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Factors Associated with Maternal-Reported Adherence to the Recommended Six-Month Duration of Exclusive Breastfeeding in the Lwani Health Area, Bandundu Urban-Rural Zone (DRC)

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Abstract

Background: Exclusive breastfeeding (EBF) for the first six months of life is recommended to promote optimal infant health and development. However, adherence remains suboptimal in many low- and middle-income settings, including the Democratic Republic of the Congo (DRC). **Objective:** To assess maternal-reported adherence to the recommended six-month duration of EBF and examine sociodemographic, knowledge-related, and contextual factors associated with reported adherence among mothers in the Lwani Health Area, DRC. **Methods:** A facility-based cross-sectional study was conducted among 394 mothers aged 18 - 45 years attending preschool consultations with infants aged 0 - 12 months. Data were collected using a structured, pretested interview questionnaire. Descriptive statistics and bivariate analyses were followed by Firth penalized logistic regression because of sparse covariate patterns and potential instability of conventional maximum-likelihood estimates. The primary multivariable model included education, occupation, number of living children, and knowledge of the recommended EBF duration. Model diagnostics and sensitivity analyses assessed covariate overlap and estimate stability. **Results:** Of 394 mothers, 92 (23.4%) reported adherence to the recommended six-month duration of EBF and 302 (76.6%) reported non-adherence. Among

non-adherent mothers, 45.4% reported introducing other foods or liquids at 3 - 5 months and 38.7% before three months. Work or daily occupational commitments were the most frequently reported reason for non-adherence (68.9%). Only 27.2% correctly identified six months as the recommended EBF duration. No sociodemographic or knowledge-related variable was significantly associated with adherence in bivariate analysis. In the primary multivariable Firth model, mothers with 2 - 3 living children (aOR = 0.08; 95% CI: 0.02 - 0.23; $p < 0.001$) and ≥4 living children (aOR = 0.12; 95% CI: 0.03 - 0.43; $p = 0.001$) had lower adjusted odds of reported adherence than mothers with one child. The 2 - 3-child association remained robust in sensitivity analyses, whereas the ≥4 child estimate was more sensitive to simultaneous adjustment for age and marital status. **Conclusion:** Maternal-reported adherence to the recommended six-month duration of EBF was low in this facility-based sample. Work and daily occupational commitments were frequently reported barriers, although occupational category was not independently associated with adherence. Number of living children was the only factor associated with adherence in the primary adjusted model, but the ≥4 child estimate was sensitive to model specification. Because exact infant age at interview was not recorded, six-month completion could not be independently verified; findings should therefore be interpreted as maternal-reported adherence rather than objectively verified completed six-month EBF.

Keywords

Exclusive Breastfeeding, Breastfeeding Adherence, Maternal Knowledge, Occupational Constraints, Firth Logistic Regression, Democratic Republic of Congo, Cross-Sectional Study

1. Introduction

Exclusive breastfeeding (EBF) during the first six months of life is recommended by the World Health Organization (WHO) and UNICEF as the optimal feeding practice for infants. EBF means that infants receive only breast milk, with no other foods or liquids, including water, except oral rehydration solution and drops or syrups containing vitamins, minerals or medicines when indicated [1]. Breastfeeding provides nutritional and immunological benefits and is associated with important short- and long-term health benefits for children and mothers [2] [3]. WHO recommends EBF for the first six months, followed by nutritionally adequate complementary feeding while breastfeeding continues up to two years or beyond [1] [4].

In sub-Saharan Africa, EBF practices vary substantially across countries and population groups. An analysis of Demographic and Health Survey data from 25 countries estimated a pooled EBF prevalence of 49% (95% CI: 42% - 55%), with substantial between-country variation [5]. Earlier multilevel analyses similarly identified differences according to maternal education and age, household wealth,

residence, antenatal care, place of delivery, and early initiation of breastfeeding [6]. A recent systematic review and meta-analysis also emphasizes that EBF is shaped by multiple maternal, household, health-service, and contextual factors rather than a single determinant [7].

Evidence from individual African settings illustrates the importance of context. In Uganda, 62.3% of mothers with children younger than six months were practising EBF in pooled district surveys, and EBF decreased with increasing infant age [8]. In Ethiopia, a systematic review and meta-analysis found lower odds of EBF among full-time employed mothers than among mothers not in paid employment [9]. Broader African evidence suggests that workload, working conditions, limited workplace support, perceived insufficient breast milk, family influence, and inadequate support can affect mothers' ability to maintain EBF [10] [11].

In the DRC, locally generated evidence remains limited and heterogeneous. Evidence from the Dibaya health zone has documented low adherence and associations with social and contextual characteristics, including place of residence, marital status, husband's occupation, traditional rules or prohibitions, and information received about EBF [12]. Such findings underline the need for setting-specific evidence because breastfeeding practices and the constraints experienced by mothers may differ across urban, rural, and urban-rural environments.

The Lwani Health Area in the Bandundu urban-rural setting provides a relevant context in which to examine these issues. Mothers may simultaneously face childcare and household responsibilities, occupational demands, family influence, and variable access to breastfeeding support. Local evidence is limited regarding maternal-reported adherence to the recommended six-month duration of EBF, the timing of introduction of other foods or liquids, reported reasons for non-adherence, and factors associated with reported adherence.

This study therefore aimed to assess maternal-reported adherence to the recommended six-month duration of EBF and to examine its sociodemographic and knowledge-related correlates among mothers in the Lwani Health Area, Bandundu Urban-Rural Zone, DRC. The study also described the timing of introduction of other foods or liquids, mothers' reported reasons for non-adherence, and their preferred support measures.

2. Methodology

2.1. Study Design and Setting

A quantitative, descriptive, cross-sectional, and correlational study was conducted at the Lwani Reference Health Center in the Lwani Health Area, Bandundu urban-rural zone, Kwilu Province, DRC. The health center provides maternal and child health services, including pediatrics, maternity, nutrition counselling, and family planning.

Study population and sampling

The target population consisted of mothers aged 18 - 45 years residing in the Lwani Health Area who attended preschool consultations with an infant aged 0 -

12 months. Eligibility regarding infant age (0 - 12 months) was assessed at recruitment; however, the exact infant age (in months) was not recorded in the analytical dataset. Previous experience with, or an attempt to practice, EBF was not an eligibility criterion.

2.2. Eligibility and Recruitment

Mothers were eligible if they were aged 18 - 45 years, resided in the Lwani Health Area, attended the selected health facility with an infant aged 0 - 12 months, were present during data collection, had a living child relevant to the interview, voluntarily agreed to participate after receiving study information, and were able to answer the questionnaire. Mothers were excluded if they did not meet these criteria, declined participation, could not complete the interview or provide sufficient information, or attended with a child outside the defined age range.

Participants were recruited consecutively by convenience during preschool consultation sessions until the planned sample size was reached. Mothers were approached individually, informed about the study objectives, procedures, voluntary nature of participation, and confidentiality safeguards, and then enrolled after verbal informed consent. The final analytical sample comprised 394 mothers.

Data collection

Data were collected through structured, pretested interviews covering sociodemographic characteristics, breastfeeding knowledge and practices, reported reasons for non-adherence, and preferred support measures. Interviewers were trained to standardize questionnaire administration.

2.3. Outcome and Explanatory Variables

The primary outcome was maternal-reported adherence to the recommended six-month duration of EBF, coded Yes = 1 and No = 0. Because the exact age of each infant at the time of interview was not recorded in the analytical dataset, completion of six months of EBF could not be independently verified and the analysis could not be restricted to infants known to have reached six months. The outcome is therefore interpreted throughout as maternal-reported adherence to the recommended six-month duration of EBF rather than objectively verified completion of six-month EBF.

Candidate explanatory variables were maternal age group, education level, marital status, occupation, number of living children, and knowledge of the recommended EBF duration. Number of living children was categorized as 1, 2 - 3, and ≥4. Timing of introduction of other foods or liquids was analyzed descriptively and was not included as an explanatory variable because it was intrinsically linked to the definition of breastfeeding outcome. Reported reasons for non-adherence were not entered into the primary multivariable regression model because they were defined conditionally among non-adherent mothers. Preferred recommendations were also excluded from the regression because their temporal relationship with breastfeeding behaviour could not be established.

2.4. Sample Size Calculation

The sample size was determined using the standard formula for proportions based on the exclusive breastfeeding prevalence reported by the Kwilu Provincial Health Division (63%):

$$n = Z^2\, p(1-p) \big/ d^2$$

where:

- $P = 0.63$
- $Z = 1.96$ for a 95% confidence level
- $d = 0.05$

The minimum estimated sample size was 358 participants. After allowing 10% for potential non-response, the final planned sample size was 394 mothers.

2.5. Statistical Analysis

Statistical analyses were performed using R statistical software (version 4.6.1). The dataset was examined for completeness, coding consistency, sparse cells, and cross-classification of categorical variables. Frequencies and percentages were used for descriptive analysis. Pearson chi-square tests described bivariate associations between categorical characteristics and reported adherence. Firth penalized logistic regression was performed in R using the logistf package. Each candidate explanatory variable was also evaluated using univariable Firth penalized logistic regression to estimate crude odds ratios (ORs), profile penalized-likelihood 95% confidence intervals (CI), and two-sided p-values.

Before multivariable modelling, cross-classifications and pairwise Cramér's V were examined to assess structural overlap among categorical predictors. Strong associations were observed between number of living children and marital status (V = 0.775), education (V = 0.735), age group (V = 0.678), and occupation (V = 0.586). Simultaneous inclusion of highly overlapping categorical variables increased sparse covariate patterns and estimate instability. Age group and marital status were therefore not retained in the primary multivariable model; this decision was based on model structure and stability rather than on univariable statistical significance.

The primary multivariable model included education level, occupation, number of living children, and knowledge of the recommended EBF duration. Firth penalized logistic regression was used because sparse categories and covariate patterns could bias or destabilize conventional maximum-likelihood estimates. Adjusted generalized variance inflation factors [$\text{GVIF}^{(1/(2\times \text{df}))}$] ranged from approximately 1.32 to 1.67 for variables retained in the primary model, providing no evidence of severe multicollinearity within that model. The no-formal-education category was sparse (n = 6), and estimates using this reference category were interpreted cautiously.

Reference categories were no formal education for education level, unemployed for occupation, one living child for number of living children, and less than three

months for knowledge of EBF duration. Sequential models were fitted to examine the marked changes between crude and adjusted estimates for number of living children. Sensitivity analyses added age group and marital status separately and jointly to the primary model. Statistical significance was defined as $p<0.05$, while interpretation also considered effect size, confidence-interval precision, model stability, and consistency across sensitivity analyses.

3. Ethical Considerations

This study was conducted as a preliminary undergraduate research project under authorization from the academic authorities of the Institut Supérieur de Sciences de Santé de la Croix-Rouge de Bandundu and with permission from the heads of the participating health facilities. These administrative authorizations were not equivalent to formal research ethics committee approval, and no formal review or approval was obtained from an institutional or national research ethics committee. Before participation, mothers were informed about the study objectives and procedures, voluntary participation, confidentiality, and their right to decline or withdraw without consequences. Verbal informed consent was obtained from all participants.

4. Results

4.1. Descriptive Analysis

Participant characteristics and breastfeeding-related findings

A total of 394 mothers were included. Nearly half were aged 20 - 29 years (47.5%), 33.2% were aged 30 - 39 years, 17.8% were younger than 20 years, and 1.5% were aged 40 years or older. Half had secondary education (50.0%), 33.2% higher/university education, 15.2% primary education, and 1.5% no formal education. Most were married (53.3%). Civil servants represented 48.2%, farmers 25.1%, unemployed mothers 19.0%, and traders 7.6%. Half had 2 - 3 living children (50.0%), 27.2% had ≥4, and 22.8% had one child (Table 1).

Table 1. Sociodemographic characteristics of mothers included in the study (n = 394).

Characteristic	Category	n	%
Age group	<20 years	70	17.8
	20 - 29 years	187	47.5
	30 - 39 years	131	33.2
	≥40 years	6	1.5
Education	None	6	1.5
	Primary	60	15.2
	Secondary	197	50.0
	Higher/University	131	33.2

Continued

Marital status	Married	210	53.3
	Single	100	25.4
	Divorced/Separated	78	19.8
	Widowed	6	1.5
Occupation	Unemployed	75	19.0
	Farmer	99	25.1
	Trader	30	7.6
	Civil servant	190	48.2
Living children	1	90	22.8
	2 - 3	197	50.0
	≥4	107	27.2

Only 107 mothers (27.2%) correctly identified six months as the recommended EBF duration. Ninety-two mothers (23.4%) reported adherence to the recommended six-month duration, while 302 (76.6%) reported non-adherence. Among the 302 non-adherent mothers, 137 (45.4%) reported introducing other foods or liquids at 3 - 5 months and 117 (38.7%) before three months. Work or daily occupational commitments were the most frequently reported reason for non-adherence (208/302; 68.9%), followed by family influence (13.6%), perceived insufficient breast milk (11.3%), and maternal illness (6.3%). Support for working mothers was the most frequently preferred support measure (54.6%) as presented in Table 2.

Table 2. Breastfeeding knowledge, adherence, reasons for non-adherence, and preferred support measures among mothers (n = 394).

Indicator	Category	n	%
Knowledge of recommended EBF duration	<3 months	99	25.1
	3 - 5 months	87	22.1
	6 months	107	27.2
	>6 months	101	25.6
Reported adherence	Yes	92	23.4
	No	302	76.6
Timing among non-adherent mothers (n = 302)	Before 3 months	117	38.7
	3 - 5 months	137	45.4
	After 5 months	48	15.9

Continued

Reason among non-adherent mothers (n = 302)	Insufficient breast milk	34	11.3
	Family influence	41	13.6
	Work or daily occupation	208	68.9
	Maternal illness	19	6.3
Preferred support measure to Improve Adherence to EBF	Strengthen professional counselling	123	31.2
	Educate family members	56	14.2
	Support working mothers	215	54.6

4.2. Bivariate and Multivariate Analysis

4.2.1. Bivariate Associations

No statistically significant bivariate association was observed between reported EBF adherence and maternal age ($\chi^2 = 0.577$; df = 3; p = 0.902), education level ($\chi^2 = 4.41$; df = 3; p = 0.220), marital status ($\chi^2 = 0.389$; df = 3; p = 0.942), occupation ($\chi^2 = 1.62$; df = 3; p = 0.655), number of living children ($\chi^2 = 2.85$; df = 2; p = 0.240), or knowledge of the recommended EBF duration ($\chi^2 = 0.838$; df = 3; p = 0.840). Preferred support measures were associated with reported adherence ($\chi^2 = 10.69$; df = 2; p = 0.0048); because these preferences were measured cross-sectionally and their temporality is uncertain, this association was not interpreted as evidence of intervention effectiveness (see Table 3).

Table 3. Bivariate associations between maternal characteristics, breastfeeding-related factors, and reported adherence to exclusive breastfeeding.

Factor	Category	Adherence n (%)	Non-adherence n (%)	χ^2	df	p
Age group	<20	15 (21.4)	55 (78.6)	0.577	3	0.902
	20 - 29	43 (23.0)	144 (77.0)			
	30 - 39	32 (24.4)	99 (75.6)			
	≥40	2 (33.3)	4 (66.7)			
Education	None	2 (33.3)	4 (66.7)	4.41	3	0.220
	Primary	8 (13.3)	52 (86.7)			
	Secondary	51 (25.9)	146 (74.1)			
	Higher/University	31 (23.7)	100 (76.3)			
Marital status	Married	48 (22.9)	162 (77.1)	0.389	3	0.942
	Single	24 (24.0)	76 (76.0)			
	Divorced/Separated	18 (23.1)	60 (76.9)			
	Widowed	2 (33.3)	4 (66.7)			

Continued

Occupation	Unemployed	16 (21.3)	59 (78.7)	1.62	3	0.655
	Farmer	22 (22.2)	77 (77.8)			
	Trader	5 (16.7)	25 (83.3)			
	Civil servant	49 (25.8)	141 (74.2)			
Living children	1	25 (27.8)	65 (72.2)	2.85	2	0.240
	2 - 3	39 (19.8)	158 (80.2)			
	≥4	28 (26.2)	79 (73.8)			
Knowledge	<3 months	23 (23.2)	76 (76.8)	0.838	3	0.840
	3 - 5 months	18 (20.7)	69 (79.3)			
	6 months	28 (26.2)	79 (73.8)			
	>6 months	23 (22.8)	78 (77.2)			
Preferred support measure to Improve Adherence to EBF	Strengthen professional counselling	21 (17.1)	102 (82.9)	10.69	2	**0.0048**
	Educate family members	22 (39.3)	34 (60.7)			
	Support working mothers	49 (22.8)	166 (77.2)			

4.2.2. Firth Penalized Logistic Regression

In univariable Firth models, none of the age-group, marital status, education, occupation, number-of-children, or knowledge categories was statistically associated with maternal-reported adherence. In the primary multivariable model, number of living children was the only predictor with statistically significant category-specific associations. Compared with mothers with one living child, those with 2 - 3 children had lower adjusted odds of reported adherence (aOR = 0.08; 95% CI: 0.02 - 0.23; $p < 0.001$), and those with ≥4 children also had lower adjusted odds (aOR = 0.12; 95% CI: 0.03 - 0.43; $p = 0.001$). Education, occupation, and knowledge were not statistically significant after adjustment. Civil servants had higher adjusted odds than unemployed mothers, but the estimate was imprecise and did not meet the predefined significance threshold (aOR = 4.59; 95% CI: 0.996 - 22.82; $p = 0.051$) as presented in Table 4.

Table 4. Crude and adjusted associations between maternal characteristics and reported adherence to exclusive breastfeeding using Firth penalized logistic regression.

Variable	Crude OR	95% CI	p	aOR	95% CI	p
Education:						
None	1.00	Ref.	—	1.00	Ref.	—
Primary	0.29	0.05 - 1.88	0.179	0.21	0.03 - 1.48	0.110
Secondary	0.63	0.14 - 3.72	0.579	2.15	0.37 - 15.16	0.395
Higher/University	0.56	0.12 - 3.36	0.495	1.28	0.18 - 10.46	0.808

Continued

Occupation:						
Unemployed	1.00	Ref.	—	1.00	Ref.	—
Civil servant	1.26	0.68 - 2.43	0.468	4.59	0.996 - 22.82	0.051
Farmer	1.05	0.51 - 2.17	0.901	2.41	0.89 - 7.19	0.085
Trader	0.78	0.25 - 2.17	0.641	2.23	0.47 - 10.43	0.309
Living children:						
1	1.00	Ref.	—	1.00	Ref.	—
2 - 3	0.64	0.36 - 1.15	0.132	0.08	0.02 - 0.23	<0.001
≥4	0.92	0.49 - 1.73	0.796	0.12	0.03 - 0.43	0.001
Knowledge:						
<3 months	1.00	Ref.	—	1.00	Ref.	—
3 - 5 months	0.87	0.43 - 1.72	0.684	1.10	0.46 - 2.64	0.830
6 months	1.17	0.62 - 2.20	0.630	1.00	0.33 - 3.10	0.997
>6 months	0.97	0.51 - 1.88	0.938	0.82	0.24 - 2.84	0.755
Age group						
<20 years	1.00	Ref.	—	—	—	—
20 - 29 years	1.08	0.57 - 2.13	0.822	—	—	—
30 - 39 years	1.17	0.59 - 2.37	0.654	—	—	—
≥40 years	1.99	0.32 - 9.95	0.427	—	—	—
Marital status				—	—	—
Married	1.00	Ref.	—	—	—	—
Single	1.07	0.61 - 1.86	0.804	—	—	—
Divorced/Separated	1.02	0.55 - 1.87	0.938	—	—	—
Widowed	1.86	0.32 - 8.68	0.455	—	—	—

OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; Ref., reference category. Crude ORs were estimated using univariable Firth penalized logistic regression (Table 4). The primary multivariable Firth model included education level, occupation, number of living children and knowledge of the recommended EBF duration. Age group and marital status were evaluated in univariable analyses but were not included in the primary multivariable model because of substantial structural overlap with number of living children and other sociodemographic characteristics; both variables were subsequently evaluated in sensitivity analyses.

4.2.3. Model Diagnostics and Sensitivity Analyses

Sequential models indicated that the large change between crude and adjusted estimates for number of living children was reproducible rather than a coding error. For mothers with 2 - 3 children, the OR changed from 0.64 in the univariable model to 0.17 after adjustment for education, to 0.08 after further adjustment for

occupation, and remained approximately 0.08 after addition of knowledge. For mothers with ≥4 children, the corresponding estimates were 0.92, 0.29, 0.12, and 0.12. Thus, the shift arose mainly after adjustment for education and occupation.

Sensitivity analyses supported the stability of the association for 2 - 3 children: the adjusted OR remained between approximately 0.09 and 0.11 and statistically significant when age group and/or marital status were added. The estimate for ≥4 children was less stable; it remained significant when age or marital status was added separately but was attenuated and no longer statistically significant when both were included simultaneously (aOR = 0.23; p = 0.082). These results support cautious interpretation of the ≥4 child association (see Table 5).

Table 5. Sensitivity analysis of the association between number of living children and maternal-reported adherence to the recommended six-month duration of exclusive breastfeeding.

Model specification	2 - 3 children aOR	95% CI	p	≥4 children aOR	95% CI	p
Primary model	0.077	0.022 - 0.234	<0.001	0.118	0.029 - 0.432	0.001
Primary + age group	0.104	0.028 - 0.354	<0.001	0.202	0.049 - 0.782	0.020
Primary + marital status	0.086	0.024 - 0.269	<0.001	0.108	0.022 - 0.465	0.003
Primary + age group + marital status	0.105	0.028 - 0.355	<0.001	0.226	0.040 - 1.209	0.082

Reference category: one living child.

Primary model: adjusted for education level, occupation, and knowledge of the recommended duration of EBF.

CI: profile penalized-likelihood 95% confidence interval;

aOR: adjusted odds ratio.

5. Discussion

This study provides facility-based evidence on maternal-reported adherence to the recommended six-month duration of EBF in the Lwani Health Area. Four findings are particularly important. First, only 23.4% of mothers reported adherence, while 76.6% reported non-adherence. Second, among non-adherent mothers, early introduction of other foods or liquids was common, with most reporting introduction before six months. Third, work or daily occupational commitments were the dominant reported reason for non-adherence, yet occupational category itself was not independently associated with adherence. Fourth, number of living children was the only factor associated with reported adherence in the primary multivariable model, although sensitivity analyses showed that the estimate for mothers with ≥4 children was less stable than that for mothers with 2 - 3 children.

The 23.4% level of maternal-reported adherence indicates an important gap between the six-month recommendation and reported practice in this sample. However, direct comparison with prevalence estimates from population-based surveys requires caution. For example, pooled DHS analyses across sub-Saharan Africa and district-level data from Uganda assessed EBF among infants younger than six

months using age-specific or recent-feeding measures [5] [8], whereas the present study asked mothers of infants aged 0 - 12 months about adherence to the recommended six-month duration. Because exact infant age at interview was not recorded, our measure cannot be interpreted as an age-standardized or objectively verified prevalence of completed six-month EBF. This methodological distinction is central to interpretation and may partly explain differences between our estimate and those reported elsewhere.

Knowledge of the recommended EBF duration was limited: only 27.2% of mothers identified six months correctly. Nevertheless, knowledge was not associated with reported adherence in either bivariate or adjusted analyses. This finding suggests that knowledge alone may not adequately capture mothers' ability to maintain EBF when practical and social constraints are present. Qualitative evidence from sub-Saharan Africa has similarly emphasized that breastfeeding behaviour reflects interacting influences such as workload, perceived milk insufficiency, family expectations, and the availability of practical support [11]. The result should not be interpreted as evidence that counselling is unimportant; rather, it indicates that information provision may need to be accompanied by support that addresses mothers' day-to-day constraints.

Work or daily occupational commitments were reported by 68.9% of non-adherent mothers, making them the most common stated barrier. This finding is consistent with African evidence linking employment, workload, and limited workplace support with difficulties maintaining EBF [9] [10]. At the same time, occupation as a categorical variable was not independently associated with adherence in the adjusted model. These observations are not necessarily contradictory. The reported reason captures mothers' perceived practical constraints among the non-adherent subgroup, whereas occupational category is a broad sociodemographic classification measured across all participants. A label such as civil servant, farmer, trader, or unemployed does not directly measure working hours, commuting time, maternity leave, informal economic activity, domestic workload, proximity to the infant, or opportunities to breastfeed or express milk. Future studies should therefore measure these dimensions directly rather than use occupational category as a proxy for actual workload.

The most notable adjusted association involved number of living children. Compared with mothers with one child, mothers with 2 - 3 children and those with ≥4 children had substantially lower adjusted odds of reported adherence in the primary model. One possible explanation is that mothers caring for several children may face greater competing childcare and household demands; however, these mechanisms were not directly measured and should be considered hypotheses rather than demonstrated pathways. The pronounced difference between crude and adjusted estimates also requires careful interpretation. Sequential modelling showed that the shift emerged mainly after adjustment for education and occupation, suggesting substantial covariate-dependent change in the estimated association, potentially reflecting confounding and/or suppression within the

multivariable model.

The sensitivity analyses add an important qualification. The inverse association for 2 - 3 children remained statistically significant after adding age group and marital status separately and jointly, supporting relative robustness across the examined model specifications. In contrast, the ≥4-child association weakened when age group and marital status were included simultaneously and no longer met the conventional 5% significance threshold. This instability is plausible given the strong structural overlap between number of children, age, marital status, education, and occupation. Accordingly, the primary-model estimate for ≥4 children should be regarded as less certain, and neither category should be interpreted causally.

The absence of statistically significant adjusted associations for education and knowledge differs from studies in which maternal education or information exposure predicted EBF [5]-[7] [12]. Contextual differences, measurement approaches, sample composition, and sparse categories may contribute to this discrepancy. In particular, only six mothers in this study had no formal education, producing wide confidence intervals when that category was used as the reference. Similarly, the adjusted occupational estimates were imprecise; the estimate for civil servants approached but did not reach statistical significance and had a very wide confidence interval. These findings reinforce the importance of interpreting effect sizes together with their precision rather than relying on p-values alone.

Participants' preferred support measures were associated with reported adherence in cross-tabulation, but this finding should not be interpreted as evidence that any proposed intervention improves EBF. Preferences may reflect mothers' prior experiences, barriers, or breastfeeding outcomes and were measured at the same time as the outcome. Nevertheless, the high frequency of support for working mothers as a preferred option is consistent with the prominence of work and daily commitments among reported barriers. In program planning, such preferences may be useful for identifying acceptable areas for further assessment, but intervention effectiveness requires prospective or experimental evaluation.

6. Strengths and Limitations

A strength of this study is the re-examination of the individual-level dataset using penalized logistic regression, explicit assessment of sparse covariate patterns and structural overlap, and sensitivity analyses addressing model specification. The study also distinguishes descriptive barriers reported by non-adherent mothers from covariates evaluated as potential correlates of adherence.

Several limitations remain. First, the exact age of the infant at interview was not recorded; consequently, completion of six months of EBF could not be independently verified and the analysis could not be restricted to infants known to have reached six months. The outcome must therefore be interpreted as maternal-reported adherence to the recommended six-month duration. Second, breastfeeding practices and reasons for non-adherence were self-reported and may be af-

fected by recall and social-desirability bias. Third, participants were recruited through non-probability convenience sampling during preschool consultations at one health facility, which limits generalizability beyond mothers attending that facility. Fourth, the cross-sectional design does not establish temporal or causal relationships. Fifth, some categories were sparse, particularly the no-formal-education group, resulting in imprecise estimates and wide confidence intervals. Sixth, substantial structural overlap existed among several sociodemographic and reproductive characteristics, and the ≥4-child estimate was sensitive to model specification. Finally, residual confounding by unmeasured factors including actual workload, maternity leave, breastfeeding self-efficacy, family support, breastfeeding difficulties, and infant characteristics cannot be excluded.

7. Conclusions

Maternal-reported adherence to the recommended six-month duration of EBF was low in this facility-based sample in the Lwani Health Area. Work or daily occupational commitments were the most frequently reported reason for non-adherence, but occupational category was not independently associated with adherence. Knowledge of the recommended duration was also limited but was not independently associated with reported adherence.

Number of living children was the only factor associated with reported adherence in the primary Firth model. The association for 2 - 3 children was robust across the examined sensitivity analyses, whereas the estimate for ≥4 children was more sensitive to simultaneous adjustment for age and marital status. These findings identify potentially important household and practical dimensions for further investigation but do not establish causal effects.

Because exact infant age at interview was not recorded, the 23.4% estimate should be understood as maternal-reported adherence rather than an objectively verified prevalence of completed six-month EBF. Future studies should use age-specific breastfeeding indicators, record exact infant age, measure workload and workplace conditions directly, and use prospective designs where feasible.

8. Recommendations

The following options may be considered in light of the reported barriers and participant preferences; they should not be interpreted as interventions whose effectiveness was demonstrated by this cross-sectional study.

Health services may consider combining EBF counselling with practical problem-solving that addresses perceived insufficient milk, family influence, maternal illness, work demands, and competing childcare responsibilities.

Breastfeeding-support programmes may consider involving partners and other influential family members when appropriate, particularly where household expectations influence feeding decisions.

Employers and health authorities may consider context-appropriate measures that facilitate breastfeeding or milk expression, such as feasible breaks, supportive

supervision, and maternity-protection arrangements, while recognizing that the present study did not evaluate the effectiveness of these measures.

Programs may consider the practical needs of mothers with multiple children; however, the observed association between the number of living children and EBF adherence should not be interpreted as evidence that family size causes non-adherence.

Future research should record exact infant age, use standardized age-specific EBF indicators, collect detailed measures of working hours, maternity leave, commuting, informal work, childcare and household workload, and examine the observed number of children association in larger prospective studies.

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Ethics Approval and Consent to Participate

This study was conducted as a preliminary undergraduate research project at the Institut Supérieur de Sciences de Santé de la Croix-Rouge de Bandundu. The study was authorized by the academic authorities of the institution and by the heads of the participating health facilities. No formal review or approval was obtained from an institutional or national research ethics committee for this preliminary study. Before participation, all mothers were informed about the objectives and procedures of the study, participation was voluntary, and verbal informed consent was obtained. Participants were informed that their responses would be treated confidentially and that they could decline participation or withdraw from the interview at any time without consequences.

Availability of Data and Material

The dataset generated and/or analysed during the current study is not publicly available because this study is a preliminary investigation that is intended to inform further research in additional health areas of Bandundu and other areas of Kwilu Province in DRC. The data are currently subject to restricted access. However, the dataset may be made available from the corresponding author upon reasonable request, subject to institutional considerations and applicable requirements for the protection of participants.

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Author Contributions

Merry Bassema (MB), Zébédée Biba (ZB), José Ezonga (JE), Eric Bokabo (EB),

Tonton Paul Vita (PV), and Serge Mazamay (SM) contributed to the study design, data collection, analysis and interpretation, and manuscript preparation.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Abbreviations

EBF: Exclusive Breastfeeding
DRC: Democratic Republic of the Congo
UNICEF: United Nations Children's Fund
WHO: World Health Organization
OR: Odds Ratio
aOR: Adjusted Odds Ratio
CI: Confidence Interval
GVIF: Generalized Variance Inflation Factor