International Journal of Healthcare Sciences ISSN 2348-5728 (Online)
Vol. 13, Issue 1, pp: (409-415), Month: April 2025 - September 2025, Available at: www.researchpublish.com

Factors Associated with Neonatal Hypothermia at Murunda District Hospital, Rwanda: A Cross-Sectional Study

Daphrose NYIRAHABIYAREMYE*[1], Clemence NISHIMWE[2], Ancille MUREKATETE[3]

Mount Kenya University, Rwanda, Department of Public Health

DOI: https://doi.org/10.5281/zenodo.15836221

Published Date: 08-July-2025

Abstract: **Background: Neonatal hypothermia is a global health concern contributing significantly to neonatal morbidity and mortality, particularly in low-resource settings. This study assessed factors associated with neonatal hypothermia at Murunda District Hospital, Rwanda.**

Methods: A hospital-based cross-sectional study was conducted among 124 mothers whose neonates were admitted to the neonatal unit at Murunda District Hospital. Data were collected using structured questionnaires and observational checklists. Descriptive statistics, chi-square tests, and logistic regression were used to analyze factors associated with neonatal hypothermia. A p-value <0.05 was considered statistically significant.

Results: Neonatal hypothermia prevalence was 67.7%. Multivariate analysis revealed that maternal education and time of delivery were independently associated with neonatal hypothermia. Neonates born to mothers with no schooling (OR = 0.12; 95% CI: 0.18–0.75), primary (OR = 0.12; 95% CI: 0.20–0.69), and secondary education (OR = 0.14; 95% CI: 0.20–0.97) were more likely to be hypothermic compared to those whose mothers had university-level education. Additionally, night-time delivery was associated with increased odds of hypothermia (OR = 0.37; 95% CI: 0.15–0.94).

Conclusion: Maternal education and time of delivery are significant predictors of neonatal hypothermia. Addressing these factors through targeted education and improved delivery practices during night shifts may reduce neonatal hypothermia in rural Rwandan settings. Neonatal hypothermia is multifactorial, influenced by maternal, environmental, and behavioral factors. Improved adherence to WHO thermal protection guidelines is needed to reduce the burden.

Keywords: **Neonatal hypothermia, thermal care, maternal factors, Rwanda, newborn health.**

1. INTRODUCTION

Neonatal hypothermia defined by the World Health Organization as an axillary temperature below 36.5°C is a common and preventable contributor to neonatal morbidity and mortality, particularly in low-resource settings. Though hypothermia is rarely a direct cause of neonatal death, it significantly worsens outcomes in neonates with infections, prematurity, or birth asphyxia (World Health Organization, 2001).

Globally, neonatal hypothermia affects 32% to 85% of hospital-born and 11% to 90% of home-born infants in developing countries (Yitayew et al., 2020). Factors include early bathing, inadequate drying, low birth weight, and delivery in cold environments (Nebiyu et al., 2021). In high-income countries, prevalence reaches 28%, often linked to preterm birth, night-time delivery, and insufficient thermal protection (Beletew et al., 2020).

Sub-Saharan Africa contributes to half of the world's 2.45 million annual neonatal deaths. Hypothermia accounts for a major share, with prevalence ranging from 8% to 85% (Brambilla Pisoni et al., 2022). Ghana, South Africa, and Nigeria report rates exceeding 70% within 24 hours of birth (Diala et al., 2022; Patel et al., 2022; Pellegrino et al., 2023). In East Africa, the burden is also high: Ethiopia reports 57.2% and Kenya up to 87% (Beletew et al., 2020; Nyandiko et al., 2021).

In Rwanda, CHUK reported a 27% hypothermia rate among neonates (Urubuto et al., 2021). However, Murunda District Hospital reported a 54.1% prevalence in 2022 (HMIS, 2022), despite being a district-level referral facility. Understanding the determinants of hypothermia in such settings is essential for guiding policy and improving outcomes.

2. METHODS

Study Design and Setting

A facility-based cross-sectional quantitative study was conducted from June to September 2023 at Murunda District Hospital, a district-level referral facility located in Rutsiro District, Western Province of Rwanda. The hospital serves a population of over 250,000 and receives referrals from 17 surrounding health centers across 13 sectors.

Study Population and Eligibility Criteria

The study involved 124 mothers whose neonates were admitted with or without hypothermia. Mothers were selected using purposive sampling. Inclusion criteria included mothers whose neonates were admitted during the study period. Mothers with medical or psychological impairments or those who declined consent were excluded.

Sample Size and Sampling Technique

The sample size was determined using Yamane's formula for a finite population, assuming a 95% confidence level and a 5% margin of error (Yamane, 1967). Based on 178 neonatal admissions with hypothermia reported over the previous four months, the calculated sample size was 124 mothers. A purposive sampling technique was employed to select eligible participants who met the inclusion criteria during the data collection period.

Data Collection Tools and Procedures

Data were collected using a structured and pre-tested interviewer-administered questionnaire. The tool captured information on socio-demographic characteristics, maternal obstetric history, neonatal profile, delivery conditions, and postnatal thermal care practices. The questionnaire was pretested on 13 mothers at Mugonero District Hospital, and necessary modifications were made prior to data collection. Neonatal hypothermia was defined in accordance with WHO guidelines as an axillary temperature below 36.5°C. Temperature was measured at admission using a calibrated digital thermometer by trained neonatal nurses.

Study variables

Independent variables included maternal age, education, occupation, ANC attendance, mode and place of delivery, thermal care practices (e.g., drying, bathing timing, clothing, and breastfeeding initiation), and neonatal characteristics such as birth weight and gestational age. The dependent variable was hypothermia status (yes/no) based on axillary temperature.

Data Analysis

Data were cleaned and analyzed using SPSS Version 20 and Microsoft Excel. Descriptive statistics were presented as frequencies and percentages. Bivariate analysis using Pearson's chi-square test was employed to assess the association between independent variables and neonatal hypothermia. Variables significant at $p < 0.05$ were further analyzed using multivariate logistic regression to estimate adjusted odds ratios (AORs) with 95% confidence intervals.

Ethical Considerations

Ethical clearance was obtained from Mount Kenya University, and official authorization was granted by Murunda District Hospital. Written informed consent was obtained from all participants. Confidentiality was maintained by anonymizing data and ensuring voluntary participation without penalty or coercion.

3. RESULTS

Participants' Characteristics

A total of 124 mothers with their neonates were included in this study. The majority of the mothers were between the ages of 18–33 years, with 38.7% aged 18–25 and another 38.7% aged 26–33. Only one respondent was aged between 42–49 years (0.8%). Regarding religion, most mothers identified as Catholic (43.5%), followed by ADEPR (27.4%) and EPR (15.3%). A smaller proportion were Muslim (9.7%) or AEBR (4.0%). In terms of education, nearly half of the mothers (47.6%) had completed primary school, while 26.6% had no formal education. Secondary and university education were reported by 18.5% and 7.3% of participants, respectively.

The dominant occupation among mothers was farming (71.0%), followed by government employment (16.1%). Only 8.1% were private employees and 4.8% were involved in small businesses. A vast majority (91.9%) had medical insurance. Most mothers were married (89.5%), and the rest were single (10.5%). A high proportion (83.1%) attended antenatal care (ANC), with 43.5% having 1–4 visits and 39.5% attending more than four visits. About 16.9% had no ANC visits at all. Most pregnancies were singleton (90.3%), with twin pregnancies accounting for 9.7%. Multiparous women constituted 58.9% of the sample, while 41.1% were primiparous.

In terms of gestational age, 54.0% of the neonates were born at term, 41.1% preterm, and 4.8% post-term. A fifth (20.2%) of the mothers experienced delivery complications. Neonatal hypothermia was observed in 67.7% of the neonates, while 32.3% were normothermic at admission. The majority of neonates (88.7%) were aged between 1–5 days, with smaller proportions aged 6–11 days (6.5%) and 18–24 days (4.8%). Males slightly outnumbered females, accounting for 54.8% and 45.2% respectively. Low birth weight was observed in 45.2% of neonates, with 43.5% having average birth weight and 11.3% above average. Regarding delivery mode, 71.8% were delivered via spontaneous vaginal delivery, while 28.2% were born via cesarean section. Most deliveries occurred at a health facility (78.2%), while 20.2% occurred at home and a small fraction (1.6%) in ambulances. More than half of the births occurred during the day (55.6%), while 44.4% occurred at night. Resuscitation was required for 38.7% of neonates post-delivery. Notably, 61.3% of mothers reported that windows or doors were open during delivery, which could contribute to heat loss.

In terms of immediate newborn care, 75.0% of neonates were dried immediately after birth. However, only 23.4% were placed on the mother's chest or abdomen right after delivery. About 70.2% were breastfed within the first hour, and none were bathed within 24 hours of birth, adhering to WHO guidelines. Clothing practices were generally adequate, with 86.3% of neonates fully covered, though 12.1% were inadequately dressed and 1.6% had only their heads covered. Among those without hats, 9.7% had only their heads exposed and 3.2% had both head and legs uncovered. Furthermore, 73.4% of neonates were placed under an infant warmer immediately after birth, while 26.6% were not. (Table 1)

Table 1: Participants' Characteristics (N=124)

		Frequency(n)	Percent(%)
Grouped mothers'age	18-25	48	38.7
	26-33	48	38.7
	34-41	27	21.8
	42-49	1	.8
Mother religion	ADEPR	34	27.4
	AEBR	5	4.0
	Catholic	54	43.5
	EPR	19	15.3
	Muslim	12	9.7
Mother education	No school attendance	33	26.6
	Primary	59	47.6
	Secondary	23	18.5
	University	9	7.3
Mother occupation	Farmer	88	71.0
	Government employee	20	16.1
	Own business	6	4.8
	Private employee	10	8.1
Have Medical insurance	No medical insurance	10	8.1
	Yes	114	91.9
Mother marital status	Married	111	89.5
	Single	13	10.5
ANC attendance	No	21	16.9
	Yes	103	83.1
Nber of ANC Visit	1-4	54	43.5
	Above 4	49	39.5
	None	21	16.9

Type of pregnancy	Single	112	90.3
	Twin	12	9.7
Parity	Multiparous	73	58.9
	Primiparous	51	41.1
Age of Pregnancy	Post term	6	4.8
	Preterm	51	41.1
	Term	67	54.0
Delivery Complication	None	99	79.8
	Yes	25	20.2
Hypothermia status	Hypothermic	84	67.7
	None Hypothermic	40	32.3
Neonates ages in days	1-5	110	88.7
	6-11	8	6.5
	18-24	6	4.8
Sex	Female	56	45.2
	Male	68	54.8
Birthweight grouped	Low birthweight	56	45.2
	Above average birthweight	14	11.3
	Average birthweight	54	43.5
Mode of delivery	Cesarean section	35	28.2
	Sponteneous vaginal delivery	89	71.8
Place of delivery	Ambulance	2	1.6
	Health facility	97	78.2
	Home	25	20.2
Time of delivery	Day	69	55.6
	Night	55	44.4
Resuscitation after delivery	No	76	61.3
	Yes	48	38.7
Door window of delivery room open during the time of delivery	No	44	35.5
	Unknown	4	3.2
	Yes	76	61.3
Neonate dried immediately after birth	No	31	25.0
	Yes	93	75.0
The neonate put on chest abdomen of mother immediately after birth	No	95	76.6
	Yes	29	23.4
Immadiate breastfeed	No	37	29.8
	Yes	87	70.2
Bathing before 24hours	No	124	100.0
Neonate wear adequate clothes totally covered whole body	head only	2	1.6
	No	15	12.1
	Yes	107	86.3
If now hat part of body was not covered	Head and Legs	4	3.2
	Head only	12	9.7
	N/A	108	87.1
The neonate put under infant warm immediate after birth	No	33	26.6
	Yes	91	73.4

Factors Associated with Neonatal Hypothermia

Bivariate Analysis of Factors Associated with Neonatal Hypothermia

As indicated in Table 2, Bivariate analysis showed statistically significant associations between neonatal hypothermia and several maternal and birth-related factors. Maternal education was significantly associated with hypothermia status (χ^2 = 9.265, P = 0.026), with neonates born to mothers with no schooling or only primary education being more likely to be hypothermic compared to those born to mothers with secondary or university education. Gestational age showed a significant association with hypothermia (χ^2 = 6.524, P= 0.038), as preterm neonates experienced higher rates of hypothermia (80.4%) than those born at term or post-term. Birth weight was also significantly associated with hypothermia (χ^2 = 7.437, P = 0.024), with low birthweight neonates having a higher prevalence (80.4%) compared to those with average or above-average birthweight. The time of delivery exhibited the strongest association (χ^2 = 8.962, P = 0.003), with neonates delivered at night showing a higher incidence of hypothermia (81.8%) compared to those delivered during the day (56.5%).

Table 2: Bivariate Analysis of Factors Associated with Neonatal Hypothermia

		Hypothermia status		χ2	P Value
		Hypothermic	None Hypothermic		
Mother education	No school attendance	24	9	9.265	.026
	Primary	42	17		
	Secondary	16	7		
	University	2	7		
Age of Pregnancy	Post term	4	2	6.524	.038
	Preterm	41	10		
	Term	39	28		
Birthweight grouped	Low birthweight	45	11	7.437	.024
	Average birthweight	31	23		
	Above average birthweight	8	6		
Time of delivery	Day	39	30	8.962	.003
	Night	45	10		

Multivariate Analysis of Factors Associated with Neonatal Hypothermia

As indicated in Table 3, Multivariate logistic regression identified several independent predictors of neonatal hypothermia. Compared to neonates whose mothers had university-level education, those born to mothers with no schooling (OR = 0.12; 95% CI: 0.18–0.75; P = 0.024), primary education (OR = 0.12; 95% CI: 0.20–0.69; P = 0.017), and secondary education (OR = 0.14; 95% CI: 0.20–0.97; P = 0.046) were significantly more likely to be hypothermic. Time of delivery also remained a significant factor, with neonates delivered at night having higher odds of hypothermia (OR = 0.37; 95% CI: 0.15–0.94; P = 0.036) compared to those delivered during the day. Birth weight, although important in bivariate analysis, was not statistically significant in the multivariable model.

Table 3: Multivariate Analysis of Factors Associated with Neonatal Hypothermia

	P value	OR (95%)
Education level of Mother		
No school attendance	.024	0.12(0.18-0.75)
Primary	.017	0.12(0.20-0.69)
Secondary	.046	0.14(0.20-0.97)
University	**Ref**	**Ref**
Grouped Birth weight of neonate in gram		
Low birthweight	.559	0.67(0.18-2.53)
Average birthweight	.268	0.42(0.09-1.93)
Above average birthweight	**Ref**	**Ref**
Time of delivery		
Night	.036	0.37(0.15-0.94)
Day	**Ref**	**Ref**

4. DISCUSSION

This study confirms that neonatal hypothermia at Murunda District Hospital is a prevalent issue influenced by both maternal and delivery-related factors. The analysis identified maternal education and time of delivery as the most significant predictors. Neonates born to mothers with no formal education or only primary or secondary education were significantly more likely to develop hypothermia compared to those whose mothers had attended university. This suggests that maternal education plays a vital role in awareness and practice of thermal care, consistent with findings from Rwanda (Musabyemariya et al., 2020) and other low-resource settings like Ethiopia and Kenya (Nyandiko et al., 2021; Ukke & Diriba, 2019; Yitayew et al., 2020).

Additionally, night-time delivery emerged as a strong predictor of neonatal hypothermia. This aligns with previous research from Ethiopia and Nigeria, which highlighted reduced staffing, inadequate lighting and heating, and lower adherence to thermal protection protocols during night shifts as key factors (Beletew et al., 2020; Diala et al., 2022). Similarly, (Brambilla Pisoni et al., 2022) emphasized that environmental factors significantly influence neonatal temperature regulation in sub-Saharan settings, particularly in rural or under-equipped hospitals.

Interestingly, although birth weight was significantly associated with hypothermia in bivariate analysis, it did not retain significance in the multivariate model. This result is consistent with findings from (Urubuto et al., 2021) and (Patel et al., 2022)), suggesting that the relationship between low birth weight and hypothermia may be mediated or confounded by other maternal or delivery-related variables such as gestational age, delivery complications, or inadequate thermal care.

5. CONCLUSION

Neonatal hypothermia is a significant challenge in rural Rwandan healthcare settings. The condition is influenced by maternal, environmental, and behavioral factors. Interventions must focus on staff training, maternal education, and infrastructure improvements to ensure adherence to WHO thermal care protocols.

6. RECOMMENDATIONS

At the hospital level, there is an urgent need to strengthen adherence to the World Health Organization's warm chain thermal care guidelines. All health workers attending deliveries and newborns should be regularly trained in key practices, including immediate drying, delayed bathing, skin-to-skin contact, timely initiation of breastfeeding, and appropriate clothing of neonates. Routine monitoring and supervision of these practices should be institutionalized to ensure consistent implementation. Additionally, the hospital should prioritize infrastructural improvements, such as ensuring proper insulation in delivery rooms, closing windows during cold weather, and maintaining functional radiant warmers and thermal blankets.

At the national level, the Ministry of Health should update and disseminate neonatal thermal care policies tailored to rural and district-level healthcare facilities. Maternal health education components in antenatal care should be expanded to include practical guidance on newborn temperature management, especially targeting low-literacy and high-risk mothers. Furthermore, the government should ensure that district hospitals and health centers are equipped with basic thermal care equipment, including temperature monitoring devices, warm wraps, and resuscitation tables with thermal protection.

Finally, future research should explore seasonal variation in neonatal hypothermia to determine whether climatic factors affect prevalence and outcomes. Qualitative studies are also encouraged to understand the cultural beliefs, health system limitations, and behavioral factors that influence thermal care practices in rural Rwandan settings. These insights could inform community-based interventions and targeted health education campaigns aimed at reducing neonatal hypothermia and its consequences.

REFERENCES

[1] Beletew, B., Mengesha, A., Wudu, M., & Abate, M. (2020). Prevalence of neonatal hypothermia and its associated factors in East Africa: A systematic review and meta-analysis. BMC Pediatrics, 20(1), 148. https://doi.org/10.1186/s12887-020-02024-w

[2] Brambilla Pisoni, G., Gaulis, C., Suter, S., Rochat, M. A., Makohliso, S., Roth-Kleiner, M., Kyokan, M., Pfister, R. E., & Schönenberger, K. (2022). Ending Neonatal Deaths From Hypothermia in Sub-Saharan Africa: Call for Essential Technologies Tailored to the Context. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.851739

[3] Diala, U. M., Kanhu, P. U., Shwe, D. D., & Toma, B. O. (2022). Prevalence and Risk Factors for Admission Hypothermia in Neonates in a Tertiary Hospital in Jos, Nigeria. Journal of Clinical Neonatology, 11(4), 195. https://doi.org/10.4103/jcn.jcn_52_22

[4] Musabyemariya, E., Mukamana, D., Muteteli, C., Uwizeyimana, P., Chironda, G., & Rajeswaran, L. (2020). Neonatal Hypothermia: Mothers' Knowledge and Practice at a Provincial Hospital in Rwanda. Rwanda Journal of Medicine and Health Sciences, 3(2), Article 2. https://doi.org/10.4314/rjmhs.v3i2.6

[5] Nebiyu, S., Berhanu, M., & Liyew, B. (2021). Magnitude and factors associated with neonatal hypothermia among neonates admitted in neonatal intensive care units: Multicenter cross-sectional study. Journal of Neonatal Nursing, 27(2), 111–117. https://doi.org/10.1016/j.jnn.2020.07.010

[6] Nyandiko, W. M., Kiptoon, P., & Lubuya, F. A. (2021). Neonatal hypothermia and adherence to World Health Organisation thermal care guidelines among newborns at Moi Teaching and Referral Hospital, Kenya. PLOS ONE, 16(3), e0248838. https://doi.org/10.1371/journal.pone.0248838

[7] Patel, M., Ramagaga, N., Kruger, D., Lehnerdt, G., Mansoor, I., Mohlala, L., Rendel, D., Zaheed, F., Jordaan, M., Mokhachane, M., Nakwa, F. L., & Mphahlele, R. (2022). Hypothermia in neonates born by caesarean section at a tertiary hospital in South Africa. Frontiers in Pediatrics, 10, 957298. https://doi.org/10.3389/fped.2022.957298

[8] Pellegrino, J., Kanyangarara, M., Agbinko-Djobalar, B., Owusu, P. G., Sakyi, K. S., Baffoe, P., Sackey, A., Sagoe-Moses, I., & Dail, R. B. (2023). Occurrence of neonatal hypothermia and associated risk factors among low birth weight (LBW) infants in Accra, Ghana. Journal of Global Health Reports, 6, e2022066. https://doi.org/10.29392/001c.55766

[9] Ukke, G. G., & Diriba, K. (2019). Prevalence and factors associated with neonatal hypothermia on admission to neonatal intensive care units in Southwest Ethiopia—A cross-sectional study. PloS One, 14(6), e0218020. https://doi.org/10.1371/journal.pone.0218020

[10] Urubuto, F., Agaba, F., Choi, J., Dusabimana, R., Teteli, R., Kumwami, M., Conard, C., O'Callahan, C., & Cartledge, P. (2021). Prevalence, risk factors and outcomes of neonatal hypothermia at admission at a tertiary neonatal unit, Kigali, Rwanda – a cross-sectional study. The Journal of Maternal-Fetal & Neonatal Medicine, 34(17), 2793–2800. https://doi.org/10.1080/14767058.2019.1671334

[11] World Health Organization. (2001). Thermal protection of the new born: A practical guide.

[12] Yamane, T. (1967). Statistics: An Introductory Analysis. Harper & Row. https://books.google.rw/books?id=Wr7rAAAAMAAJ

[13] Yitayew, Y. A., Aitaye, E. B., Lechissa, H. W., & Gebeyehu, L. O. (2020). Neonatal Hypothermia and Associated Factors among Newborns Admitted in the Neonatal Intensive Care Unit of Dessie Referral Hospital, Amhara Region, Northeast Ethiopia. International Journal of Pediatrics, 2020, 3013427. https://doi.org/10.1155/2020/3013427