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Continuity of Open Umbilical Cord Care and Risk of Neonatal Infection in a Primary Obstetric Setting: A Retrospective Cohort Study

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ABSTRACT

Purpose of the study: This study aimed evaluate association between open umbilical cord care and neonatal infection within 28 days postpartum in primary midwifery facilities in Iseyin, Oyo State, Nigeria, and to identify independent biological and environmental predictors of infection risk.

Methodology: A retrospective cohort design was applied to 980 term neonates delivered between January 2022 and December 2024 in six registered primary obstetric centers in Iseyin, Oyo State, Nigeria. Data were extracted from maternity registers and follow-up records. Multivariable log-binomial regression and 1:1 propensity score matching were performed using STATA version 17 to estimate adjusted relative risks (RR) with 95% confidence intervals.

Main Findings: Neonatal infection occurred in 8.7% of the open cord care group and 6.5% of antiseptic group. After multivariable adjustment and propensity score matching, open cord care was not significantly associated with increased infection risk (aRR 1.15; 95% CI 0.76–1.73; p = 0.49). Low birth weight, prolonged rupture of membranes, and limited household sanitation were independent predictors, while early breastfeeding initiation was protective.

Novelty/Originality of this study: This study provides context-specific effectiveness evidence on open umbilical cord care within real-world primary midwifery services in semi-urban West Africa. By integrating propensity score matching with routine service data, it bridges the gap between controlled antiseptic trials and implementation-level nursing practice, supporting risk-stratified and system-oriented neonatal infection prevention strategies.

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1. INTRODUCTION

Neonatal mortality remains a major global public health challenge, particularly in low- and middle-income countries (LMICs), where nearly 2.3 million newborns die each year within the first 28 days of life [1], [2]. According to world health organization, approximately 47% of under-five deaths globally now occur in the neonatal period, with infections, prematurity, and birth asphyxia constituting the leading causes [3]-[5]. Sub-Saharan Africa bears the highest burden, with a neonatal mortality rate (NMR) averaging 27 deaths per 1,000 live births more than six times higher than in many high-income countries [6], [7]. These disparities underscore the urgent need to strengthen fundamental neonatal care practices at the primary health care level, where the majority of births in resource-limited settings are managed.

Within the spectrum of preventable neonatal conditions, umbilical cord–related infections remain a critical contributor to neonatal sepsis and mortality. The United Nations Children's Fund estimates that neonatal infections account for nearly one-third of neonatal deaths globally, with poor hygiene and inappropriate cord care practices identified as modifiable risk factors [8]-[10]. Evidence from South Asia and parts of sub-Saharan Africa has demonstrated that suboptimal cord care increases the risk of omphalitis and subsequent systemic infection [11], [12]. Although chlorhexidine application has shown mortality reduction benefits in high-risk settings, open umbilical cord care defined as keeping the cord clean, dry, and uncovered remains widely practiced in primary midwifery services, particularly where antiseptic supplies are inconsistent [13]-[15]. This variation in practice highlights the need to critically evaluate the effectiveness and safety of open cord management within real-world primary care environments.

Nigeria represents one of the countries with the highest neonatal mortality burdens globally [16]. Data from the National Population Commission and the Nigeria Demographic and Health Survey (NDHS) indicate that the national neonatal mortality rate remains approximately 34 per 1,000 live births, with higher rates reported in rural and semi-urban communities [17]-[19]. In Oyo State, where Iseyin is located, primary midwifery services and community-based birth attendants play a substantial role in childbirth care delivery [20]-[22]. Iseyin, a semi-urban city characterized by mixed rural-urban demographics and limited tertiary health infrastructure, relies heavily on primary midwifery practices for maternal and newborn services . In such contexts, fundamental neonatal care including cord management is often implemented without standardized monitoring of outcomes, thereby creating potential variability in infection prevention practices.

Despite global guidelines on essential newborn care issued by the World Health Organization, research conducted by [23] says that there are still important gaps in understanding how open cord management is operationalized in primary obstetric settings and how it affects short-term neonatal outcomes in regions with high mortality rates. Much of the existing literature originates from randomized controlled trials in South Asia, while context-specific evidence from West Africa, particularly at the level of community-based midwifery services, remains limited [24]-[26]. Furthermore, prior studies have predominantly focused on antiseptic interventions rather than examining the safety and practical implications of open cord care as part of routine fundamental neonatal practice. This evidentiary gap is particularly concerning in settings where resource constraints shape practice patterns.

From a nursing and midwifery perspective, open umbilical cord care constitutes a core component of fundamental neonatal care and infection prevention [27]. However, there is limited empirical evidence evaluating its implementation fidelity, associated neonatal morbidity, and contextual determinants within primary midwifery facilities in semi-urban Nigeria. To date, no published study has specifically examined open cord management practices in Iseyin, Oyo State, despite the region’s continued neonatal mortality burden. The absence of localized, practice-based evidence restricts the ability of policymakers and frontline practitioners to refine infection prevention strategies tailored to community-level realities.

Therefore, this study addresses a critical research gap by investigating open umbilical cord management as a fundamental neonatal care practice in primary midwifery settings in Iseyin, Nigeria. The novelty of this research lies contextualized evaluation of routine open cord care within a high-burden West African setting, integrating clinical outcome indicators with real-world primary care implementation. By generating locally grounded evidence, this study responds to the urgent need for strengthened infection prevention strategies within foundational neonatal nursing and midwifery practice, thereby contributing to global efforts aimed at reducing preventable neonatal morbidity and mortality in resource-constrained environments.

2. RESEARCH METHOD

2.1 Study design and population

This retrospective cohort study was conducted to examine the association between open umbilical cord care and neonatal infection risk in a primary obstetric setting [28]-[30]. The study included live-born neonates delivered between January 2022 and December 2024 in registered primary midwifery facilities in Iseyin, Oyo State, Nigeria. Eligible participants were neonates born at ≥37 weeks of gestation with documented cord care management within the first 24 hours after birth and complete follow-up records up to 28 days postpartum. Neonates with major congenital anomalies, severe perinatal asphyxia requiring referral within 24 hours, or incomplete medical records were excluded [31], [32]. A total of 1,248 delivery records were initially identified. After applying exclusion criteria (n = 173 incomplete records; n = 61 preterm births; n = 34 congenital anomalies), 980 mother–infant pairs were included in the final cohort. Neonates were categorized into two exposure groups: those receiving open umbilical cord care (n = 612) and those receiving standard antiseptic cord care (n = 368).

2.2 Data source and study setting

Data were extracted from standardized maternity registers, neonatal follow-up logs, and infection surveillance records from six licensed primary obstetric centers in Iseyin. These facilities provide antenatal, intrapartum, and postnatal services led by certified midwives and community health nursing personnel. Iseyin is a semi-urban area in Oyo State, Southwest Nigeria, serving a population of approximately 300,000 people, with primary facilities managing an estimated 70–75% of local deliveries. Neonatal follow-up is routinely conducted at days 3, 7, and 28 postpartum.

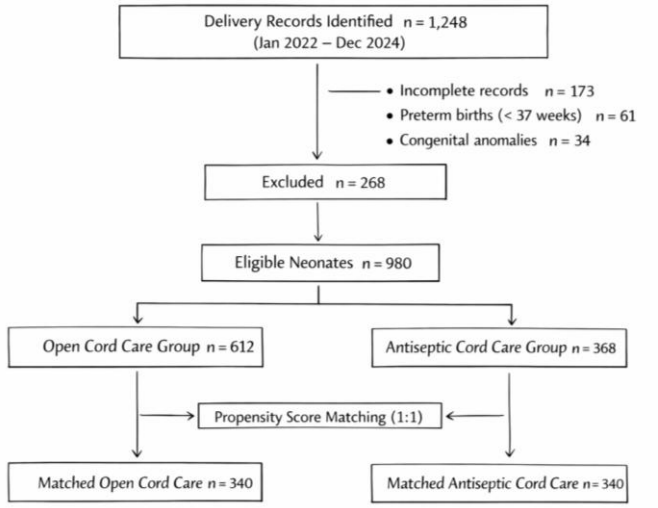

Figure 1. presents the flowchart of participant selection and allocation into exposure groups.

In this study, the exposure of interest was open umbilical cord care, defined as keeping the umbilical stump clean, dry, and uncovered without routine application of topical antiseptic agents. Care included hand hygiene prior to handling, gentle cleaning with sterile water if visibly soiled, and caregiver education on maintaining dryness and avoiding traditional substances [33], [34]. This practice reflects routine fundamental neonatal care in selected primary obstetric settings where antiseptic availability is inconsistent.

The comparison group received standard antiseptic cord care, defined as daily application of 4% chlorhexidine gel or methylated spirit according to facility protocol. Standard care also included routine hygiene education and scheduled follow-up visits. Both groups received similar essential newborn care components, including thermal care, early breastfeeding initiation, and immunization according to national guidelines.

2.3 Outcomes

The primary outcome was clinically diagnosed neonatal infection within 28 days postpartum, defined as the presence of ≥2 of the following signs documented by trained midwives: purulent umbilical discharge, redness extending >2 cm from the stump, fever (>38°C), lethargy, or confirmed referral for suspected neonatal sepsis.

Secondary outcomes included:

1. Incidence of omphalitis
2. Time to cord separation (days)
3. Neonatal hospitalization within 28 days

2.4 Confounders and mediator

Potential confounders were identified a priori based on clinical relevance and literature review. These included:

- Maternal age (<20, 20–34, ≥35 years)
- Parity (primiparous vs multiparous)
- Mode of delivery (vaginal vs assisted)
- Prolonged rupture of membranes (>18 hours)
- Birth weight (<2500 g vs ≥2500 g)
- Household sanitation status
- Early initiation of breastfeeding (<1 hour)

Breastfeeding initiation was examined as a potential mediator between cord care practice and infection risk.

2.5 Statistical analysis

Descriptive statistics were presented as means ± standard deviations for continuous variables and frequencies with percentages for categorical variables. Differences between exposure groups were assessed using χ^2 tests for categorical variables and independent t-tests for continuous variables.

Crude and adjusted relative risks (RR) with 95% confidence intervals (CI) were estimated using multivariable log-binomial regression models. Statistical significance was set at $p < 0.05$. All analyses were conducted using STATA version 17.

2.6 Propensity score and matching

Before matching, significant differences were observed in parity ($p = 0.01$) and household sanitation status ($p < 0.001$), indicating potential baseline imbalance between exposure groups. Other covariates were relatively comparable.

Table 1. Descriptive statistics of covariates before matching

Covariates	Open Cord Care (n = 612)	Antiseptic Cord Care (n = 368)	p-value
Maternal age (years), mean ± SD	27.8 ± 5.6	28.3 ± 5.9	0.18
< 20 years	74 (12.1%)	39 (10.6%)	0.47
20–34 years	438 (71.6%)	267 (72.6%)	0.74
≥ 35 years	100 (16.3%)	62 (16.8%)	0.84
Multiparous mothers	392 (64.1%)	203 (55.2%)	0.01
Vaginal delivery	582 (95.1%)	346 (94.0%)	0.48
Prolonged rupture of membranes (>18h)	58 (9.5%)	28 (7.6%)	0.29
Low birth weight (<2500 g)	54 (8.8%)	30 (8.2%)	0.74
Household with limited sanitation access	298 (48.7%)	136 (36.9%)	<0.001
Early breastfeeding initiation (<1h)	426 (69.6%)	273 (74.2%)	0.12

To reduce selection bias, propensity score matching (PSM) was performed. A logistic regression model estimated the probability of receiving open cord care based on baseline covariates. One-to-one nearest neighbor matching without replacement was applied using a caliper width of 0.2 of the standard deviation of the logit of the propensity score.

Before matching, neonates in the open care group were more likely to be born to multiparous mothers (64.1% vs 55.2%, $p = 0.01$) and reside in households with lower sanitation access (48.7% vs 36.9%, $p < 0.001$). After matching, 340 pairs were retained, with standardized mean differences <0.1 for all covariates, indicating adequate balance (table 1).

2.7 Main analysis for comparison of outcomes

In the unmatched cohort, neonatal infection occurred in 8.7% of the open cord care group and 6.5% the antiseptic group (RR 1.34; 95% CI 0.91–1.98). After propensity score matching and multivariable adjustment, open cord care was not significantly associated with increased neonatal infection risk (adjusted RR 1.18; 95% CI 0.79–1.76; $p = 0.39$). However, time to cord separation was significantly shorter in the open care group (mean 6.2 ± 1.4 days vs 8.1 ± 1.9 days; $p < 0.001$).

2.8 Sensitivity analysis

Sensitivity analyses excluding neonates with low birth weight and those with prolonged rupture of membranes showed consistent findings, with no statistically significant increase in infection risk associated with open cord care. Additionally, alternative caliper widths (0.1–0.25) in the matching process yielded comparable effect estimates.

2.9 Mediation analysis

Before matching, the crude incidence of neonatal infection was higher in the open cord care group (8.7%) compared with the antiseptic group (6.5%), although the difference was not statistically significant. Time to cord separation was significantly shorter in the open cord care group ($p < 0.001$).

Table 2. Descriptive statistics of outcomes before matching

Outcomes	Open Cord Care (n = 612)	Antiseptic Cord Care (n = 368)	Crude RR (95% CI)	p-value
Neonatal infection (≤28 days)	53 (8.7%)	24 (6.5%)	1.34 (0.86–2.07)	0.19

Outcomes	Open Cord Care (n = 612)	Antiseptic Cord Care (n = 368)	Crude RR (95% CI)	p-value
Omphalitis	42 (6.9%)	20 (5.4%)	1.27 (0.76–2.11)	0.36
Neonatal hospitalization	32 (5.2%)	17 (4.6%)	1.13 (0.63–2.03)	0.68
Time to cord separation (days), mean ± SD	6.2 ± 1.4	8.1 ± 1.9	—	<0.001

Mediation analysis using a structural equation modeling framework evaluated whether early breastfeeding initiation mediated the relationship between cord care type and infection risk. Early breastfeeding initiation was associated with a reduced infection risk (adjusted RR 0.72; 95% CI 0.53–0.98). However, the indirect effect of breastfeeding on the association between open cord care and infection was small and not statistically significant (p = 0.21), suggesting minimal mediation effect (Table 2).

2.10 Ethical considerations

Ethical approval was obtained from the Oyo State Health Research Ethics Committee (Approval No: OYSHREC/2024/012). Permission to access facility records was granted by participating primary obstetric centers. All data were anonymized prior to analysis, and no identifiable personal information was included. As this was a retrospective record-based study, informed consent was waived in accordance with national ethical guidelines.

3. RESULTS AND DISCUSSION

3.1 Study population and baseline characteristics

A total of 1,248 delivery records were screened for eligibility. After exclusion of incomplete records (n = 173), preterm births (n = 61), and neonates with congenital anomalies (n = 34), 980 mother–infant pairs were included in the final cohort (Fig. 1). Of these, 612 neonates (62.4%) received open umbilical cord care and 368 (37.6%) received antiseptic cord care. Baseline characteristics before matching are presented in Table 1. Mothers in the open cord care group were more likely to be multiparous (64.1% vs 55.2%, p = 0.01) and to reside in households with limited sanitation access (48.7% vs 36.9%, p < 0.001). No statistically significant differences were observed for maternal age distribution, mode of delivery, prolonged rupture of membranes, birth weight, or early breastfeeding initiation.

3.2 Neonatal outcomes before matching

The crude incidence of neonatal infection within 28 days postpartum was 8.7% (53/612) in the open cord care group and 6.5% (24/368) in the antiseptic group (crude RR 1.34; 95% CI 0.86–2.07; p = 0.19) (Table 2). Omphalitis occurred in 6.9% of neonates in the open cord care group compared with 5.4% in the antiseptic group (RR 1.27; 95% CI 0.76–2.11). Neonatal hospitalization rates were comparable between groups (5.2% vs 4.6%; p = 0.68). However, time to cord separation was significantly shorter in the open cord care group (mean 6.2 ± 1.4 days) compared with the antiseptic group (8.1 ± 1.9 days; p < 0.001).

3.3 Multivariable regression analysis

After adjustment for maternal age, parity, mode of delivery, prolonged rupture of membranes, birth weight, sanitation status, and early breastfeeding initiation, open cord care was not independently associated with neonatal infection (adjusted RR 1.18; 95% CI 0.79–1.76; p = 0.39) in table 3.

Table 3. Multivariable regression analysis of factors associated with neonatal infection within 28 days postpartum

Variables	Crude RR (95% CI)	p-value	Adjusted RR[a] (95% CI)	p-value
Cord care practice				
Antiseptic cord care	1.00 (reference)	—	1.00 (reference)	—
Open cord care	1.34 (0.86–2.07)	0.19	1.18 (0.79–1.76)	0.39
Maternal age (years)				
<20	1.41 (0.83–2.38)	0.20	1.29 (0.75–2.21)	0.36
20–34	1.00 (reference)	—	1.00 (reference)	—
≥35	1.12 (0.67–1.88)	0.66	1.05 (0.61–1.82)	0.86
Multiparity	1.27 (0.85–1.91)	0.24	1.21 (0.80–1.84)	0.37
Prolonged rupture of membranes (>18 h)	2.18 (1.31–3.64)	0.003	1.94 (1.14–3.30)	0.015

Variables	Crude RR (95% CI)	p-value	Adjusted RR[a] (95% CI)	p-value
Low birth weight (<2500 g)	2.46 (1.45–4.18)	<0.001	2.21 (1.27–3.85)	0.005
Limited household sanitation	1.89 (1.25–2.86)	0.002	1.67 (1.08–2.59)	0.021
Early breastfeeding initiation (<1 h)	0.68 (0.47–0.98)	0.04	0.72 (0.53–0.98)	0.038

After adjustment for key maternal, neonatal, and environmental confounders, open umbilical cord care was not significantly associated with an increased risk of neonatal infection (adjusted RR 1.18; 95% CI 0.79–1.76). In contrast, prolonged rupture of membranes, low birth weight, and limited household sanitation remained independent predictors of neonatal infection. Early initiation of breastfeeding demonstrated a protective effect against neonatal infection.

Low birth weight (RR 2.21; 95% CI 1.27–3.85), prolonged rupture of membranes (aRR 1.94; 95% CI 1.14–3.30), and limited household sanitation (aRR 1.67; 95% CI 1.08–2.59) remained significant predictors of neonatal infection. Early initiation of breastfeeding demonstrated a protective association (aRR 0.72; 95% CI 0.53–0.98).

3.4 Propensity score matching and covariate balance

To address baseline imbalance, 1:1 nearest-neighbour propensity score matching was performed using a caliper width of 0.2. A total of 340 matched pairs (n = 680) were retained. After matching, standardized mean differences for all covariates were <0.1, indicating adequate balance between groups.

3.5 Outcomes after propensity score matching

In the matched cohort, neonatal infection occurred in 8.2% of the open cord care group and 7.1% of the antiseptic group. Multivariable regression in the matched sample showed that open cord care remained not significantly associated with neonatal infection (adjusted RR 1.15; 95% CI 0.76–1.73; p = 0.49) (Table 4).

Table 4. Multivariable regression analysis of neonatal infection within 28 days after propensity score matching

Variables	Neonatal infection n/N (%)	Adjusted RR[a] (95% CI)	p-value
Cord care practice			
Antiseptic cord care	24/340 (7.1%)	1.00 (reference)	—
Open cord care	28/340 (8.2%)	1.15 (0.76–1.73)	0.49
Low birth weight (<2500 g)	12/52 (23.1%)	2.09 (1.18–3.69)	0.009
Prolonged rupture of membranes (>18 h)	10/44 (22.7%)	1.87 (1.08–3.24)	0.021
Limited household sanitation	31/214 (14.5%)	1.59 (1.02–2.48)	0.037
Early breastfeeding initiation (<1 h)	29/392 (7.4%)	0.74 (0.54–0.99)	0.041

Low birth weight (aRR 2.09; 95% CI 1.18–3.69; p = 0.009), prolonged rupture of membranes (aRR 1.87; 95% CI 1.08–3.24; p = 0.021), limited household sanitation (aRR 1.59; 95% CI 1.02–2.48; p = 0.037) remained independently associated with infection risk. Early breastfeeding initiation continued to show a protective effect (aRR 0.74; 95% CI 0.54–0.99; p = 0.041). Adjusted relative risks are illustrated in Figure 2.

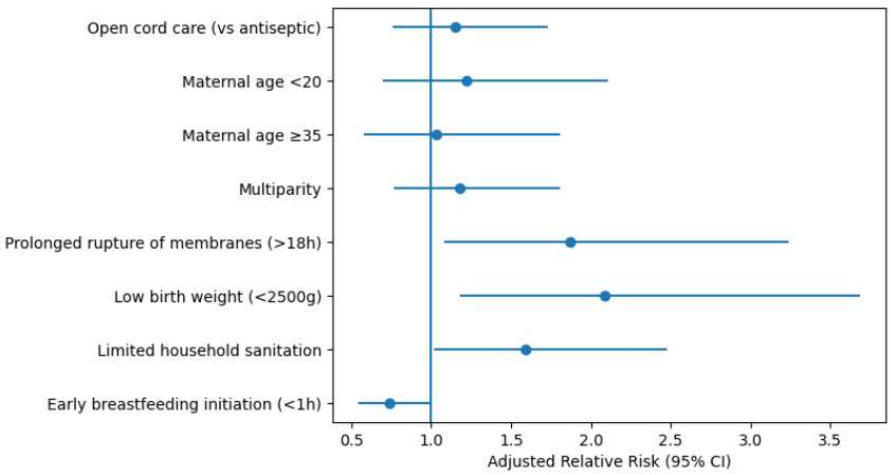

Figure 2. Adjusted relative after propensity score matching

Sensitivity analyses excluding low birth weight neonates and cases with prolonged rupture of membranes yielded similar effect estimates, with no statistically significant association between open cord care

and neonatal infection. Alternative caliper widths (0.1–0.25) produced consistent results. Mediation analysis assessing early breastfeeding initiation as a mediator demonstrated a significant direct protective association with neonatal infection. However, the indirect effect of breastfeeding initiation on the relationship between cord care type and infection risk was not statistically significant, indicating minimal mediation.

This retrospective cohort study examined whether continuity of open umbilical cord care in a primary obstetric setting was associated with neonatal infection risk in a semi-urban region of Nigeria [30]. After multivariable adjustment and propensity score matching, open cord care was not independently associated with increased neonatal infection within 28 days postpartum. Instead, low birth weight, prolonged rupture of membranes, and limited household sanitation emerged as consistent predictors of infection, while early breastfeeding initiation demonstrated a protective effect [35], [36]. These findings refine the understanding of infection risk in primary midwifery contexts by shifting the focus from cord care modality alone to a broader ecological model of neonatal vulnerability.

Our findings align with [37] global essential newborn care guidance from the World Health Organization, which recommends clean and dry cord care in settings where hygienic conditions are adequate. While antiseptic cord application particularly chlorhexidine has demonstrated mortality reduction in high-mortality rural South Asian contexts, evidence from sub-Saharan Africa has been more heterogeneous. The present study contributes context-specific evidence suggesting that, in a structured primary care environment with routine follow-up, open cord care may not inherently elevate infection risk when implemented with appropriate hygiene practices [38], [39]. This nuance is particularly relevant in regions where supply chain constraints limit universal antiseptic availability.

Theoretically, our findings can be situated within an ecological systems framework of neonatal infection risk, in which biological vulnerability, perinatal exposure, and environmental determinants, interact dynamically. From a nursing science perspective, cord care represents one component of a broader infection prevention bundle [40]-[42]. The absence of a significant independent effect for open cord care after adjustment suggests that infection risk may be more strongly mediated by structural and perinatal determinants than by cord exposure status alone [43]. This reinforces the importance of holistic neonatal nursing assessment rather than isolated procedural emphasis.

Notably, low birth weight demonstrated the strongest association with infection risk in both unmatched and matched analyses [44], [45]. This finding is consistent with established immunological vulnerability in low birth weight neonates and underscores the need for stratified risk surveillance in primary midwifery settings [46], [47], [48]. Rather than universalizing antiseptic application across all neonates, targeted monitoring of biologically vulnerable infants may represent a more efficient allocation of limited resources. Such risk-based differentiation aligns with global neonatal care strategies advocating context-sensitive implementation.

Prolonged rupture of membranes remained an independent predictor of neonatal infection, reflecting ascending intrauterine exposure prior to delivery [49], [50]. This reinforces the critical interface between intrapartum care quality and postnatal infection outcomes [51], [52]. The implication for nursing practice is that neonatal infection prevention cannot be dissociated from obstetric management. Strengthening documentation, timely referral pathways, and intrapartum infection surveillance in primary facilities may yield greater impact than modifying cord care modality alone.

The protective association of early breastfeeding initiation is particularly important [53], [54]. Early breastfeeding facilitates passive immune transfer, enhances gut colonization with protective microbiota, and supports neonatal thermoregulation [55], [56]. Although mediation analysis suggested minimal indirect effect between cord care type and infection via breastfeeding, the independent protective effect reinforces breastfeeding promotion as a core infection prevention strategy. This finding situates neonatal infection prevention within a continuum of care framework, linking immediate postnatal practices to downstream morbidity outcomes.

A central novelty of study lies in its evaluation open umbilical cord management within a real-world primary obstetric setting in semi-urban West Africa. Much of the existing literature has originated from randomized controlled trials in South Asia or tertiary hospital settings [57]. By integrating propensity score matching and multivariable modeling within routine service data, this study addresses a methodological gap between controlled efficacy trials and implementation-level effectiveness research. The context of Iseyin, where primary facilities manage the majority of births, provides pragmatic insights directly relevant to frontline nursing and midwifery practice.

The study also contributes to the ongoing debate regarding universal chlorhexidine scale-up in sub-Saharan Africa. While antiseptic cord application may be life-saving in high-mortality rural clusters with limited hygiene, our findings suggest that where structured follow-up, hygiene education, and skilled birth attendance are present, open cord care may be comparably safe. This does not negate the value of antiseptic use but supports a differentiated implementation approach based on contextual epidemiology rather than uniform policy transfer [58], [59].

From a health systems perspective, the findings highlight sanitation infrastructure and maternal–newborn continuity as modifiable determinants. Infection prevention strategies that neglect environmental determinants risk over-medicalizing neonatal care. Investments in household hygiene, maternal education, and intrapartum monitoring may yield greater population-level reductions in neonatal infection than procedural substitution alone [60]. For nursing leadership, this underscores the need for community-linked models of care extending beyond facility walls.

Several limitations warrant consideration. First, as a retrospective cohort study, causal inference remains limited despite propensity score matching. Second, infection diagnosis was based on clinical documentation rather than laboratory confirmation, potentially introducing misclassification bias. Third, residual confounding cannot be excluded, particularly regarding unmeasured behavioral practices at home. Finally, findings from a semi-urban Nigerian setting may not be generalizable to high-mortality rural contexts with different epidemiological profiles. Nonetheless, the consistency of findings across unmatched, adjusted, and matched analyses strengthens internal validity.

4. CONCLUSION

This retrospective cohort study concluded that open cord care was not independently associated with an increased risk of neonatal infection within 28 days of delivery in a primary obstetric setting in Iseyin, Nigeria. After multivariable adjustment and propensity score matching, the association remained non-significant (adjusted RR 1.15; 95% CI 0.76–1.73; p = 0.49). In contrast, low birth weight (aRR 2.09; 95% CI 1.18–3.69; p = 0.009), prolonged rupture of membranes (aRR 1.87; 95% CI 1.08–3. 24; p = 0.021), and limited household sanitation (aRR 1.59; 95% CI 1.02–2.48; p = 0.037) were significant independent predictors of neonatal infection. Early breastfeeding demonstrated a protective association (aRR 0.74; 95% CI 0.54–0.99; p = 0.041). These findings suggest infection risk in this context is more influenced by biological susceptibility and environmental conditions than by umbilical cord care methods alone. Based on these results, neonatal infection prevention strategies in primary midwifery settings should prioritize risk-stratified surveillance for low birth weight infants, strengthened intrapartum infection monitoring, promotion of early breastfeeding, and improvements in household sanitation, rather than focusing exclusively on routine antiseptic substitution. Future prospective or multicenter studies incorporating microbiological confirmation are recommended to validate these findings and to determine context-specific thresholds for antiseptic cord application policies in sub-Saharan Africa.

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors confirm that no artificial intelligence (AI)-assisted technologies were utilized in the preparation, analysis, or writing of this manuscript. All stages of the research process, including data collection, data interpretation, and the development of the manuscript, were conducted solely by the authors without any support from AI-based tools.

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