ORIGINAL ARTICLE

Survival Analysis of Duration of Exclusive Breast Feeding Using Life Table and Hazard Function

Thakur N. A.[1], Holambe V. M.[1], Wadagale A.V.[1]*

Department of Preventive and Social Medicine, Government Medical College, Latur- 413512

(Maharashtra) India

Abstract:

Background: Breastfeeding and complementary feeding are crucial for growth and development of an infant. Non-exclusive breastfeeding among 0-5 month old infants can increase the risk of dying due to diarrhea and pneumonia. In developing countries, the age of starting of complementary feeding is of public health importance. Higher prevalence of malnutrition among older children (6-12 months) may be related to prolong exclusive breast-feeding. *Objective:* To determine the duration of exclusive breast feeding using survival analysis (Life table) and hazard function. *Material and Methods:* This was a cross sectional study conducted in Government Medical College, Latur (Maharashtra, India) during 1st May 2013 to 30th June 2013. The study population consisted of 197 mother-infant pairs attending the Immunization Clinic. Data was collected by direct interview using predesigned and pretested questionnaire. Informed consent was taken from all the study subjects. The data was analyzed using survival analysis procedure with life table approach and hazard function graph with Statistical Package for the Social Sciences (SPSS) 20. *Results:* Out of the 197 infants 101(51.27%) were males and 96 (48.73%) were females. The mean age of mothers was 24.17 ± 3.60 years. Majority of the parents had at least secondary school education. Exclusive breast feeding rate at 6 months was 100 %. Delayed weaning practices were seen in 53.63% of total weaned infants. Steep fall seen at 7 months in hazard function graph also indicates delayed weaning practices. *Conclusions:* Delayed weaning practices are a major concern in the study area which needs attention.

Introduction:

Breast feeding and complementary feeding of an infant are not only crucial for optimal growth and development but also are important determinants of future physical and mental well being because of the rapid growth spurt and development of organs and tissues during the first year of life [1, 2]. Exclusive breastfeeding means that the infant receives only breast milk. No other liquids or solids are given – not even water – with the exception of oral rehydration solution or drops/syrups of vitamins, minerals or medicines [3]. Non-exclusive breastfeeding rather than exclusive breastfeeding among 0-5 month old infants can increase the risk of dying due to diarrhea and pneumonia by more than two-fold [4].

Complementary feeding is the systematic process of introduction of suitable food at right time in addition to mother's milk in order to provide needed nutrients to the baby [5]. In developing countries, the age of starting of complementary feeding is of public health importance, because of the risk of pathogens contamination and over dilution of milk leading to increased risks of morbidity and under nutrition [6]. Higher prevalence of malnutrition among older children (6-12 months) may be related to prolong exclusive breast-feeding [7, 8].

The present study was designed with aim to determine the duration of exclusive breast feeding using survival analysis (Life table) and hazard function.

Material and Methods:

This was a cross sectional study conducted in Immunization Clinic of Government Medical College, Latur (Maharashtra, India). Using the formula for cross-sectional studies and exclusive breastfeeding prevalence of 53% a sample size of 151 was calculated with confidence level of 95% and power of 85%, i.e 5% of alpha error and 15% of beta error. The study was planned with consecutive sampling, in which all the mothers attending immunization OPD with their infants were enrolled in the study. The study duration was from 1st May 2013 to 30th June 2013. Thus, the final sample size was 197 mother-infant pairs. All mothers with the age of their baby < 12 months were included in the study. Informed consent was obtained from mothers. Response rate was 100%. Resident doctors personally interviewed the mothers of infant.

Predesigned and pretested questionnaire was used as a tool for data collection. The questionnaire included sociodemographic data like age of mother, education and occupation of parents, socioeconomic status and some obstetric factors like age at marriage, parity and spacing. The mother was asked about the breastfeeding practices. If the mother was not exclusively breastfeeding to her infant (i.e. partially breast-feeding), the age at introduction of comple-mentary food was noted in complete months.

The 'start time' is when breastfeeding starts i.e. at birth of a child and event of interest is 'end of exclusive breastfeeding' i.e. when complementary food is introduced and breastfeeding becomes partial if continues. Thus the women reporting continuation of exclusive breast feeding on the date of interview were considered as censored cases. Presence of censored data makes the conventional statistical techniques inappropriate. A statistical technique useful for such situation is survival analysis, which is a method of estimating time to event data in the presence of censored cases. The data was analyzed in statistical software SPSS 20 using survival analysis procedure with life table approach and Hazard function graph. Ethical clearance was obtained from local institutional ethical committee.

Results:

Out of the 197 infants 101(51.27%) were males and 96 (48.73%) were females. The age range of infants was from 1 day to 12 months. The mean age of mothers was 24.17 ± 3.60 years. The proportion of mothers under 20 years of age was 7.61%. Majority of the parents had at least secondary school education with one fourth of the mothers and one third of the fathers having education upto graduation and above. 91.37% mothers were housewives while main occupation of fathers was clerical/shop owner/farmer (32%) followed by unskilled labourers (25%). Majority of the families belonged to class IV, socioeconomic status (44.66%) by modified Kuppuswamy's classification. 17% of the mothers were married at <18 years of age. More than half of the mothers (58.37%) married between the age of 18-21 years. Out of the 197 study subjects, 103 (52.28%) were primiparous and 94 were multiparous (47.72%). The spacing between two deliveries was 3-6 years in 53.17% mothers. (Table 1).

Table 1: Socio-demographic Characteristics of Study Subjects

Characteristic	No.	%	Characteristic	No.	%
1. Age of mother			**5. Occupation Of father**		
≥19	15	7.61	Profession	32	16.25
20-25	127	64.47	Semi profession	9	4.57
26-30	42	21.32	Clerical/shop owner/farmer	63	31.98
>30	13	6.6	Skilled	35	17.77
2. Education of mother			Semiskilled	7	3.55
Illiterate	4	2.03	Unskilled	49	24.87
Primary	3	1.52	Unemployed	2	1.01
Secondary	87	44.16	**6. Socioeconomic status**		
HSC/diploma	54	27.41	I	4	2.03
Graduate and/or above	49	24.88	II	32	16.25
3. Education of father			III	72	36.54
Illiterate	5	2.54	IV	88	44.66
Primary	2	1.01	V	1	0.52
Secondary	68	34.52	**7. Age of mother at marriage**		
HSC/diploma	58	29.44	<18	33	16.75
Graduate and/or above	64	32.49	18-21	115	58.37
4. Occupation of mother			22-25	43	21.83
Profession	2	1.01	>25	6	3.05
Semi profession	10	5.08	**8. Parity**		
Clerical/shop owner/farmer	1	0.52	Primiparous	103	52.28
Skilled	2	1.01	Multiparous	94	47.72
Semiskilled	0	0	**9. Spacing (n=94)**		
Unskilled	2	1.01	<3	35	37.23
Housewife	180	91.37	3-6	50	53.19
			>6	9	9.58

Table 2: Life Table

Interval Start Time		Number Entering Interval	Number Withdrawing during Interval	Number Exposed to Risk	Number of Terminal Events	Proportion Terminating	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	SE of Cumulative Proportion Surviving at End of Interval	Probability Density	SE of Probability Density	Hazard Rate	SE of Hazard Rate
Dimensions	0	197	0	197	19	0.1	0.9	0.9	0.02	0.096	0.021	0.1	0.02
	1	178	0	178	23	0.13	0.87	0.79	0.03	0.117	0.023	0.14	0.03
	2	155	0	155	20	0.13	0.87	0.69	0.03	0.102	0.022	0.14	0.03
	3	135	0	135	23	0.17	0.83	0.57	0.04	0.117	0.023	0.19	0.04
	4	112	0	112	22	0.2	0.8	0.46	0.04	0.112	0.022	0.22	0.05
	5	90	0	90	11	0.12	0.88	0.4	0.03	0.056	0.016	0.13	0.04
	6	79	32	63	8	0.13	0.87	0.35	0.03	0.051	0.017	0.14	0.05
	7	19	17	10	2	0.19	0.81	0.28	0.05	0	0	0	0

Out of the 197 infants,128 (64.98%) were exclusively breastfed at the time of interview, thus were considered as censored cases, while in 69 (35.02%) infants event of interest had occurred i.e. complementary food was introduced.

Table 2 is a descriptive life table summarizing the time to introduction of complementary food. In the column number of terminal events, Proportion terminating, the greatest number and proportion of terminal events occur within 4 months, which suggests that children should be monitored more closely with their mothers during their first four months time interval. The column "number withdrawing during interval" states that all the women were exclusively breastfeeding their infants till 5 completed months. This conforms to the WHO norms. Out of the 69 infants in whom complementary food was found started at the time of their enrollment in the study, 32(46.37%) had started it by completion of six months age, while it was also noted that there were 17(24.64%) and 20(28.99%) women who were practicing exclusive breastfeeding at the age of 7th and 8th months respectively. This indicates delayed weaning practices in 37 out of 6953.63% of total weaned infants.

Median survival time i.e. median length for exclusive breastfeeding (including the censored cases i.e. who had started complementary food at the time of interview) for given study was 4.614, which shows maximum no. of the censored events occurred around the age of 4 months.

Fig. 1 shows the survivorship function which gives a visual representation of the life table (table 2). It gives the proportion or percent of infants exclusively breast fed to a fixed time 't' or beyond. Thus, the curve is then a function of 't'. The horizontal axis shows the time to event. The vertical axis shows the probability of survival. Thus, any point on the survival curve shows the probability that a child will remain with exclusive breast feeding. In this plot, drops in the survival curve occur at one-month intervals, as specified in the dialogs.

Fig. 2 shows the hazard function graph. The hazard function h (t) gives the instantaneous potential per unit time for the event to occur, given that the individual has survived up to time t. In contrast to the survivor function, which focuses on not failing, the hazard function focuses on failing, that is, on the event occurring. Thus, in some
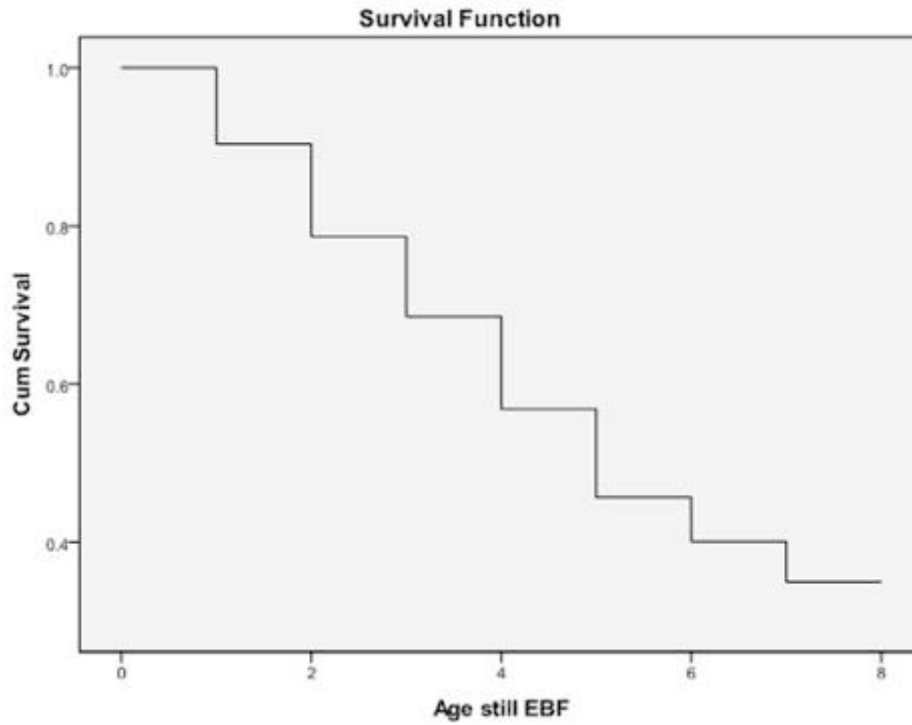
Fig. 1 : Survival Curve Showing Survival Probability for Duration of Exclusive Breastfeeding
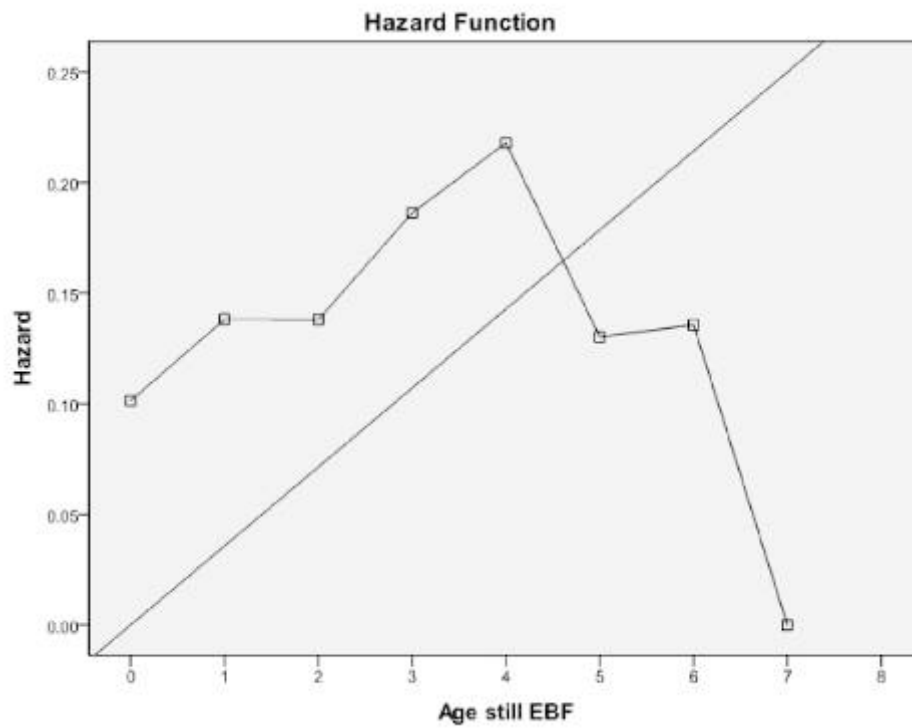

Fig. 2 : Hazard Function Graph

sense, the hazard function can be considered as giving the opposite side of the information given by the survivor function. The hazard function is sometimes called a conditional failure rate.

Here, in our study, when child started breast feeding at 0 months, there is certain probability of giving complementary food at any age from 0 to above months.

In Fig. 2, Hazard function graph, X axis represents number of months of exclusive breast feeding given to child and Y axis represents probability of introducing complimentary food. By inspecting fairly, it looks like normal curve which is skewed to right side of graph. Hazard is constant over the time. Straight line in graph is shifted above i.e. to left side of our standard reference line (shown in dotted version) because falling of frequencies are more in right side. Steep fall is seen at 7 months which should actually be seen at 6 months. This indicates prolonged exclusive breastfeeding practices and late introduction of complementary food.

Discussion:

In the present study when data on 197 women were analysed through survival analysis procedure, the median duration of EBF was 4.614 months, this corresponds to the findings of Agampodi *et al* [9] in Sri Lanka and Giashuddin MS *et al* [10] which were 4 and 3.67 months respectively. However the data from NFHS 3 [11] and Caldeira AP *et al* [12] shows the median duration of EBF as 2 months and 1 month respectively which is lower than present study. Chudasamaa *et al* [13] in their study in Gujarat found median duration of EBF as 6 months which is longer than present study.

Delayed weaning practices were quiet prevalent in present study. Out of the 69 infants in whom weaning was started, in 37 (53.62%) infants the weaning was started after 7 months. In the study from tea garden workers, Assam [7], introduction of complementary feedings was generally delayed. Out of the 48 infants aging ≥7 months 18 (37.5%) were exclusively breastfed.

In developing countries like India, the age at introduction of weaning foods is of public health importance. There is risk of growth faltering and malnutrition from delayed weaning and also increased chances of diarrhoeal diseases from contaminated weaning foods thus putting the infants in the vicious cycle of infection and malnutrition.

In India about 47% of children are weaned at age ≥ 6 months. Stunting gradually increases as weaning is postponed to age ≥6 months [14].

Conclusion and Recommendations:

The median duration of exclusive breastfeeding (including censored cases) is 4.614 months. Out of the 69 infants, in whom introduction of complementary food was done, in 53.63% it was started late. Steep fall seen at 7 months in Hazard function graph which should actually be seen at 6 months, also indicates prolonged exclusive breastfeeding practices.

Further studies are needed to explore the fact that prolonged exclusive breastfeeding and association with malnutrition. There is need of health education to promote introduction of timely complementary feeding i.e. at 6 months.

References:

1. Waterlow JC. Protein energy malnutrition. London: Edward Arnold. 1992.

2. Deshpande JD, Giri PA, Phalke DB, Phalke VD, Kalakoti P, Syed MMA. Socio-cultural practices in relation to breastfeeding, weaning and child rearing among Indian mothers and assessment of nutritional status of children under five in rural India. *AMJ* 2010; 3(9): 618-624.

3. WHO. Infant and Young Child nutrition resolution 54.2 of World Health Assembly. Resolutions and diseases of 54th World Health Assembly, 14-22 May 2001.

4. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics* 2001; 108(4):E67.

5. Elizabeth KE. Nutrition and Child Development. 4th ed. Paras Medical Publisher Hyderabad; 2010.

6. Huttly SR, Morris SS, Pisani V. Prevention of diarrhea in young children in developing countries. *Bull World Health Organ* 1997; 75(2):163-174.

7. Medhi GK, Mahanta J. Breastfeeding, Weaning Practices and Nutritional Status of Infants of Tea Garden Workers of Assam. *Indian Pediatrics* 2004; 41:1277-1279.

8. Kleinbaum DG, Klein M. Survival Analysis A Self Learning Text. 3rd ed. Springer publications, New York, 2012: 11-12.

9. Agampodi SB, Agampodi TC, Kankanamge U, Piyaseeli D. Breastfeeding practices in a public health field practice area in Sri Lanka: a survival analysis. *International Breastfeeding Journal* 2007, 2:13.

10. Giashuddin MS, Kabir M. Duration of breastfeeding in Bangladesh. *Indian J Med Res* 2004; 119: 267-272

11. National Family Health Survey (NFHS-3), 2005–06: India: Volume I. Mumbai: IIPS.

12. Caldeira AP, Goulart EM. Breastfeeding in Montes Claros, Minas Gerais: a representative sample study. *J Pediatr (Rio J)* 2000; 76(1):65-72.

13. Rajesh K Chudasama, Panna C Patel, Abhay B Kavishwar. Determinants of Exclusive Breastfeeding in South Gujarat Region of India. *J Clin Med Res* 2009;1(2):102-108

14. Sabu S Padmadas, Inge Hutter and Frans Willekens. Weaning initiation patterns and subsequent linear growth progression among children aged 2-4 years in India. *International Journal of Epidemiology* 2002; 31:855-863.

Author for Correspondence: Dr. Namrata A. Acharya, Flat no-13, Shriniwas Sankul, Near Big Bazaar, Sawewadi, Latur-413512 Maharashtra, India Cell: +919823714836 Email: drnamratathakur@gmail.com