

Knowledge and Practice of Umbilical Cord Care Among Mothers Attending an Immunization Clinic in Makurdi, Benue State, Nigeria

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ABSTRACT

Background: The umbilical stump, if not properly cared for, becomes a route of infection into the newborn, leading to umbilical cord infection, neonatal sepsis, and death. When caring for the newborn, some caregivers engage in harmful practices by applying various substances to the umbilical stump, and these practices are often based on local knowledge and culture. This study assessed knowledge and practice of umbilical cord care and their determinants among mothers attending an immunization clinic in Makurdi, Benue State, Nigeria.

Methodology: A cross-sectional, descriptive study was conducted among mothers who brought their infants for immunization. Using a systematic sampling technique, 293 mothers were enrolled in the study. Data were collected using pre-tested, interviewer-administered questionnaires between October and November 2023. Data were analyzed using SPSS version 23, and associations tested with the chi-square test and binary logistic regression. Level of statistical significance was set at 5%.

Results: The mothers' mean (SD) age was 31.31 (6.38) years; most were married (69.6%), had tertiary level education (39.6%), and were full-time housewives (33.8%). Their mean (SD) parity was 2.79 (1.14) children, the median (range) number of ANC visits was 4 (2-10) visits, and the vast majority (80.5%) delivered their index baby at a health facility. Overall, only 22 mothers (7.5%) demonstrated good knowledge of umbilical cord care (UCC), while the vast majority, 271 mothers (92.5%) demonstrated poor knowledge. Conversely, 235 (80.2%) mothers observed good UCC practices, while 58 (19.8%) observed poor practices. Predictors of good UCC practice were: health facility delivery, higher maternal age (>30 years), and tertiary level education. On the other hand, predictors of poor practice of UCC were: primary education and being a civil servant or student.

Conclusion and recommendations: Knowledge about UCC was significantly poor, but most mothers were practicing good UCC. Predictors of good UCC practice were: health facility delivery, higher maternal age (>30 years), and tertiary education. On the other hand, predictors of poor UCC practice were: primary education, and being a civil servant or student. Integrating simple, umbilical cord care education into routine health education messages at antenatal, natal, and postnatal care service points will improve knowledge and practice of cord care. Healthcare providers should also give a hands-on demonstration of proper cord care before mothers are discharged after delivery.

Keywords: Knowledge, Practice, Umbilical Cord Care, Benue, Nigeria

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INTRODUCTION

Globally, according to the World Health Organization (WHO), 2.3 million newborns died in 2022, and Sub-Saharan Africa accounted for the highest global neonatal mortality rate at 27 deaths per 1000 live births. The leading causes of those global newborn deaths were reported to be due to pre-term births, intrapartum complications, neonatal infections, and congenital defects, which are conditions associated with lack of quality care at or immediately after birth.¹ A significant proportion of these neonatal infections may result from bacterial colonization of the umbilicus, because cord care practices often differ due to cultural traditions and variations in healthcare practices worldwide.²

During pregnancy, the umbilical cord serves as the link connecting the fetus to the mother via the placenta. It is the channel for the exchange of nutrients, oxygen, and waste products between the foetus and the mother's bloodstream. After birth, the umbilical cord is no longer needed and is clamped and cut, leaving a stump that remains attached to the newborn. The umbilical stump, if not cared for, becomes a route of infection into the newborn, leading to umbilical cord infection,³⁻⁵ neonatal sepsis,⁶ and death.^{4,7} Proper care of the umbilical cord, especially during a newborn's first week of life, can play a crucial role in averting preventable neonatal morbidity and mortality, particularly in situations with inadequate hygiene.⁸

Umbilical cord care refers to the practices taken to ensure the cleanliness and healing of a newborn's umbilical cord stump after birth. Proper care minimizes the risk of infection and promotes the natural detachment of the stump. In settings with low neonatal mortality and good hygiene, the WHO recommends keeping the umbilical cord stump clean and dry. This involves avoiding the application of substances to the umbilical cord stump and allowing it to dry and fall off naturally. In areas with high neonatal mortality rates or poor hygiene conditions, WHO recommends daily application of 4% chlorhexidine, especially in settings where harmful traditional substances are commonly used on the umbilical cord stump.⁹

Caregivers of newborns desire to actively care for the umbilical stump, and the intention is to promote healing and hasten cord separation.^{8,10} Backed by this intention, some caregivers engage in harmful practices by applying various substances on the umbilical stump;^{3,8,11-14} and these practices are based on the local knowledge and culture. A systematic review of umbilical cord-care (UCC) practices in low- and middle-income countries⁸ has described a variety of substances applied to the umbilical cord including: herbs, native chalk, palm oil, and toothpaste (Nigeria); shea butter, ground shea nuts, or "red earth sand" (Ghana); onions, ash from burnt papyrus, and surgical spirit (Uganda); petroleum jelly, hair lotion, iodine or gentian violet (Ethiopia); mustard oil, turmeric, and ghee, (India); coconut oil, clove oil, and talcum powder (Pakistan); smashed garlic, boric powder, and chular mati (earth from a clay oven) (Bangladesh); and dry coffee, rotten tree powder, black sesame, and burnt cloth (Turkey). Unhygienic cord care practices and application of these harmful substances have resulted in adverse consequences for the newborn, including cord infections¹⁵⁻¹⁶ and neonatal sepsis.⁶

Several factors have also been shown to influence the knowledge and practice of umbilical cord care (UCC). Studies have shown that predictors of good umbilical cord care (UCC) practices include younger maternal age (≤ 24 years and 24–32 years), attainment of primary or higher education, delivery in a health facility, and possession of adequate knowledge of UCC.¹⁷ On the other hand, predictors of low knowledge of UCC have included: living in rural areas, having no formal education and delivering at home; while predictors of poor UCC practices have included: no formal education, having primary education, being a peasant, business woman, housewife and prime para.¹² This study therefore sought to assess knowledge and practice of UCC; and their determinants among mothers with infants at an immunization clinic in Makurdi, Benue State, Nigeria.

METHODOLOGY

Study area and setting

The study area was Makurdi, the Capital of Benue State,

Nigeria. The study setting was the Immunization Clinic of the Epidemiology Unit at the Benue State Ministry of Health (BSMOH). The Unit provides Immunization services to the populations within its catchment area. Also, within the Epidemiology Unit, the following programme offices are located: Malaria, Tuberculosis/Leprosy/Buruli ulcer, Neglected Tropical Diseases, and Disease Outbreak Programme offices of the BSMOH.

Study design and population

A cross-sectional descriptive study was conducted among mothers who brought their infants, aged between 0 and 12 months, for immunization. Consenting mothers were enrolled in the study. Mothers who declined to give informed consent, and who were visibly ill or distressed during the interview, were excluded from the study.

Sample size and sampling technique

The minimum sample size was calculated using the formula for descriptive cross-sectional studies¹⁸: $n = \frac{z^2 pq}{d^2}$. Where n is the minimum sample size, z is the standard normal deviate at 95% confidence interval (1.96), p is the proportion (20.5%) of mothers with beneficial practice of cord care from a previous study in Nigeria,¹⁹ q is the complementary probability (1- p), and d is the degree of accuracy set at 0.05. After adjusting for 5% non-response, the calculated sample size was 263. However, 293 eligible and consenting mothers were enrolled over the study period to increase the power of the study.

Systematic sampling technique was used to select mothers for the study. A total of 1400 infants were immunized in the month preceding the study period. Calculating the sampling interval using this number: $k = N/n = 1400/293 = 4.02$, approximately = 4. Thus, every 4th mother was selected and interviewed.

Data collection and instrument

Data were collected by three 600-level medical students who had been trained for the study. Data were collected over a period of one month, October – November 2023, using pre-tested, interviewer-administered questionnaires. The questionnaire comprised of two

sections. Section A collected information on socio-demographic and obstetric characteristics, and Section B collected information on knowledge and practices of UCC.

Variables of the study

The dependent variable was: practice of umbilical cord care, while the independent variables were: sociodemographic and obstetric characteristics.

Data analyses

Data were analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 23. Descriptive statistics were generated, including frequencies and percentages for categorical variables, and means, standard deviations, medians, and ranges for quantitative variables. Seven aspects of knowledge of umbilical cord care were assessed: importance of cord care; safe materials used to tie the cord; time required for the cord to detach; what to apply to the cord during cleaning; exposure of cord after cleaning; causes of cord infection; and signs of cord infection. A total of 24 items were obtained as responses to these seven aspects. Of the 24 items, only 14 were correct knowledge responses, and the remaining 10 were wrong responses. A score of 1 was assigned to a correct knowledge response, and a score of 0 was assigned to a wrong response. The overall knowledge score was calculated based on the proper responses, totaling 14. Taking the average of 14, a score ≥ 7 was categorized as good knowledge, while scores < 7 were categorized as poor knowledge.

Six aspects of umbilical cord care practice were assessed: cleaning the umbilical cord; frequency of cleaning; washing of hands before cleaning the cord; washing of hands after cleaning the cord; applying a substance to the cord; and type of substance applied to the cord. A total of 18 items were obtained as responses to these six aspects of umbilical cord practice. Of the 18 items, only 6 were correct practice responses, and the remaining 12 were wrong responses. A score of 1 was assigned to a correct practice response, and a score of 0 was assigned to an incorrect response. The overall practice score was calculated based on the correct responses, which were 6. Taking the average of 6, a score

of ≥ 3 was categorized as good practice, while scores < 3 were categorized as poor practice.

Associations were tested using the chi-square test. Multivariable logistic regression analysis was performed to identify independent risk factors associated with good practice in umbilical cord care. Only variables associated with a p-value < 0.10 on bivariate analyses were included in the logistic regression model. The level of statistical significance was set at 5%.

Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee (HREC) of the College of Health Sciences, Moses Adasu Orshio University, Makurdi, Benue State, Nigeria. Informed consent was

obtained from all respondents, and participation was voluntary. The purpose of the research was explained to the respondents, and they were assured of anonymity and confidentiality of their data.

RESULTS

Socio-demographic characteristics

Respondents' socio-demographic characteristics are presented in Table 1. The mean (SD) age of the mothers was 31.31 (6.38) years, with the majority, 142 (48.5%), in the age group 21–30 years. Most, 204 (69.6%), were married; 186 (63.5%) were of the Tiv ethnicity; and the majority were Christians (86.3%). Most, 116 (39.6%) had a tertiary level of education, while 105 (35.8%) had secondary education. Most, 99 (33.8%), were full-time housewives, while 32 (10.9%) were students.

Table 1: Socio-demographic characteristics (n = 293)

Socio-demographic characteristics	Frequency	Percentage
Age (years)		
<20	2	0.7
21 – 30	142	48.5
31 – 40	134	45.7
41 – 50	15	5.1
Mean (SD) = 31.31 (6.38); Range = 18-50		
Marital status		
Single	56	19.1
Married	204	69.6
Divorced	9	3.1
Separated	20	6.8
Widowed	4	1.4
Ethnic group		
Tiv	186	63.5
Idoma	61	20.8
Igede	30	10.2
Others*	16	5.5
Religion		
Christian	253	86.3
Muslim	32	11.6
Traditional	6	2.0
Level of education		
No formal	37	12.6
Primary	35	11.9
Secondary	105	35.8
Tertiary	116	39.6
Occupation		
Business/trader	86	29.4
Civil servant	76	25.9
Student	32	10.9
House wife	99	33.8

*Other ethnic groups included Hausa, Ibo, Etulo

Obstetric characteristics

Respondents' obstetric characteristics are presented in Table 2. The mean (SD) parity was 2.79 (1.14) children, with a range of 1-8 children. More than half, 171 (58.4%) of the mothers had 3–4 children,

while the smallest proportion had 7–8 children (1.4%). The median number of ANC visits was 4, with a range of 2-10 visits. Most, 132 (45.1%) of the mothers had made 3–4 ANC visits, with the vast majority, 236 (80.5%) delivering their index baby at a health facility.

Table 2: Obstetric characteristics (n = 293)

Obstetrics characteristics	Frequency	Percentage
Parity		
1-2	105	35.8
3-4	171	58.4
5-6	13	4.4
7-8	4	1.4
Mean (SD) = 2.79 (1.14); Range = 1 -8		
Number of ANC visits to birth of index child		
1-2	22	7.5
3-4	132	45.1
5-6	100	34.1
7-8	15	5.1
9-10	24	8.2
Median (range) = 4 (2 -10)		
Place of delivery		
Home	57	19.5
Health facility	236	80.5

Table 3: Knowledge of umbilical cord care (n = 293)

Variables	Frequency	Percentage
Importance of umbilical cord care		
To prevent infection*	188	64.2
To help the cord detach in time	105	35.8
Safe materials used to tie the cord		
Thread	83	28.3
Cord clamp*	210	71.7
Time required for the cord to detach (days)		
<5	142	48.5
5-15*	141	48.1
>15	10	3.4
What to apply to the cord during cleaning		
Spirit	99	33.8
Nothing*	41	14.0
Water	49	16.7
Vaseline	14	4.8
Chlorhexidine*	48	16.4
Closeup toothpaste	42	14.3
Exposure after cleaning		
Yes*	153	52.2
No	140	47.8
Causes of umbilical cord infection		
When exposed	116	39.6
When wet*	39	13.3
Dirty stump*	138	47.1
Signs of umbilical cord infection		
Bleeding*	172	58.7
Discharge*	57	19.5
Redness*	24	8.2
Foul smell*	13	4.4
Swelling*	24	8.2
Long healing time*	3	1.0
Overall knowledge		
Good	22	7.5
Poor	271	92.5

*Correct knowledge responses

Knowledge of umbilical cord care

Respondents' knowledge of umbilical cord care is presented in Table 3. Of the 293 mothers, correct knowledge about UCC was expressed by: 188 (64.2%) for the importance of UCC in preventing infection; 210 (71.7%) for cord clamp being the safe material to tie the cord; 141 (48.1%) for 5-15 days being the number of days required for cord detachment; 41 (14%) and 48 (16.4%) for the application of nothing or chlorhexidine to the cord, respectively; 153 (52.2%) for exposure of the cord after cleaning; 39 (13.3%) and 138 (47.1%) for wetness and dirty stump as causes of umbilical cord infection, respectively; 172 (58.7%), 57 (19.5%), 24 (8.2%), 13 (4.4%), 24 (8.2%) and 3 (1%) for bleeding, discharge, redness, foul smell, swelling, and long healing time as signs of umbilical cord infection, respectively. Overall, only 22 (7.5%) mothers demonstrated good knowledge, while the vast majority, 271 (92.5%) demonstrated poor knowledge of UCC.

Practices of umbilical cord care

Respondents' practice of umbilical cord care is presented in Table 4. Of the 293 mothers, correct practices of UCC was observed by: 235 (80.2%) that cleaned the umbilical cord; 48 (16.4%) that cleaned the cord only once in a day; 245 (83.6%) that washed their hands before cleaning the cord, and 278 (94.9%) that washed their hands after cleaning the cord; only 64 (21.8%) did not apply any substance on the cord; and 74 (25.3%) that applied Chlorhexidine gel to the cord. Overall, good practices of UCC predominated with 235 (80.2%) mothers observing appropriate care. Conversely, 58 (19.8%) mothers observed poor practices of UCC.

Table 4: Practices of umbilical cord care (n = 293)

Variables	Frequency	Percentage
Cleaning the umbilical cord		
Yes*	235	80.2
No	58	19.8
Frequency of cleaning in a day		
Once*	48	16.4
Twice	81	27.6
Three times	123	42.0
Four times	41	14.0
Washing of hands before cleaning the cord?		
Yes*	245	83.6
No	48	16.4
Washing of hands after cleaning the cord?		
Yes*	278	94.9
No	15	5.1
Apply substance on the cord?		
Yes	229	78.2
No*	64	21.8
What substance is applied?		
Vaseline	122	41.6
Concoctions	4	1.4
Close up toothpaste	78	26.6
Palm kernel oil	12	4.1
Penicillin ointment	3	1.0
Chlorhexidine gel*	74	25.3
Overall practice		
Good practice	235	80.2
Poor practice	58	19.8

*Correct practice response

Predictors of good practice of umbilical cord care

Predictors of good practice of umbilical cord care are presented in Table 5. Mothers aged >30 years were significantly more likely to practice good UCC compared to those ≤30 years (AOR = 2.35, 95% CI = 1.03–5.36, p = 0.042). Higher levels of education were positively associated with good practice, and mothers with tertiary education had significantly better practices than those with no formal education (AOR = 4.83, 95% CI = 1.21–19.14, p = 0.025). On the other hand, mothers with primary education were significantly less likely to

practice good UCC compared to those with no formal education (AOR = 0.21, 95% CI = 0.06–0.70, p = 0.012). Furthermore, civil servants (AOR = 0.26, 95% CI = 0.07–0.96, p = 0.044) and students (AOR = 0.16, 95% CI = 0.04–0.57, p = 0.005) were significantly less likely to practice good UCC compared to business women/traders. Place of delivery was the strongest predictor, as mothers who delivered in health facilities were significantly more likely to practice good UCC than those who delivered at home (AOR = 6.93, 95% CI = 2.61–18.40, p < 0.001).

Table 5: Predictors of good practice of umbilical cord care (n = 293)

Variables	Good practice n (%)	Poor practice n (%)	χ^2	AOR	95% CI	p-value
Age (years)						
≤ 30	109 (75.7)	35 (24.3)	3.628	Reference		
> 30	126 (84.6)	23 (15.4)		2.35	1.03-5.36	0.042
Educational level						
No formal	24 (64.9)	13 (35.1)	66.884**	Reference		
Primary	12 (34.3)	23 (65.7)		0.21	0.06-0.70	0.012
Secondary	91 (86.7)	14 (13.3)		2.06	0.62-6.77	0.232
Tertiary	108 (93.1)	8 (6.9)		4.83	1.21-19.14	0.025
Occupation						
Business/Trader	74 (86.0)	12 (14.0)	14.887*	Reference		
Civil servant	68 (89.5)	8 (10.5)		0.26	0.07-0.96	0.044
Student	20 (62.5)	12 (37.5)		0.16	0.04-0.57	0.005
Housewife	73 (73.7)	26 (26.3)		0.71	0.26-1.95	0.512
Parity						
1-2	80 (76.2)	25 (23.8)	8.230*	Reference		
3-4	145 (84.8)	26 (15.2)		1.03	0.44-2.40	0.939
-	10 (58.8)	7 (41.2)		1.11	0.23-5.27	0.894
Place delivered						
Home	24 (42.1)	33 (57.9)	64.701**	Reference		
Health Facility	211 (89.4)	25 (10.6)		6.93	2.61-18.40	<0.001

Note: Hosmer-Lemeshow goodness of fit test: $\chi^2 = 11.671$, df = 8, p = 0.112

*p<0.05; **p<0.001; AOR = adjusted odds ratio; 95% CI = 95% confidence interval

DISCUSSION

Sociodemographic characteristics

Mothers in the present study were relatively young, with a mean (SD) age of 31.31 (6.38) years. This suggests that, being in their prime reproductive years, they were currently engaging with reproductive and child health services. This finding is similar to a study conducted in Southwest Ethiopia,¹³ where the median age of mothers was 32 years. In contrast, mothers were younger in the Tabora region of Tanzania,¹² with a mean (SD) age of 20.79 (2.74) years, and in Sokoto, Nigeria²⁰ with a mean (SD) age of 27.62 (5.4) years, which likely reflects the demography of mothers in those areas. Most of the mothers in the present study were married, suggesting that they may have greater support from their spouses/significant family members or better decision-making abilities in their households²¹ to seek health services for their children. In support of our findings, a higher proportion of married mothers was seen in several studies across Africa.^{5,12-14,17,20}

The larger proportion of the Tiv ethnic group and Christians reflects the local demographic composition of the study area, and this is important for adapting health education messages to be culturally sensitive and relevant. Educational attainment was relatively high in the present study, and this is probably a reflection of the educational status of mothers in the study area. In support of this finding, an earlier study²² conducted in the same study area and with a similar study population demonstrated similar results, with most of the mothers having secondary and post-secondary education. In contrast, most mothers in Ethiopia¹¹ had no education, while most had primary/less than primary education in Western Uganda,⁵ and most had primary education in Tanzania.¹² Mothers in the present study were mostly full-time housewives, suggesting that they might have more time to focus on childcare; while the inclusion of students shows that some mothers are still in educational transition. In other studies, mothers were also mostly housewives.^{15,20}

Obstetric characteristics

More than half of the mothers had 3–4 children,

suggesting that most of the mothers in the present study have previous newborn care experience. It is important to note, however, that multiparity may not necessarily translate into correct newborn care practices, especially if previous deliveries were not accompanied by adequate health education concerning newborn care. Similar to our finding, more than half (59.2%) of the mothers in another study¹⁷ were also multiparous. In contrast, however, a higher proportion (40.41%) of mothers had 2 children in Sherpur District, Bangladesh,²³ while slightly more than half (50.2%) of the mothers were primiparous in another study.¹² The difference between the latter and present study might be due to the fact that mothers in the latter study were younger and thus, in the beginning stage of their childbearing career, compared to the already experienced mothers in the present study. The median of 4 ANC visits suggests that mothers in the present study have a moderate level of engagement with ANC services. However, this falls below the WHO recommendation of a minimum of eight ANC visits for a positive pregnancy experience²⁴ and indicates a need for improvement. Furthermore, this moderate level of engagement may suggest that some mothers are experiencing barriers to accessing ANC services. Similar to our findings, four or more ANC visits were seen in another study.¹¹ Majority of mothers in the present study had delivered their index child in a health facility, indicating relatively high utilization of skilled birth attendants. This offers the potential for health education on postnatal care, including care of the newborn's umbilical cord. Several studies also report that the majority of mothers delivered their last child in a health facility.^{12-14,17,20}

Overall knowledge and practice of umbilical cord care

The present study reveals a paradox between knowledge and practice. Only a small proportion (7.5%) of mothers had good knowledge of UCC, while the vast majority (92.5%) demonstrated poor knowledge. At the same time, 80.2% of mothers were practicing good UCC, compared to 19.8% who had poor practices. This finding indicates a significant knowledge gap about UCC;

however, despite this gap, most mothers continue to practice appropriate cord care. It also demonstrates that good practice does not necessarily equate to good knowledge among these mothers, but probably, mothers with poor knowledge are also the ones contributing to poor practices.

Since the majority of mothers in the present study had delivered in health facilities, the high rate of appropriate UCC despite low knowledge may be a reflection of the effectiveness of routine postnatal counseling. Mothers may follow newborn care instructions provided by healthcare providers without fully understanding the rationale behind them. In addition, some mothers may follow cultural traditions or imitate the practices of trusted family members, friends, and peers they believe are experienced in newborn care, which inadvertently promotes good UCC practices. Nevertheless, this knowledge versus practice paradox raises concerns that have significant implications for newborn care and health outcomes. Without a foundation of sound knowledge, mother's good practices of UCC might dwindle over time. Furthermore, should complications arise with the umbilical cord, mothers with poor knowledge may be unable to identify the problem or take appropriate action, and might be inclined to seek harmful traditional remedies.

In comparison to the findings of the present study, a systematic review revealed that knowledge and practice of umbilical cord care were low among African caregivers, and care of the umbilical cord was significantly poor in over 70% of their findings. Furthermore, the high prevalence of umbilical cord infections and neonatal sepsis among infants was largely attributed to the unsafe umbilical cord care practices.⁴ Contrary to findings of the present study, in two communities of Plateau State, Nigeria, 73.8% of mothers had good knowledge of UCC while the remaining 26.2% had poor knowledge;¹⁴ in the Tabora region of Tanzania, 62.2% of mothers had adequate knowledge of cord care;¹² and in Sherpur District, Bangladesh, 48.7% of mothers demonstrated a good level of knowledge of UCC, while the remaining 51.3% had poor level of knowledge, which the authors reported

as significant gaps in maternal knowledge.²³

With regards to practice, findings comparable to those of the present were seen elsewhere, with 77.8% of mothers engaged in good UCC practice while the remaining 22.2% had poor practice.¹⁴ In contrast, only 21% of mothers in the Tabora region of Tanzania had good cord care practices.¹² Moreover, in Benin City, Nigeria, 79.5% of mothers were engaged in harmful or non-beneficial cord care practices, and the authors acknowledged that this threatened the health of infants.¹⁹ While in India, 70% of mothers did not follow the recommended cord care protocols, 39.6% applied harmful substances to the cord, while 30.4% did not clean the cord at all; and the authors found a significant association between application of harmful substances and umbilical cord infections.¹⁶

In the literature, a disparity is apparent in the level of knowledge and practice of UCC across different studies and settings. This disparity may be a reflection of several interacting factors, including culture, socio-demographic characteristics, and healthcare infrastructure;^{14,23} as well as differences in research methodologies. This emphasizes the importance of developing culturally sensitive, context-specific interventions and improving access to healthcare resources.

Predictors of good practice of umbilical cord care

In the present study, the strongest predictor of good UCC practice was health facility delivery. This suggests that mothers are receiving appropriate health education on newborn care by trained healthcare providers present at the deliveries, and that healthcare providers are correctly demonstrating how to care for the cord. This highlights the critical role of health facility deliveries in promoting proper care of the newborn, including adequate care of the umbilical cord. In other studies,^{14,17} health facility deliveries were also significantly associated with good UCC practice, while home deliveries were significantly associated with potentially harmful traditional umbilical cord care practices.¹¹ In contrast, there was no association between place of delivery and good cord care in Southwest Ethiopia.¹³

Other predictors of good practice of UCC were higher maternal age (>30 years) and tertiary education. This suggests that older mothers in the present study are mature, may have more experience with child-rearing, and might have learned how to properly care for the newborn's cord from healthcare providers due to repeated exposure to health services. Contrasting findings have shown mothers ≤ 24 years, and 25-32 years to be significantly more likely to practice good cord care compared to mothers ≥ 33 years;¹⁷ while mothers 25-34 years and 35-49 years were associated with potentially harmful traditional umbilical cord care practices;¹¹ and in Plateau State, Nigeria, there was no association between age and good practice of cord care.¹⁴

With regards to education, it has been shown to positively correlate with maternal health literacy, and as educational attainment increases, health literacy also increases.²⁵⁻²⁷ In the present study, tertiary education as a predictor of good practice of UCC would suggest that those mothers also have better health literacy, were able to understand health education messages about proper UCC, and translate them into good practice. They probably also had more access to reliable sources of health information. Other studies have also demonstrated a significant association between higher levels of mothers' educational attainment and good umbilical cord care practices.^{13,17,28} Furthermore, the less likelihood of potentially harmful traditional umbilical cord care practices was seen in mothers with primary and $\geq$ secondary levels of education, compared to those with no formal education.¹¹

In the present study, predictors of poor practice of UCC were primary education and being a civil servant or student. Mothers with lower education probably had lower literacy levels,²⁶⁻²⁷ which might have acted as barriers to understanding health education messages about proper UCC. Additionally, they likely had limited access to reliable health information and were more susceptible to traditional beliefs that led to poor UCC practices. In another study, primary education also predicted poor UCC practice.¹² It is surprising that civil servants and students in the present study also had poor

UCC practices. This suggests that being employed or undergoing formal education alone may not necessarily translate to higher health literacy or appropriate newborn care. It is also possible that civil servants and students were busy with work and academic commitments, respectively. Due to time constraints, they were probably relying on others to care for their newborns, resulting in poor UCC practice. In an earlier study conducted in the same study area among a similar study population, mothers with no formal education and primary education were significantly less likely to apply methylated spirit alone to the umbilical cord of their infants. At the same time, civil servants and traders were substantially more likely to apply methylated spirit alone to the umbilical cord of their infants. The authors acknowledged that while the use of methylated spirit for cord care was high among mothers in the study, they recommend the application of chlorhexidine gel as recommended by WHO.²²

Conclusion and Recommendations

This study revealed a significant knowledge gap about UCC; but despite this gap, most mothers were practicing appropriate cord care. Implying that good practice may not be consistent and sustainable over time, if mothers do not fully understand the reasons behind proper cord care. Health facility delivery emerged as the strongest predictor of good practice of UCC; while other predictors were higher maternal age (>30 years) and tertiary education. On the other hand, predictors of poor practice of umbilical cord care were primary education, being a civil servant, or student.

To close the knowledge gap, structured cord care education should be mandatory, based on the WHO guidelines of clean, dry cord care or the daily application of 4% chlorhexidine gel. This should be integrated into the routine health education messages and delivered at every antenatal, delivery, and post-natal contact. Healthcare providers should encourage mothers to consider health facility deliveries at every opportunity. Also, for health facility deliveries, healthcare providers should give a hands-on demonstration of proper cord care before mothers are discharged. While maternal age and education are non-modifiable, health education

messages should be tailored specifically for younger mothers and those with lower education levels, using local language and simple, illustrated, culturally appropriate materials. In addition, mother-to-mother support groups can be encouraged, where older, experienced mothers can mentor younger or first-time mothers on newborn care practices. Distributing simple, illustrated pamphlets with health education messages about proper cord care at every antenatal, delivery, and post-natal contact will benefit civil servants and student mothers. For student mothers, cord care education can also be integrated into school health services and student clinics.

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