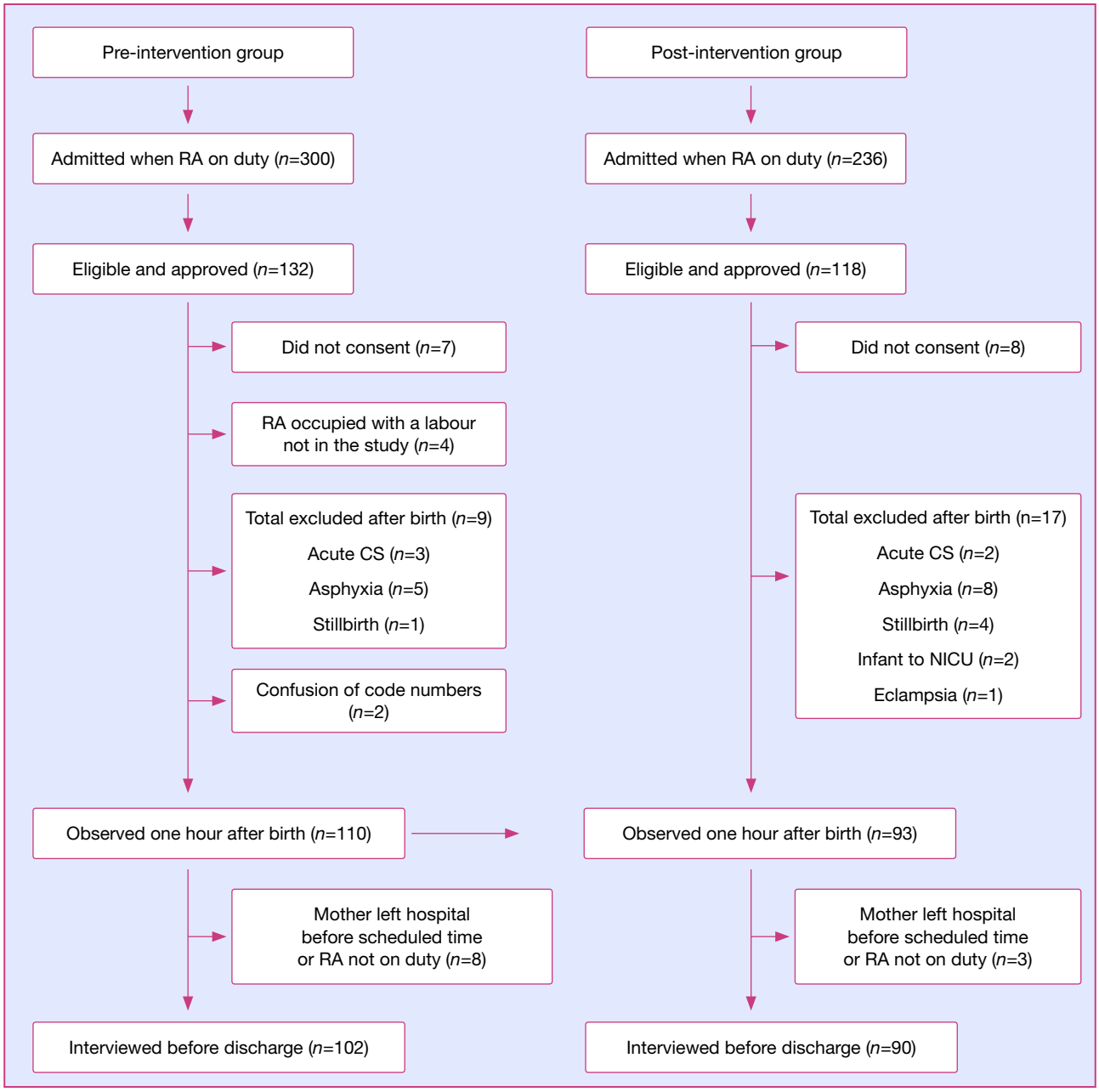

Figure 1. Flow chart of data collection in the pre- and post-intervention groups. RA: research assistant; CS: caesarean section; NICU: neonatal intensive care unit

Data analysis

Data were directly entered into Microsoft Excel via Mobile Data Anywhere. The Excel files were converted into SPSS files and SPSS version 24 was used for statistical analyses. Independent *t*-tests were used to compare parametrically distributed continuous variables. Data on nominal level were analysed by Chi-square (χ^2) test or by Fisher's exact test when expected values were <5 in each cell.

As the dependent variable, interscapular temperature, was not Normally distributed, nonparametric tests were used. As descriptive measure, median (Md) and interquartile distances (Q_{25}–Q_{75}) were used. Hypothesis testing was performed by Mann-Whitney *U*-test for independent samples and Wilcoxon's signed rank test for dependent variables (temperature changes over time). For correlation, Spearman's rank correlation (R_s) was used. A linear regression analysis was performed to

establish the impact of room temperature at 5 minutes' observation and the effect of the mothers' breast temperature at 5 minutes' observation on infant interscapular temperature at 60 minutes.

Ethical approval

The project was approved by the Institutional Review Board of Makerere University (SHREC REF 213–051), the Ugandan National Council of Science and Technology (ADM 154/212/01) and the Central Ethical Review Board in Stockholm (2013/1732–31/4).

RESULTS

Sociodemographic characteristics

There was no significant difference in age for women in the pre-intervention group (M=19.54, SD=2.67) and women in the post-intervention group (M=19.96, SD=2.81). The age ranged between 16 and 29 years in the pre-intervention group and between 15 and 29 years in the post-intervention group. Other background data is displayed in *Table 1* and shows that the majority of the women in both groups were cohabiting or married but approximately 10% in both groups were single. The majority of women were housewives, Christian, and had completed primary or secondary school. There was 1 woman in each group who had no education (*Table 1*). There was no statistical difference in collected sociodemographic details between the two groups.

Table 1. Background of participants in the pre-intervention group (*n*=110) and in the post-intervention group (*n*=93)

	Pre-intervention group		Post-intervention group	
	n	**%**	***n***	**%**
Education				
Primary	47	42.7	39	41.9
Secondary	43	39.1	29	31.2
Tertiary	10	9.1	16	17.2
No education	1	0.9	1	1.1
Missing	9	8.2	8	8.6
Work				
Housewife	62	56.4	53	57.0
Self-employed	15	13.6	7	7.5
Employed	9	8.2	9	9.7
Other/unemployed/student	16	14.5	16	17.2
Missing	8	7.3	8	8.6
Marital status				
Cohabiting	73	66.4	71	76.3
Married	14	12.7	4	4.3
Single	14	12.7	10	10.8
Data missing	9	8.2	8	8.6

Obstetric and infant background

None of the women were induced or were given oxytocin for augmentation of labour. All women except two in the pre-intervention group had been given oxytocin 10 IU intramuscularly postpartum. The majority of women were assisted by a midwife during birth (79.1% pre-intervention group; 78.5% post-intervention group). Two women in the post-intervention group were assisted by a medical doctor and the rest were assisted by students (information was missing for one woman in the post-intervention group).

The ratio of male to female infants was evenly distributed in both groups (55.5% of infants born in the pre-intervention group were female, compared to 52.7% in the post-intervention group). Bbetween the groups, there were no significant differences in infant birth weight (M=3.037g; SD=0.47 vs M=3.013g; SD=0.50) or length (M=49.3 cm; SD=1.69 vs M=49.4 cm; SD=0.79).

Skin-to-skin contact before and after the intervention

Before the intervention, none of the mothers undertook 1 hour's uninterrupted skin-to-skin contact with their newborns, compared to 54.8% in the post-intervention group.

Caring routines

In the pre-intervention group, all (100%) of the mothers were separated from their babies after birth. In the post-intervention group, 46.2% of the mother–baby dyads were separated. In both groups, the reasons for separating the mothers and their infants were infant examination and weighing, injection of vitamin K and application of tetracycline ointment. The separated infants were placed beside the examination bed or on a desk in the delivery ward.

Exclusions from temperature measurements

In all, 6 infants were excluded from the calculations due to technical attrition. Overall, 105 mothers participated in the pre-intervention group and 92 in the post-intervention group.

There were no differences in maternal age, augmentation of labour or induction (no mother had these interventions) or injection of oxytocin postpartum between the six excluded mother–infant dyads and those that were included. The infants did not differ in birth weight, but they differed in length (Md length of excluded infants=47 cm; range=45.1–49.3 cm vs Md length of included infants=49.5 cm; range=49.0–50.0 cm; Z=–2.63, P=0.007).

Duration of skin-to-skin contact in infants with interrupted skin-to-skin contact (temperature study)

None of the 105 pairs in the pre-intervention group had uninterrupted skin-to-skin contact for 1 hour, but 34 pairs had some skin-to-skin contact. This was ended at Md infant age=10.19 minutes (range= 6.85–12.67). For the remaining 71 cases, no skin-to-skin contact was reported.

In the post-intervention group (n=92) skin-to-skin contact ended in 41 cases at a Md infant age=11.36 minutes (range=5.34–16.01) . There were no significant differences between the time that skin-to-skin contact ended between the groups (Z=–0.736; P=0.462).

The temperature of the infants who had had interrupted skin-to-skin contact did not differ from those without skin-to-skin contact, either at 5 minutes (Z=–1.447, P=0.140) or at 60 minutes observation (Z=–0.746, P=0.455). In the results section, we have therefore chosen to conduct a per protocol analysis, based on actual uninterrupted skin-to-skin contact or not. Thus, the result is based on 51 participants in the

'skin-to-skin contact group' (experienced uninterrupted skin-to-skin contact for 1 hour after birth) and 146 participants in the 'no skin-to-skin contact group' (did not experience uninterrupted skin-to-skin contact for 1 hour after birth).

Infant temperature

In the skin-to-skin contact group, the median interscapular temperature increased from 35.8 °C (range=35.0–37.0 °C) at 5 minutes' observation to 36.6 °C (range=35.4–37.2 °C) at 60 minutes' observation (Z=–3.728; P<0.001). The median interscapular temperature for the no skin-to-skin contact group was 35.4 °C (range=34.6–36.2 °C) at 5 minutes and 36.2 °C (range=34.4–36.8 °C) at 60 minutes (Z=–7.313; P<0.001). Interscapular temperature differed at both timepoints between the groups at 5 minutes (Z=–2.303; P=0.021) and at 60 minutes (Z=–2.034; P=0.042) (*Figure 2*).

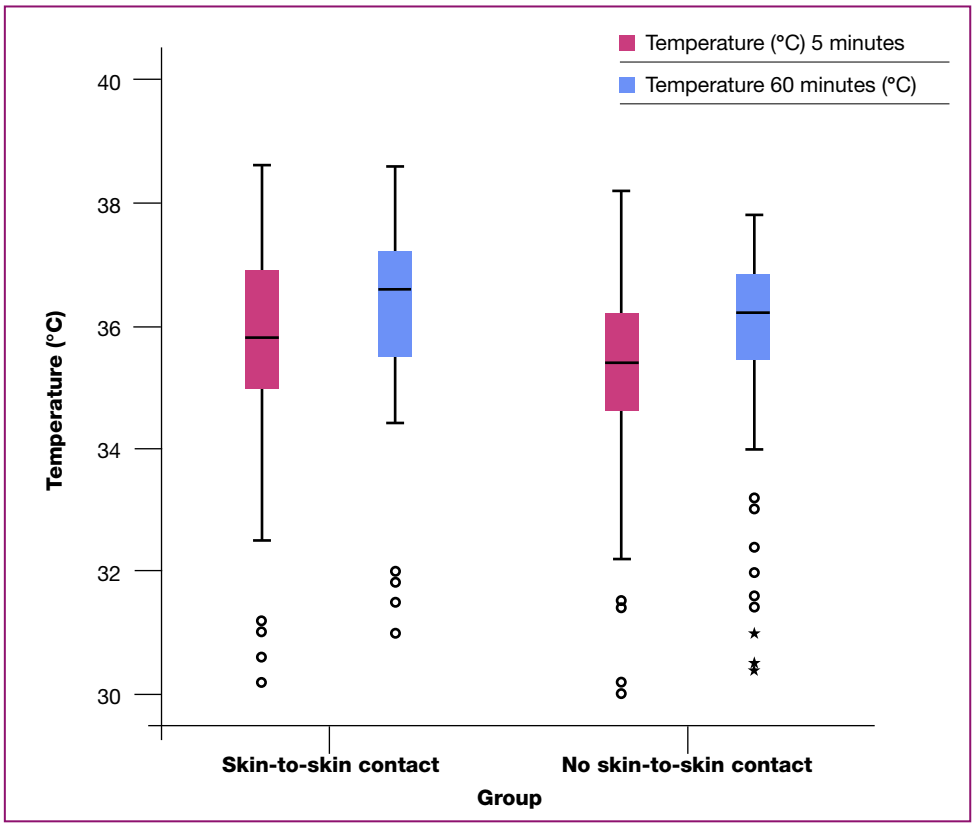

Figure 2. Interscapular temperature in 'skin-to-skin contact' and 'no skin-to-skin contact' infants

There was no significant correlation between the room temperature and infant temperature at 5 minutes (R_s=0.207; P=0.146) or at 60 minutes (R_s=0.209; P=0.141) in the skin-to-skin contact group. In contrast, significant correlations occurred in the no skin-to-skin contact group at 5 minutes (R_s=0.309; P<0.001) and at 60 minutes (R_s=0.414; P<0.001). The effect size of skin-to-skin contact was P=0.164.

Maternal breast temperature

The median temperature of the left breast for mothers in the skin-to-skin contact group was 37.0 °C (range =36.6–37.6 °C) at 5 minutes and 37.2 °C (range=36.8–37.6 °C) at 60 minutes. The median temperature of the right breast was 37.0 °C (36.6–37.6 °C) at 5 minutes and 37.2 °C (36.8–37.8 °C) at 60 minutes. The rise in temperature between

5 and 60 minutes was not significant (Z=–1.302; P=0.193) in the left breast but was significant in the right breast (Z=–2.700; P=0.007).

The median temperature of the left breast for mothers in the no skin-to-skin contact group was 36.4 °C (range=36.0–37.0 °C) at 5 minutes and 36.6 °C (range=36.2–37.2 °C) at 60 minutes. In the right breast the median temperature increased from 36.4 °C (range=36.0–37.0 °C) at 5 minutes to 36.8 °C (range=36.4–37.2 °C) at 60 minutes. The increase was significant in the left breast (Z=–3.575; P<0.001) as well as the right breast (Z=–4.083; P<0.001).

The median temperature of the left breast differed significantly between skin-to-skin contact and no skin-to-skin contact groups at 5 minutes (Z=–4.301; P<0.001) and at 60 minutes (Z=–4.449; P<0.001). The corresponding figures for the right breast were also significant at 5 minutes (Z=–4.600; P<0.001 and at 60 minutes (Z=–4.674; P<0.001).

The outliers of breast temperature disappeared over the observation period among the mothers in the skin-to-skin contact group, but not among the mothers in the no skin-to-skin contact group (*Figure 3*).

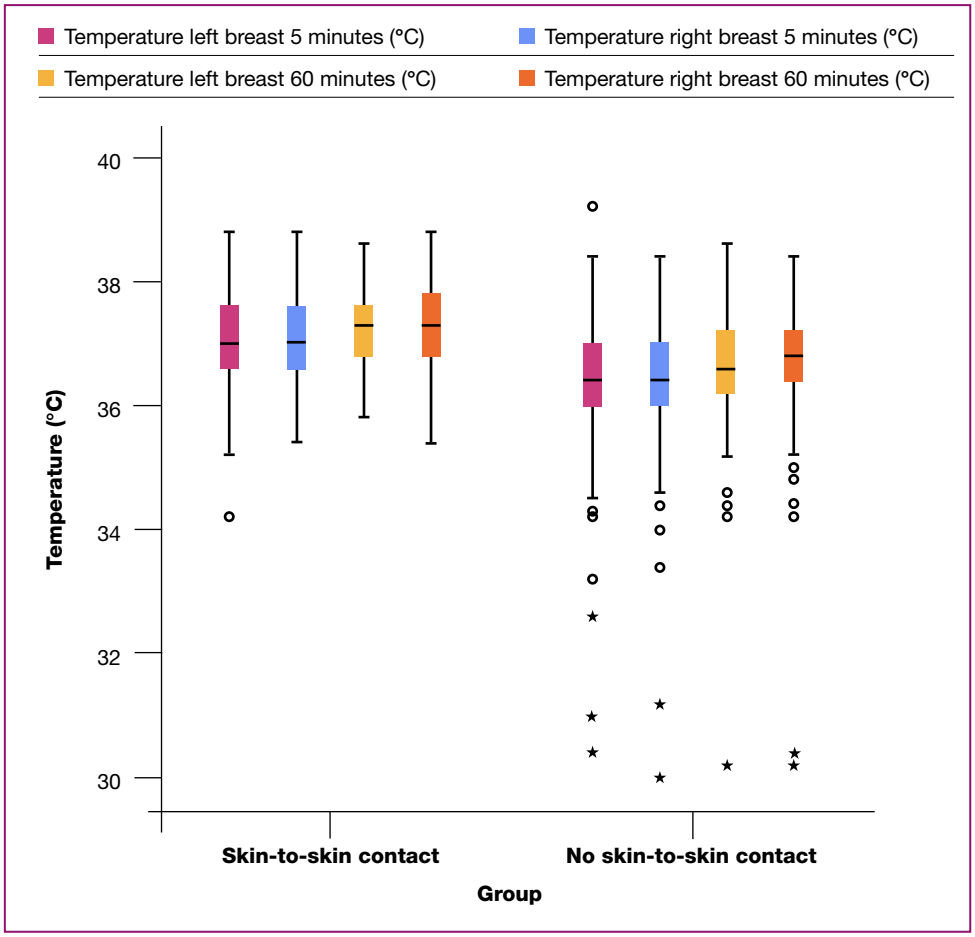

Figure 3. Differences in breast temperature between mothers in the 'Skin-to-skin contact' and mothers in the 'no skin-to-skin contact' groups

Room temperature

The room temperature during the two study periods varied between 22.6 and 37.5 °C (interquartile range=27.0–30.8 °C). In the skin-to-skin contact group, the room temperature did not change significantly between 5 minutes (Md=30.4; range=29.0–31.8 °C) and 60 minutes (Md=30.2 °C; range=29.0–31.4 °C). In the no

skin-to-skin contact group, the room temperature also did not change significantly between 5 minutes (Md=28.2 °C; range=26.4–30.2 °C) and 60 minutes (Md=28.0 °C; range=26.5–30.2 °C).

A linear regression analysis was performed to elucidate the impact of maternal breast temperature and room temperature at 5 minutes on the infant's interscapular temperature at 60 minutes. A mean for the right and left breast temperature was calculated and used as one of the explanatory variables and the room temperature at 5 minutes was used as the second explanatory variable (*Table 2*). The regression analysis showed that there was no statistically significant impact of room temperature on infant interscapular temperature at 60 minutes. Only the breast temperature at 5 minutes was shown to be significant and explained about 12% of the variation.

Table 2. Regression analysis for the impact of room and breast temperature at 5 minutes' observation on infant interscapular temperature at 60 minutes' observation, R_2=0.131; Adj. R_2=0.122

	B	Std. error	*t*	Sig.	Lower bound	Upper bound
(Constant)	17.672	3.647	4.845	0.000	10.479	24.865
Room temperature	0.066	0.036	1.865	0.064	–0.004	0.137
Breast temperature	0.447	0.105	4.259	<0.001	0.240	0.654

DISCUSSION

The main finding of this study was that the low-cost intervention was effective at increasing the practice of skin-to-skin contact. After the intervention, the proportion of uninterrupted skin-to-skin contact for 1 hour was 54.8%, whereas none of the infants received skin-to-skin contact with their mothers before the intervention. One of the reasons for not practising uninterrupted skin-to-skin contact was injection of vitamin K, which can easily be performed in skin-to-skin contact soon after birth, when the infant is relaxed (Widström et al, 2010). Indeed, skin-to-skin contact has been shown to relieve pain for the infant (Seo et al, 2016). Other reasons for ending skin-to-skin contact were weighing the infant and administering tetracycline, which can wait until the important first hour has passed. This study found that separated infants were placed beside the examination bed or on a desk in the delivery ward. In another article, staff were interviewed about skin-to-skin. One advantage that they described was that it would allow the mother to supervise the infant when staff were too busy to observe (Mbalinda et al, 2018).

This study has examined whether skin-to-skin contact would impact infant temperatures during the first hour after birth. The skin temperature between the infant's scapulae was measured and found that infants in skin-to-skin contact had a higher skin temperature at 5 minutes after birth and at 60 minutes after birth than infants with no or interrupted skin-to-skin contact. However, infants without skin-to-skin contact also increased their skin temperature and there was no difference in the size of the increase of the temperatures between the groups.

In this study, maternal breast temperature increased at 60 minutes. Bystrova et al (2007) reported similar results. Animal studies have shown that warmth from the udder or teats activates suckling behaviour in the young (Vince, 1984; Welch and Baxter, 1987). It is possible that the warmth transmitted from the mother also releases such behaviour in human infants.

The mother's breast temperature was higher than the interscaplar temperature of the infant. In line with the animal studies, Zernardo et al (2017) found a difference

in temperature between mother's areola and the infant's mouth region. The authors concluded that the gradient between the mothers' areola and the infant's mouth region suggested mother–infant thermal recognition and communication in the natural progression from birth to breastfeeding. This may regulate the evaporation rate of odorants from the glandules in the areola, which helps the infant to identify the mother (Zernardo et al, 2017) and may also elicit suckling behaviour.

STRENGTHS AND LIMITATIONS

The research assistants who collected data were thoroughly trained in observation and interview techniques; however, there was confusion with two code numbers and thus those were excluded. The research assistants were assigned to observe the women included in the study and were instructed not interfere with routines at the delivery ward, but the observation of four of the women was interrupted because staff were needed for other women in labour. Piloting was performed to check whether the protocols were easy for the research assistants to use and to ensure that the mothers understood the interview questions. Observation techniques were compared to standardise the research assistants.

Clinical measures are often based on temperature measurements such as the type of measurements conducted in this study. However, it is not sufficient to measure just skin, breast and room temperature: dry heat loss such as convective, radiative and conductive heat loss as well as humidity between the infant's skin and the cloth covering should also be measured (Karlsson, 1996). The large differences in room temperature during pre- and post-intervention may be caused by seasonal differences in temperature over the two observation periods; however, according to the regression analysis, the variation in room temperature did not seem to interfere with the infant skin temperature at 60 minutes.

It was surprising that the increase in the temperature of the left breast in the skin-to-skin contact group was not significant. This might be due to larger variation and/or the smaller size of the skin-to-skin contact group. It is also possible that more infants latched onto the right breast.

The range of skin temperatures in this study corresponds to measurements in similar studies conducted in Uganda, Zambia and Sweden (Christenson et al, 1992; Ransjö-Arvidson et al, 2001; Byaruhanga et al, 2005).

Further studies are needed to explore the long-term sustainability of the intervention, how mothers experience skin-to-skin contact, if the practice has an impact on the duration of breastfeeding, and how it affects mothers' feelings towards the infant.

CONCLUSIONS

The low-cost intervention to increase skin-to-skin contact was introduced in a regional hospital in the north of Uganda and was found to be effective. The reasons for separating healthy mothers included giving vitamin K injections, weighing the infant, and applying tetracycline eye ointment. Vitamin K can be injected during skin-to-skin contact, especially as the baby relaxes immediately after birth, while the other interventions can be delayed until the important first hour has passed to allow the baby to remain in skin-to-skin contact.

Under the conditions in the hospital, it was found that interscapular temperature over the first hour after birth increased in infants in skin-to-skin contact and infants wrapped in cloth, separated from their mother. The infants in skin-to-skin contact

were warmer at 5 minutes and remained so at 60 minutes. Uninterrupted skin-to-skin contact is therefore safe in regard to temperature regulation, and low-cost interventions to promote skin-to-skin contact, such as the intervention reported in this article, are critical to newborn wellbeing and survival.

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Conflict of interest

None declared.

Key points:

- A cost-effective simple intervention to increases uninterrupted skin-to-skin contact for 1 hour following birth was introduced in a hospital in Uganda
- This study investigated if a low-cost intervention targeting the behavior of hospital staff would increase skin-to-skin contact whether skin-to-skin contact stabilised temperature in the newborn
- It was found that putting the newborn in uninterrupted skin-to-skin contact immediately after birth resulted in stable skin temperature and prevented heat loss.

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