Modelling time-to-discontinuation of exclusive breastfeeding: analysis of infants and under-2 survival in Nigeria

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Abstract

Background: Regardless of national and international strategies towards promoting exclusive breastfeeding, only 17% and 35% of infants were exclusively breastfed in 2015 in Nigeria and Worldwide respectively. Therefore, we aim to estimate average length of exclusive breastfeeding for infants and under-2, evaluate and predict maternal impact.

Data Source and Methods: This retrospective cross-sectional study applied NARHS data collected via multistage-cluster random sampling. Count and proportion quantified maternal characteristics, Kaplan-Meier method estimated length of exclusive breastfeeding whereas Cox Proportional Hazard model and Wald-test determine and evaluate maternal effect.

Results: Median duration of exclusive breastfeeding was 6.0 months. Locality {$P < 0.05$ (0.73 – 0.98)} and place-of-delivery {$P < 0.01$ (1.06 – 1.19)} were the determinant factors. Cox Proportional Hazard model fit the data and Wald-test identified main predictors.

Conclusions: Average time at which exclusive breastfeeding was discontinued was six months, mothers' locality and delivery-place of infants influence exclusive breastfeeding duration in Nigeria. Hence, exclusive breastfeeding interventions should target those factors.

Keywords: Infants, Maternal, Exclusive Breastfeeding, Kaplan-Meier, Cox Proportional Hazard, Wald Test, NARHS.

Introduction

Time at which mothers initiate breastfeeding, discontinue exclusive breastfeeding (EBF) and start supplementary feeding are underlining determinant of infant/child survival. Though, EBF is the most challenging of all the three breastfeeding stages due to the fact that it involves feeding infant with breastmilk only in the first six months of life and without supplement of any type (i.e. water, other liquids, semi-solid or solid food) except for vitamins minerals and medications (Gartner et al., 2005). WHO and UNICEF (2009) however recommends breastfeeding initiation in the first hour of life, exclusive breastfeeding for the first six months of life and nutritional adequate supplementary feeding while breastfeeding continues up to 2 years to help reduce infant morbidity and mortality. However, early discontinuation of exclusive breastfeeding remain a major setback to proper growth and development of infants in Nigeria since prevalence of Infant and Young Child Feeding (IYCF) based on EBF practice decreased from 17% in 2003 to 13% in 2008 and increased by only 4% to 17% in 2013. Whereas, discontinuation time of EBF and Predominant feeding are less than 1 month and 4.4 months respectively (NPC, 2008; NPC 2013).

Literature review and theoretical framework

Even though less than 35% of infants and under-2 children are exclusively breastfed worldwide (WHO, 2010). studies has however opined on benefit of EBF Practice to infants – as a source of immunity against early life infections like diarrhoea and pneumonia and as a major support to growth, health and survival of infants (Ip et al., 2007; WHO, 2009). Also, practicing EBF for infant helps mothers in reducing the risk of postmenopausal, breast and ovarian cancer (Kramer et al., 2001; Elizabeth et al., 2011). Mapoma and Banda (2019) recent study in Zambia concluded that 0 – 6 months period of breastfeeding that coincide with EBF is the most effective period relative to reduce risk of fever, diarrhoea and acute respiratory infections in infants and young children. Black et al. (2013) also corroborated that suboptimal breastfeeding including EBF in low and middle income countries can increase risk of morbidity and mortality in children in the first 2 years of life. Duration of EBF measured from the time at which

mothers initiate EBF to the time at which supplementary feeding was introduced varies for infants and under-2. This EBF discontinuation time have been reported to be affected by multiple factors and dependent on Population studied (Lawal and Ajao, 2016). Thus,nursing mothers are faced with multiple challenges as they strive to practice exclusive breastfeeding for their infants; since health, economic, socio-cultural, and family and other factors are influential in a woman's decision to breastfeed. Berhe et al. (2013) affirm that several ranges of factors, among which are; place and mode of delivery and antenatal visit are determinant of timely initiation and practice of exclusive breastfeeding in Northern Ethiopia.

Based on population studied, mothers level of education, occupation, age, marital status, family income and parity are identified factors affecting EBF practice in Nigeria (Onayade et al., 2004; Nwosu et al., 2004; Ukegbu et al., 2011). Ajibade et al. (2013) disclosed that cultural factors is associated with the early discontinuation of exclusive breastfeeding in rural communities of Osun state. WHO (2008) study reported that decisions regarding initiation and duration of breastfeeding in low/middle income countries are influenced by mothers' education, employment, place of delivery, family pressure, and cultural values. Which is in accordance with the findings of (Tempah-Nah and Kumi-Kyerme, 2013) that also reported region and place of delivery as determinant of EBF duration among Mothers in Ghana.

Several Nigerian studies (Agunbiade and Ogundele, 2013; Umar and Oche, 2013) utilized descriptive analysis to measure prevalence of EBF practice by reporting the percentage of nursing mothers at stoppage time between 0 and 6 months. Lawal and Ajao (2016) study in Benue state however applied the nonparametric Log rank and Wilcoxon test in two separate group to compare mothers educational level and partners influence. This study however aim to apply the Kaplan Meier and Cox Proportional Hazard model technique in survival analysis that will allow us to obtain joint estimate and hazard ratio of multiple variables influencing early EBF discontinuation, control for confounders and avoid temporal bias in order to evaluate average time to discontinuation of EBF for infant and under-2, determine its predictors and as well provide a model that will predict maternal factors influencing early EBF stoppage in Nigeria.

Conceptual framework

Fig 1 is the study framework concept drawn out of the length of EBF structure (being a continuous scale outcome variable) – measured by time at which supplement was first introduced since EBF was initiated, was grouped by the expected average and recommended 6 months period (<6 months, 6months and >6 months). EBF period which could be censored is expected to be between 0 and less than 24 months for all infants and under 2 children that make up the study population as a pair with their mother. Maternal characteristics divided by; reproductive and maternal health and social economic and demographic status are explanatory variables that determine the study outcome (EBF duration) and study extractions (Censoring) was controlled for ill-health mothers/infants or both and inconclusive EBF duration due to death of mother/infant or both. Thus, whether mother was censored or not, this operating characteristics are influential to infant/under-2 survival.

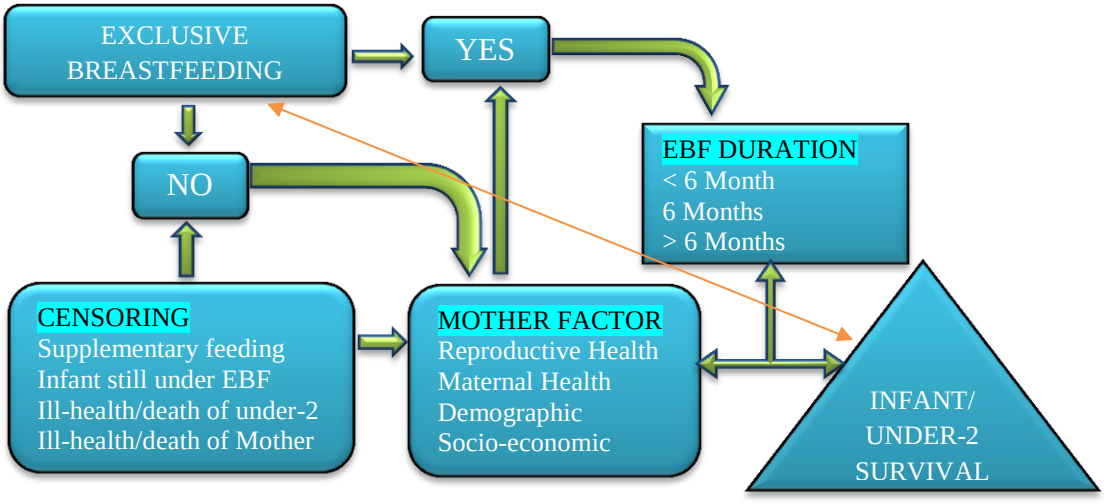

Figure 1: Conceptual Framework of Infant/Under-2 Exclusive Breastfeeding.

Data and methods

Data/sampling

This study uses data collected by National Aid and Reproductive Health Survey (NARHS) on Mothers breastfeeding history in Nigeria - using multistage cluster random sampling technique, to select eligible individuals from the updated National Population Commission (NPC) master sampling frame for rural and urban localities. This make up the enumeration areas that define the primary sampling units (PSU) called cluster. A total of 15,639 females respondent between the ages of 15 – 49 years with mean age of 29.2 (SD=9.5) were interviewed but only complete response from 2,163 females respondent nursing under two children constitutes sample size used for the data analysis. The survey captured several variables, among which for the purpose of the study are exclusive breastfeeding duration measured by infant/under-2 age at introduction of supplementary feeding, socio-economic/demographic and reproductive and maternal health characteristics.

Data management and analysis

Data management began with data cleaning of the outcome variable (EBF Time measured from time of breastfeeding initiation to time of supplement introduction) and coding and recoding of explanatory variables to extract data summary and detect missing data/outliers and as well maintain the sample size for all study variables. Descriptive tool reporting; frequencies and percentages were used to summarize mother socio-demographic and maternal health factors presented in tables. Using Kaplan-Meier method, average discontinuation time of EBF was obtained from the plotted survival curve that shows the median survival time is 50th percentile (the point at which survivorship is 0.5) of infants or under-2 EBF age.

Multivariate analysis was carried out using the Cox Proportional Hazards model to evaluate EBF discontinuation time model and determine factors that influence early discontinuation of EBF among the set of maternal characteristics (explanatory variables). This model analysis was considered to show significant effect when p-value is less than α level of significance (set as 0.05). The effect was measured through the risk/hazard ratio obtained from exponential of the Cox regression co-efficient. The survival model fitness and adequacy was assessed through the chi-square goodness of fit test and Wald test respectively.

Analysis of censoring in EBF time duration

Censoring which is backward (event has occurred before study – retrospective) in this study refers to the situation where breastfeeding mother (subject) under observation in the study was no longer followed up while event of interest has not occurred during the observed follow up period. Event of interest been time at which supplementary feeding was introduced. EBF time is censored if; infant still under EBF, EBF time is inconclusive due to ill-health or death of Mother or infant or both, Mother did not practice EBF for infant/under-2. Thus, outcome indicators or event indicators takes value 0 or 1, such that:

EBF time event '$\mathbf{E_i}$' =

$$\begin{cases} \mathbf{0}, \boldsymbol{if\ the\ EBF\ time\ event\ was\ censored} \\ \mathbf{1}, \boldsymbol{if\ EBF\ time\ event\ was\ observed} \end{cases}$$

The EBF survival and hazard time function

EBF Survivor function denoted as S(t) measures the probability of exclusively breastfeeding beyond time't'. It is the ratio of nursing mothers experiencing event of interest (discontinuing EBF) to the total number of nursing mothers in the study. S(t) is a non-increasing function with a value 1 at the time origin and value 0 as time 't' approaches infinity. It is express as:

$$S(t) = P(T>t) = \int_t^{\infty} f(u)du = 1 - F(t) \quad \ldots\ldots (1)$$

Thus, EBF hazard function denoted as $\lambda(t)$ measures the instantaneous failure rate (discontinuation of EBF) at time 't' conditional on survival up to time 't'. It is express as:

$$\lambda(t) = \frac{p(t \le T < t+\partial t)}{P(T \le t)} = \frac{f(t)}{S(t)} \quad \ldots\ldots (2)$$

Kaplan-Meier approach of estimating EBF survival time

Kaplan Meier method of estimating S(t) is known as the product-limit method. It is the first step in analysing ungrouped censored survival data. The Kaplan-Meier method was developed for applications where survival time is measured on a continuous scale (only those intervals containing EBF discontinuation time contributed to the estimate), so we can ignore all other intervals. Thus, Kaplan-Meier estimate of S(t) is express as:

$$s(t) = \prod_{j=1}^{k} \frac{(n_j - d_j)}{n_j} \ldots\ldots\ldots (3)$$

Where; nj is the number of nursing mothers to be observed at time tj and dj is the number of nursing mothers discontinuing EBF at time tj.

Fitting EBF-Cox proportional hazard model

The Cox proportional hazards model named after its inventor Sir David Cox in 1972 is a model that does not make any assumption about the shape of the underlying hazards, but makes the assumption that the hazards for subject (nursing mothers) subgroups are proportional over follow-up time. Hence, the

quantitative impact of these predictors on EBF discontinuation time outcome (EBF survival time) can be assessed. Thus, the Cox model for the EBF discontinuation time can be express as:

$\lambda(t|X) = \lambda 0(t)\exp(X1\beta 1 + X2\beta 2 + - - - + X11\beta 11)$…(4)

Where: $\boldsymbol{\lambda(t|X)}$ is the hazard of discontinuing EBF at time t, $\boldsymbol{\lambda 0(t)}$ represents a reference point that depends on time which is the baseline hazard, **β's** are the regression coefficients and $\boldsymbol{Xi,\ i = 1, 2, \ldots, 11}$ are the set of explanatory variables.

EBF-Cox proportional hazard ratio

It is not realistic for a breastfeeding mother not to have all the attribute, such that all values of the explanatory variables is zero, so $\boldsymbol{\lambda 0(t)}$ represents a reference point that depends on EBF survival time which is the baseline hazard, just as β_0 denotes an arbitrary reference point in other types of regression models. Hazard Ratio >1 indicate maternal effect harmful to infant survival, Hazard Ratio<1 indicate maternal effect benefits infant survival and Hazard Ratio = 1 indicate no maternal risk on infant/under-2 survival based on exclusive breastfeeding. Hence, the hazard/risk ratio is estimated as:

$\lambda(t|X) = \exp(\beta 1 + \beta 2 + - - - + \beta 11)$ ….. (5)

EBF-Model adequacy and wald-test

This study uses chi-square goodness of fit test to judge EBF-Cox proportional hazard model fitness and Wald test to examine the adequacy of relationship between discontinuation time of EBF and explanatory variables included in the model. The hypothesis is set as:

$H_0: \beta_j (j = 1, 2, - - -, 11) = 0$ vs $H_1: \beta_j (j = 1, 2, - - -, 11) \neq 0$ in the presence of other terms.

The test statistic; $t = \beta / S.e(\beta)$ ….. (6)

The square of the test statistics (t) is asymptotically distributed as chi-square with one degree of freedom (Wald test). i.e. $t^2 \sim \chi^2_1$d.f.

Where: β is the cox regression model co-efficient and s.e(β) is the standard error of the cox regression model co-efficient. The rejection of null hypothesis for any β_j (j = 1, 2, ---, 11) will lead to significant need of its corresponding predictor in the presence of others.

Analysis and results

Description of mothers characteristic

Table 1 and 2 shows frequencies and percentages of nursing mothers' socio-economic and demographic and reproductive and maternal health characteristics that predispose the practice of exclusive breastfeeding. Most (34.5%) of nursing mothers are between ages of 20 to 29 years while few (18.3%) are between 15 to 19 years. Nursing mothers reside more (68.7%) in the rural areas than the urban (31.3%) and only 12.2% (265) of them have tertiary education. As low as 7.1% (153) of them are employed and as high as 64.4% (1392) are married. Most (78.8%) antenatal care visit are more than 4 while few are less than 4(21.2%) but only 37.7% (816) attended postnatal care. 34.8% (753) and 34.4% (745) of delivery are in a government hospital and at home respectively. Whereas, only 39.2% (848) of nursing mothers initiate breastfeeding early.

Table 1: Percentage Distribution of Mothers by Socio-Economic and Demographic Characteristics

Socio-Economic and Demographic Factors	Frequency *(n)*	Percentages (%)
Age group (years)		
15 – 19	396	18.3
20 – 29	745	34.5
30 – 39	589	27.2
40 – 49	433	20.0
Total	2163	100.0
Zone		
North central	416	19.2
North east	337	15.6
North west	426	19.7
South east	297	13.7
South south	342	15.8
South west	345	16.0
Total	2163	100.0
Locality		
Rural	1485	68.7

Urban	678	31.3
Total	2163	100.0
Education		
No formal education	689	31.9
Primary	365	16.9
Secondary	844	39.0
Tertiary	265	12.2
Total	2163	100.0
Occupation		
Unemployed	964	44.6
Self employed	1046	48.4
Employed	153	7.1
Total	2163	100.0
Marital status		
Never married	684	31.6
Married	1392	64.4
Divorce/Widow	87	4.0
Total	2163	100.0
Social economic class		
Poorest	484	22.4
Poorer	461	21.3
Average	442	20.4
Richer	409	18.9
Richest	367	17.0
Total	2163	100.0

Table 2: Percentage Distribution of Mothers by Reproductive and Maternal Health Characteristics

Reproductive and Maternal Health Factors	Frequency *(n)*	Percentages (%)
Antenatal care visit		
Less than 4	459	21.2
4 or more	1704	78.8
Total	2163	100.0
Place of delivery		
Home	745	34.4
Government hospital	753	34.8
Private centre	524	24.2
Faith based	141	6.5
Total	2163	100
Postnatal care status		
No	1347	62.3
Yes	816	37.7
Total	2163	100.0
Breastfeeding initiation		
Immediately after	848	39.2
Hours later	941	43.5
Days after	374	17.3
Total	2163	100.0

Infant/under-2 survival by EBF age

In fig 2, where survival probability [S(t)] is plotted against time [infant/under-2 EBF-age (months)], shows that survival curve of EBF in which time origin is 0 month while endpoint of time is 15 months. Not less than 100 (5.20%) breastfeeding mothers were censored, Survivor is at the peak (1.0) at the time origin and then decreases in a stepwise manner as infant/under-2 grow in EBF-age. Hence Survivorship was constant at 0.5 and equivalent to 6 months age of

infant i.e. S(0.5) = 6 which is the median EBF discontinuation time. EBF Survivorship thus decreases (tending towards zero) as infant child grow and it is zero at the maximum point of EBF discontinuation time (tending towards 2 years).

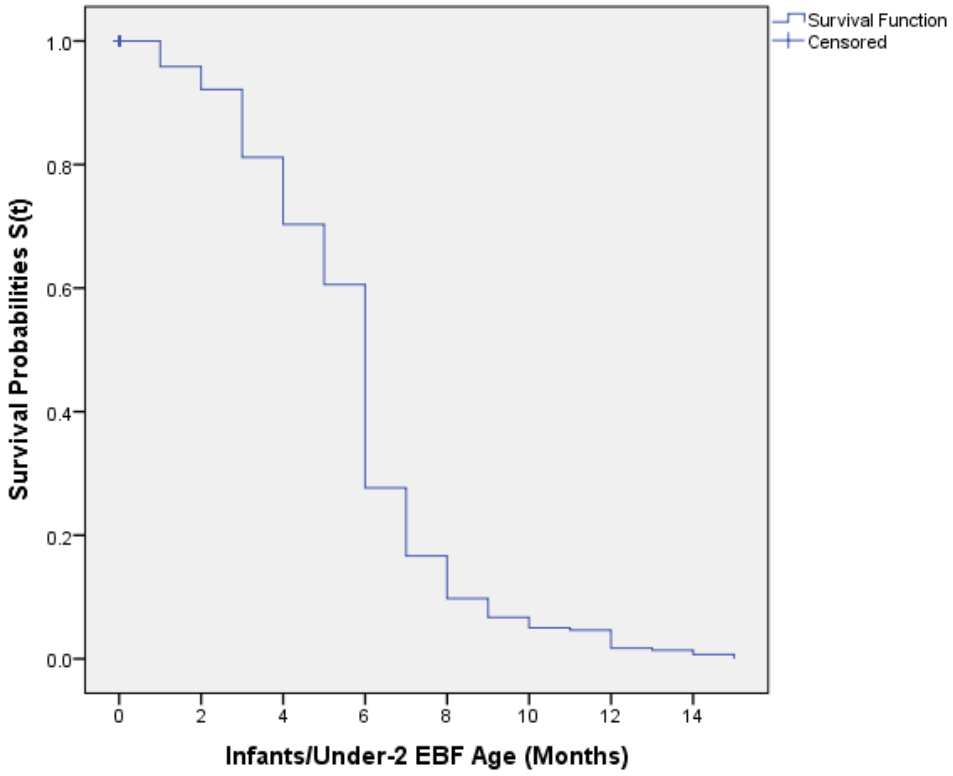

Figure 2: Survival Curve of Time (Months) to EBF Discontinuation

Cox model predictors of EBF-time duration:
Table 3 shows the estimate of fitted Cox model; $\lambda(t/x) = \lambda 0(t)\exp(-0.0345X1 - 0.0138X2 - 0.1709X3 - 0.0066X4 - 0.0323X5 - 0.0264X6 + 0.0003X7 - 0.0352X8 + 0.1168X9 + 0.0346X10 + 0.0434X11)$ where; only mothers locality and place of child delivery are significant at $P < 0.05$ (0.7284 – 0.9754) and $P < 0.01$ (1.0556 – 1.1965) respectively. However, these two predictors respectively have negative and positive influence leading to increase and decrease in hazard rate of discontinuing EBF among nursing mothers of infants and under-2 children.

Table 3: Cox Regression Showing Breastfeeding Mothers Effect on EBF Duration

Socio-Economic/Demographic and Reproductive Maternal Health Factor	Estimate	Standard error	p-value
Age (years)	-0.0345	0.0424	0.432
Zone	-0.0138	0.0182	0.455
Locality	-0.1709	0.0628	0.022*
Education	-0.0066	0.0368	0.859
Occupation	-0.0323	0.0532	0.555
Marital status	-0.0264	0.1412	0.855
Socio economic class	0.0003	0.0295	0.993
Antenatal care visit	-0.0352	0.0718	0.636
Place of delivery	0.1168	0.0359	0.001**
Postnatal care status	0.0346	0.0645	0.579
Breastfeeding initiation	0.0434	0.0466	0.331

* Significant at p<0.05, ** Significant at p<0.01.

Hazard rate of discontinuing exclusive breastfeeding

From the table 4 below, it can be infer that Hazard of discontinuing EBF is high (HR 1.1; 0.8 – 1.4) among mothers in ages of 20-29 years compared to 15-19, while it is low among the upper age class of 40-49 (HR 0.95; 0.7 – 1.4). Low hazard ratio from North-West and South-West implies that nursing mothers from both regions significantly influence late stoppage of EBF with $P < 0.05$ (HR 0.78; 0.63 – 0.95) and (HR 0.80; 0.64 – 0.99) respectively. Meanwhile, hazard of discontinuing EBF is high in South-East (HR 1.2; 0.9 – 1.5) and South-South (HR 1.1; 0.9 – 1.4) compare to North-Central and other zones. Hazard of stopping EBF in urban is 1.04 times less likely to that of rural and therefore nursing mothers who reside in rural areas are likely to discontinue EBF earlier due to the 4% excess risk.

Nursing Mothers with at least primary education (HR 0.85; 0.7-1.0) practice EBF longer than those without formal education and also mothers with tertiary knowledge (HR 0.79; 0.6 – 1.0) are more likely to exclusively breastfeed their infant longer than those without formal education. Also Married nursing mothers practice EBF longer than unmarried and divorce nursing mothers as the former is associated with low hazard. Poor mothers discontinue EBF earlier than wealthier mothers. Mothers who delivered in private clinic are significantly influenced by early stoppage of EBF {$P < 0.05$ (HR 1.47; 1.02 – 2.13)}. Thus, nursing mothers that gave birth at private centre are 1.48 times more likely to discontinue EBF early. Mothers that initiate breastfeeding early breastfed longer than those that delayed it, since hazard of late breastfeeding initiation is higher than that of early breastfeeding initiation and mothers that attended postnatal care are more likely to practice EBF longer than those who do not attend.

Table 4: Hazard Rate (and confidence level) of Discontinuing EBF with respect to subgroup classification of Mothers Characteristics

Socio-Economic/ Demographic and Reproductive Maternal Health Factors	Hazard ratio	Standard error	95% CI
Age group (years)			
15 – 19#			
20 – 29	1.0562	0.1146	0.8076 – 1.3814
30 – 39	0.9886	0.1419	0.7462 – 1.3096
40 – 49	0.9566	0.1713	0.6735 – 1.3588
Zone			
North central#			
North east	0.8864	0.9694	0.7154 – 1.0983
North west	0.7751	0.0804*	0.6325 – 0.9450
South east	1.1733	0.1376	0.9323 – 1.4765
South south	1.1215	0.1146	0.9180 – 1.3700
South west	0.7964	0.0865*	0.6438 – 0.9852
Locality			
Rural#			
Urban	0.9602	0.0787	0.8178 – 1.1275
Education			
No formal education#			
Primary	0.8575	0.0872	0.7130 – 1.0312
Secondary	0.9943	0.0893	0.8337 – 1.1858
Tertiary	0.7909	0.1123	0.5987 – 1.0447
Occupation			
Unemployed#			
Self employed	0.9770	0.6814	0.8522 – 1.1201
Employed	0.8685	0.1449	0.6262 – 1.2044
Marital status			
Never married#			
Married	0.8947	0.1715	0.6145 – 1.3026
Divorce/Widow	1.0337	0.2881	0.5986 – 1.7851
Social economic status			
Poorest#			

Poorer	0.9324	0.9274	0.7673 – 1.1331
Average	0.9917	0.1042	0.8071 – 1.2185
Richer	0.9121	0.1094	0.7210 – 1.1539
Richest	0.8949	0.1171	0.6925 – 1.1565
Antenatal care visit			
Less than 4#			
4 or more	1.0021	0.0758	0.8639 – 1.1623
Place of delivery			
Home#			
Government hospital	1.1485	0.1272	0.9245 – 1.4269
Private centre	1.4761	0.2761*	1.0230 – 2.1299
Faith based	1.2869	0.1952	0.9559 – 1.7325
Postnatal care status			
No			
Yes	0.9955	0.0629	0.8795 – 1.1267
Breastfeeding initiation			
Immediately after#			
Hours later	1.0338	0.0679	0.9088 – 1.1760
Days after	1.0602	0.1045	0.8740 – 1.2861

Reference category, * Significant at $p<0.05$.

Predicting EBF discontinuation time from Cox model

The fitted cox model shows that EBF discontinuation time can only be predicted from nursing mothers locality (rural/urban) and place of infants/under-2 child delivery (home/faith-based/ public/private hospital). Thus the cox model that will predict EBF discontinuation time is a parsimonious model that measure a significant effect from the two predictors of EBF and therefore reduce the above model with eleven covariate to two. Hence, the predicting model can be written as:

$\lambda(t/x) = \lambda 0(t)\exp(-0.1709X3 + 0.1168X9)$ ….. (7)

Where -0.1709 and +0.1168 are the respective negatively and positively weighted coefficient effect of Mothers Locality 'X3' and place of child delivery 'X9' on EBF discontinuation time.

Cox (EBF) model assessment

The chi-square goodness of fit test shows that the cox proportional hazard model fit the EBF discontinuation time data and therefore imply that the observe model data conform with expected. Table 5 is the Wald test of individual Cox (EBF) model parameter that shows significant result ($P < 0.05$) for the two predictors (locality and Place of delivery) prior to EBF with estimated ($t = 7.41$ and $t = 10.59$) > 3.84(chi square value of one degree of freedom) respectively. Implying that the predictors of the Cox (EBF) model are effective (not zero). Stressing the need for each predictor in the presence of the others in the model.

Table 5: EBF-model adequacy (Wald) Test

Socio-demographic and Maternal Health Factor	Estimate	Standard error	Wald-statistic
Age (years)	-0.0345	0.0424	0.662
Zone	-0.0138	0.0182	0.575
Locality	-0.1709	0.0628	7.406*
Education	-0.0066	0.0368	0.032
Occupation	-0.0323	0.0532	0.369
Marital status	-0.0264	0.1412	0.035
Socio economic class	0.0003	0.0295	1.034
Antenatal care visit	-0.0352	0.0718	0.240
Place of delivery	0.1168	0.0359	10.585*
Postnatal care status	0.0346	0.0645	0.288
Breastfeeding initiation	0.0434	0.0466	0.867

* Significant at $p<0.05$.

Discussion

This present study evaluates discontinuation time of exclusive breastfeeding using Kaplan-Meier method to estimate infant and under-2 survivorship, determine and assess its predictors using Cox model and Wald Statistic. EBF data quality and accuracy was assessed and error due to respondent recall bias was minimized by selecting Mothers nursing under-2 children in the last two years (2010-2012) of the survey; since it's almost unrealistic for members of non-literate population to remember time at which EBF was discontinued in the previous 5 years.

Survival estimate and plot shows that, average discontinuation time of EBF in Nigeria is approximately 6 months and this is in conformity with result of cross sectional study conducted by (Yeneabat et al., 2014) in Northern Ethiopia, in which median duration of EBF was 6.06 months. This however varies across geo-political zone and delivery place in Nigeria as median EBF discontinuation time is 5 month in South-south, 4 months in South-east while private and faith based centres are 5months and 4 months respectively. This variation is in agreement with (Yeneabat et al., 2014) that median discontinuation of EBF time varies between 4 and 6 months with differences in locality and ethnicity.

Respective low hazard indicated that mothers in older maternal ages tends to exclusively breastfeed longer than breastfeeding mothers in younger ages. This is because older nursing mothers have more maternal experience since mothers in lower ages are likely to be nursing their first child. Also, breastfeeding mothers with at least primary education prolong EBF discontinuation time compared to breastfeeding mothers without formal education. This is due to mothers' literate level concerning knowledge and awareness of exclusive breastfeeding benefits to them and their infant/under-2 child.

This is in line with (Ukegbu et al., 2011) findings based on study on determinant of breastfeeding pattern in Anambra state (Nigeria) that good breastfeeding knowledge is significantly associated with EBF practice. Married mothers also tend to extends stoppage of EBF longer than unmarried or divorced mothers owing to husband influence on EBF practice. The influence of age, education and marital status on EBF discontinuation time corresponds to findings of (Nwosu et al., 2004; Onayade et al., 2004) that reported that maternal age, education, marital status and family size are among other factors that significantly influence EBF practice in Nigeria.

Low hazard found in subgroup class of mothers' zone and locality emphasize that mothers from South-west and North-west region tends to prolong EBF discontinuation time compared to those from North-central and that Breastfeeding mothers residing in rural area will discontinue EBF earlier than breastfeeding mothers residing in urban slum. This is because breastfeeding mothers in urban areas are educationally advance and are aware of benefits of EBF practice to them and their children. High hazard found in place of delivery implied that mothers who delivered at private clinics are 1.5 times more likely to stop EBF early. This is due to low awareness rate at private centres, since priority is to render basic healthcare services.

Ajibade et al. (2013) corroborated this by reporting that cultural factors are associated with discontinuation of EBF in rural communities. WHO (2008) also reported that cultural values and family pressure influence EBF practice in low/middle income countries. Mothers in the poor socio-economic class are more likely to discontinue EBF earlier than those above the poor socio-economic class. This is due to financial effect as wealthier mothers are more financially buoyant and could afford nutritional adequate replacement food while breastfeeding. This study also found out that late breastfeeding initiation is associated with early discontinuation of EBF and mothers who attend postnatal care are more likely to prolong EBF practice than those mothers who do not attend postnatal care.

Findings based on Cox proportional hazard modelling strategy and it associated Wald test shows that EBF discontinuation time is significantly influenced by mothers' locality of resident and place of child delivery. This is similar to findings by study conducted by (Tampah-Nah, 2013) in Ghana on determinants of EBF that Mothers region and infants place of delivery are associated with optimum EBF practice. The outcome was also substantiated by the result of (Yeneabat et al., 2014) that place of residence and delivery mode are predictors of EBF cessation. Chola et al. (2013) study on infant feeding survival in Uganda also found out that duration of EBF was predicted by resident of mother, delivery place and infant feeding advice.

Conclusion and policy inference

It can be concluded from this study that average discontinuation time of exclusive breastfeeding for infants and under-2 in Nigeria is 6 months and this varies across mother's geo-political zone based on locality and place of delivery. Breastfeeding mothers in higher ages, higher socio-economic class, and with higher education exclusively breastfed longer than those with lower ages, lower socio-economic class and lower education respectively. Also, married nursing mothers and nursing mothers in urban communities exclusively breastfed their child longer than unmarried and those residing in rural area

respectively. Also, Mothers who delay breastfeeding initiation for new-born and did not attend postnatal care are more likely to discontinue EBF early. Mothers' locality of residence and place of child delivery are the two significant factors that influence discontinuation time of exclusive breastfeeding, make up the explanatory variables that predict discontinuation time of EBF from the parsimonious Cox model and are also the main predictors of EBF discontinuation time in Nigeria. Though, average duration of EBF fall in the recommended period, it is essential that Women Affairs sector encourage mothers through a monitored intervention scheme that will target and strengthen mothers at their locality and place of delivery to step up EBF practice in Nigeria.

Limitations

Recall/responder bias associated with cross-sectional study can be regarded as a limitation. This was however minimized by excluding birth history more than two years.

Declaration of conflicting interests

No potential conflicts were declared.

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