

Determinants of post-partum amenorrhea among Nepalese rural mothers: A multivariate analysis

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Abstract

Introduction: Post-partum amenorrhea (PPA) is the duration variable, which is directly related to the levels of fertility. The timing of occurrence of the first menstruation after delivery is known as the duration of PPA. It is a temporary infecundable period where mothers are most likely to be free from possible conception.

Objective: This paper investigates the determinants of the duration of PPA in relation to some characteristics of mother and her child by using both current as well as retrospective status reporting data.

Materials and methods: Data are taken from a sample survey of rural Palpa and Rupandehi districts. A sample of 1019 ever-married mothers was interviewed. Of them, 642 mothers were provided PPA information for their last birth child, and 481 mothers were provided PPA information for their last but one child. Cox proportional hazard model analysis has been utilized to identify the determinants of PPA duration.

Results: A lower relative risk of PPA period was found among mothers who have higher parity, larger birth interval and longer period of breastfeeding (BF). Education was inversely associated with PPA, and about 1.5 times higher risk of returning menstruation early was found among educated mothers as compared to uneducated counter-part. BF is significantly associated with PPA where the longer is the duration of BF the longer is the duration of PPA. The relative risk was found increased with increases the level of socio-economic status. Over twice times higher risk of returning menstruation early was found among mothers who had experienced dead child as compared to mothers who have no child loss.

Conclusion: The variables like birth interval, parity, breastfeeding, education, socio-economic status and child survival are found the main determinants of PPA duration among Nepalese mothers.

Key words: Post-partum amenorrhea, breastfeeding, fertility

Post-partum amenorrhea (PPA) is considered as the duration variable. It is directly related to the levels of fertility. It affects the fertility by lengthening the period of conception¹. PPA is the period from the end of a woman's pregnancy until the time that she begins to menstruate². The timing of occurrence of first menstruation after delivery is known as the duration of PPA³. It is a temporary infecundable period, and women are supposed to be in safe period from possible conception. Several literatures have shown that there are many variables that directly affect natural fertility^{1,2,3,4,5}. In fact, Davis and Blake pointed out eleven key variables, and these variables are categorized into three main headings as intercourse, conception, and gestation variables⁴. These variables are known as intermediate variables that affect natural fertility. The other associated variables such as biomedical, demographic and socio-economic factors are termed as explanatory variables. These also influence fertility through the route of intermediate variables. PPA variable is considered to be the conception variable, and it is one of the main

proximate determinants of fertility that affect natural fertility directly^{1,4,5,6}.

Previous studies argue that distributional pattern of the duration of PPA is complex in nature where it produces very often as bi-modality, and somewhere it produces uni-modality^{4,5,6,7,8}. There are different societies where fertility is not regulated through the use of contraception, amenorrheic period can exert a dominant fertility inhibiting effect since a large number of women's reproductive life span spent in an amenorrheic state^{8,9,10}. Some empirical evidences also have argued that PPA period is positively associated with age of mother and her parity^{10,11,12}. It is well-established fact that education of mothers shows an inverse association on the duration

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of PPA^{1,8,10,11,12}. Breastfeeding (BF) and amenorrheic period are highly correlated to each other in most of the populations^{8,9}. PPA period also largely varied according to caste/ethnicity, residential status, landownership as well as socio-economic status^{1,12,13}. Studies further argued a secular declining trend in amenorrheic period over time^{1,5,14}. However, the amenorrheic duration varied within and between the populations in pertaining to the characteristics of mother and her child^{1,5,15}.

It is obvious fact that PPA is becoming an important variable to study the fertility behaviours and mothers' health status in the society especially among in the higher fertility experienced populations. It is therefore a comprehensive study is to be needed to document such issues where a high fertility experience is a natural phenomenon in the society. Since Nepal has still experienced higher pace of fertility, even slightly declining in the recent decades, though, it is far higher as compared to the Asian neighbourhoods. An adequate work on the duration of PPA has not been done yet in Nepal, which may perhaps be due to the lack of reliable data or the lack of interest among researchers. It is, therefore, the main aim of this paper is to investigate the determinants of amenorrhic period among Nepalese mothers in relation to the characteristics of mothers and their child. For this, Cox proportional hazard model analysis has been applied to identify the determinants of the duration of PPA among Nepalese mothers¹⁶.

Materials and methods

The data come from a sample survey entitled 'Demographic Survey on Fertility and Mobility (DSFM 2000): A Study of Palpa and Rupandehi Districts in Western rural Nepal'. The data were collected from four clusters of each district. The clusters consisted of wards of the village development committee (VDC). A VDC consists of nine wards, and it is a lowest administrative unit. Eight clusters (wards) were randomly selected from eight VDCs and completely enumerated. In a survey, a total of 811 households were listed first from all the selected clusters, and then completely surveyed. A sample of 1019 ever-married mothers of reproductive age was interviewed. The resumption of the menstruation was collected from each and every ever-married mother who had given at least one birth in the last 7-years preceding the survey date. Each and every mother was asked whether she had resumed menstruation following her last birth child (current status reporting) and last but one birth child (retrospective reporting status). A total of 642 mothers provided information on the duration of PPA for their last birth child who had given at least one birth in the last 7-years preceding the survey date, of whom, 544 mothers (84.7%) reported that their menstruation had returned at the survey point, and the

rest of 98 mothers (15.3%) were still amenorrheic state at the date of interview, which were considered as the censored cases. Similarly, a total of 481 mothers provided information on PPA duration for their last but one child at the survey point. The retrospective reporting in this survey refers to ask the mother about the duration of PPA subsequent to the birth of the last but one child, whereas the current status reporting requires to note about the mother's menstruation status at the survey date following the birth of the last child. In addition to this, information on socio-economic, demographic and caste/ethnicity characteristics of mothers was also collected. Since all these variables are measured at the survey date, and the variable description in brief is given below.

Dependent Variable: PPA duration is taken as the dependent variable, and included both censored and non-censored cases in the analysis. The mothers who were still in amenorrheic state at the survey point are termed as censored cases. *Independent Variables:* The demographic variables included as parity of mother (PARITY), current age of mother (AGEMOTH), age of mother at the birth of child (AGEMOTHCHB), current age of child (AGECH), duration of breastfeeding (BF), open birth interval (OPENBI), close birth interval (CLOSEBI), survival status of child (SURVCH) and sex of child (SEXCH). The age variables are all measured in completed years. Closed and open birth intervals are measured in months. Closed birth interval is considered as the time period between the penultimate child and the most recent child. Open birth interval is the interval from the birth of last child to the survey date. Socio-economic variables are included as education of mother (EDUMOTH), education of husband (EDUHUSBN), working status of mother (WORKMOTH), occupation of husband (OCUHUSBN), socio-economic status of household (SOECOHH) and place of residence (RES). Caste/ethnicity (CASTE) variable is also included in the analysis. The categories of these variables are presented in Table 2. The detail about survey and the measurement of the variables has been found in Aryal^{3,17}.

Univariate hazard model analysis is used to offer a measure of the effect of each variable on the duration-specific probabilities of the resumption of menstruation (hazard function) in the absence of the control for other variables included in the model (Table 1). A multivariate Cox proportional hazard model analysis is then undertaken to measure the effect of each category of each variable on the hazard function while controlling for the effects of other variables (and their categories) included in the model. Let us denote the risk of returning to menstruation by the equation under the Cox proportional hazard model is given below¹⁶.

$$h_i(t) = h_0(t) e^{b \cdot x_i}$$

where $h_0(t)$ is the baseline hazard for which no specific function is assumed, x is a vector of independent variables and β is a vector of regression parameters.

Results

The results of univariate hazard model analysis are presented in Table 1. The analysis indicated that the parity of mother, current age of mother and age of mother at the birth of the child were significantly related with the duration of PPA in respect of both last and last but one child. The variables, open birth interval and BF have been found significantly related with the duration of PPA. Education, working status, survival status of the child and socio-economic status of mothers showed significant differentials on the duration of PPA. Variables such as close birth interval, sex of the child and caste/ethnicity do not exhibit significant relationship with the duration of PPA.

While carrying out multivariate analysis, all insignificant variables were excluded. The variance inflation factor was used to gauge the possible multicollinearity between the variables, and if there existed multicollinearity, and then such variables were also excluded in the analysis. Finally, the variables, close birth interval, education and working status of mother, BF, survival status of child, residence and socio-economic status, were included in the multivariate analysis. The results of multivariate analysis are presented in Table 2. A relative risk of 1.0000 indicates that the category has been taken as the baseline or reference category for each variable. A relative risk is greater (less) than 1.0000 indicates a higher (lower) risk of occurrence of the event than the reference or base line category.

The coefficients were found significant for all the categories of parity of mothers for both the data sets (current status and retrospective status reporting data). The increased parity order was found with decreases the relative risk of PPA period, which indicating that mothers those who have higher parity had experienced

longer duration of PPA. The decreased risk ratio was found with increases the birth interval. Over 55 per cent less risk of returning menstruation early was found for mothers whose close birth interval was more than three years as compared to mothers whose close birth interval was a year and less. Educational attainment was found to be significantly associated with the duration of PPA. The increased level of mother's education was found with the increased relative risk ratio of returning menstruation for both the data sets. About 1.5 times higher risk of returning menstruation early was found among educated mothers as compared to that of uneducated mothers.

All the coefficients are found significant in the BF categories. It was found that the duration of BF increased with decreases the relative risk ratio for both the data sets, which implies that the longer the duration of BF leads to the longer duration of PPA period. The association of the duration of BF and PPA was found to be significant and positively related. Mothers' working status and residence showed insignificant association with the duration of PPA. However, about 15 per cent less risk of returned menstruation early was found among employed mothers as compared to that of the housewife.

Socio-economic status showed a significant association with the duration of PPA. It was found that the relative risk ratio increased with increases the level of socio-economic status. About twice times higher risk of returning PPA period was found among mothers who belong to the high socio-economic status than that of the low socio-economic counter-part. A survival status of the child showed a significant relationship with the duration of PPA period. Over twice times higher risk was found for mothers who have a dead child as compared to that of mothers who have no child loss. The relative risk ratio is significantly decreased with increases the length of the closed birth interval after controlling the effect of other variables for both the data sets. The effect of sex of the child on the duration of PPA did not offer any significant difference.

Table 1: Univariate analysis of the duration of post-partum amenorrhea

Variables	Current status reporting (n=544 & censored=98)			Retrospective reporting (n=481 & censored=0)		
	Model- χ^2	d.f.	p-value	Model- χ^2	d.f.	p-value
PARITY	83.54	3	0.0001	16.86	3	0.0001
AGEMOTH	47.36	2	0.0001	13.42	2	0.0007
AGEMOTHCHB	39.11	2	0.0001	4.21	2	0.0524
EDUMOTH	150.79	3	0.0001	13.46	3	0.0002
EDUHUSBN	154.50	3	0.0000	15.33	3	0.0001
WORKMOTH	8.93	1	0.0001	6.14	1	0.0132
OCUHUSBN	38.73	2	0.0001	2.24	2	0.1350
BF	83.91	8	0.0001	55.07	8	0.0001
CLOSEBI	-	-	-	0.14	4	0.7092
OPENBI	21.89	4	0.0000	-	-	-
SEXCH	0.24	1	0.6248	0.59	1	0.4442
CASTE	1.55	2	0.2137	1.62	2	0.2034
RES	57.50	1	0.0000	1.17	1	0.2798
SOECOHH	108.04	2	0.0000	16.79	2	0.0000
SURVCH	124.12	1	0.0000	119.71	1	0.0000

Table 2: Results of Cox proportional hazard model analysis of the duration of PPA

Variables	Variable categories	Current status reporting			Retrospective status reporting		
		Estimated coefficient (B)	p-value	Relative risk ratio	Estimated coefficient (B)	p-value	Relative risk ratio
PARITY	1-2	-	-	1.0000	-	-	1.0000
	3-4	-0.3293	.0000	0.7194	-0.2503	0.0020	0.7786
	5-6	-0.2700	.0000	0.7634	-0.3117	0.0007	0.7322
	7+	-0.2998	.0000	0.7410	-0.2957	0.0052	0.7440
CLOSEBI (in month)	<12	-	-	-	-	-	1.0000
	12-23	-	-	-	-0.3879	0.0245	0.6785
	24-35	-	-	-	-0.5290	0.0032	0.5892
	36-47	-	-	-	-0.7060	0.0004	0.4936
	48+	-	-	-	-0.8198	0.0019	0.4405
EDUMOTH	Illiterate	-	-	1.0000	-	-	1.0000
	Primary & Primary	0.1303	0.0009	1.1392	0.1237	0.0376	1.1317
	Mid-High school	0.1638	0.0028	1.1780	0.1804	0.0541	1.1977
	Inter and more	0.2798	0.0083	1.3229	0.3893	0.0454	1.4759
WORK MOTH	Housewife	-	-	1.0000	-	-	1.0000
	Employed	0.0178	0.6597	0.9824	-0.1050	0.1536	0.9003
BF (in month)	0-6	-	-	1.0000	-	-	1.0000
	7-12	-0.1142	0.0051	0.8921	-0.1581	0.0062	0.8538
	13-18	-0.2794	0.0029	0.7562	-0.2891	0.0029	0.7489
	19-24	-0.2976	0.0027	0.7426	-0.2796	0.0011	0.7561
	25-30	-0.3374	0.0059	0.7136	-0.3660	0.0048	0.6935
	31-36	-0.3821	0.0012	0.6824	-0.2870	0.0021	0.6791
	37-42	-0.4413	0.0018	0.6432	-0.4551	0.0008	0.6344
	43-48	-0.6453	0.0049	0.5245	-0.6884	0.0053	0.5024
	49+	-0.7091	0.0037	0.4921	-0.7152	0.0034	0.4891

Table 2 cont...

Table 2 cont...

Variables	Variable categories	Current status reporting			Retrospective status reporting		
		Estimated coefficient (B)	p-value	Relative risk ratio	Estimated coefficient (B)	p-value	Relative risk ratio
RES	Tarai	-	-	1.0000	-	-	1.0000
	Hills	-0.1210	0.0325	0.8860	-0.0339	0.4589	0.9668
SOECOHH	Low	-	-	1.0000	-	-	1.0000
	Middle	0.2004	0.0018	1.2219	0.2699	0.0485	1.3098
	High	0.4238	0.0000	1.5278	0.6447	0.0000	1.9054
SURVCH	Alive	-	-	1.0000	-	-	1.0000
	Dead	0.7318	0.0130	2.0789	0.6159	0.0000	1.8452

- Indicates reference category

Discussion

Cox proportional hazard model technique is used to study the net relative risk of returning menstruation. The analysis has been carried out separately for the distribution of the duration of PPA following the birth of the last born child (current status reporting) and the last but one born child (retrospective status reporting). Some explanatory variables, which were interrelated, are excluded from the multivariate hazard modelling to avoid multicollinearity between the variables.

The effects of current age of mother and age of mother at the birth of child nullified their significant influence when controlled other covariates while parity of mother maintained its significant effects on PPA. However, there might be some multicollinearity existed between these variables. This study revealed a consistent results as previous studies showed a positive relationship between the duration of PPA and the length of birth interval^{1,3,5,7,18,19,20}. It is expected that, if the child is older, the duration of breastfeeding would have been longer, and consequently, the duration of PPA may be enhanced^{9,12}.

A number of researchers have argued that a better health of mother provides a better quality of breast milk as well as in more quantity, and if the mother feeds her child for longer duration, her length of PPA would be prolonged^{21,22}. It is anticipated that among mothers of higher socio-economic status probably demonstrate a good health, a better education and a better nutrition¹⁷. However, a reverse pattern has also been observed and a shorter duration of PPA was identified among healthy mothers²³. This study supported the hypothesis that better nutrition leads to an early resumption of the menstruation⁵. Fertility might be controlled at a great extent if amenorrheic period is lengthening especially in the population where a very low levels of contraceptive use rate^{24,25}. Most of the mothers who belong to low education and low socio-economic status are most

likely to have more children, and they are less likely to use family planning methods²⁶. In such mothers, the fertility can be regulated only by amenorrheic period. The variable education showed an inverse association with the duration of PPA¹⁷. A study argues that there is no any significant difference in the risk of returning menstruation among mothers who were employed with cash or without cash⁸. This study did not exhibit any difference on the duration of PPA by caste/ethnicity.

Retrospective versus current status reporting of PPA duration showed more or less similar results. Indeed, the difference between current and retrospective reporting data was insignificant⁵. Practically, it was noticed that the censored observations observed in the current status reporting data whereas there were no censored observations in the retrospective data. This study provided an opportunity to examine the duration of PPA in respect of last child (current status) as well as last but one child (retrospective status), which have broader thoughts on fertility behaviours. If there is a change in the duration of PPA over time, the current status data would catch the change immediately but the retrospective data would fail to do so²⁰. The reporting bias might be higher in the retrospective data due to recall lapse specially for those births, which occurred long back than that of the current status data^{3,9}. Of course, it is apparent that current status data may provide a better estimate of the duration of PPA than that of the retrospective data.

Conclusions

The determinants of the duration of post-partum amenorrhea of Nepalese mothers have been investigated in relation to the characteristics of mother and her child. Univariate analysis indicated that the parity, current age of mother and age of mother at the birth of the child, open birth interval, breastfeeding, education, occupation, survival status of the child and socio-economic status

of mothers were found to be significant differentials of PPA period. However, close birth interval, sex of the child and caste/ethnicity do not exhibit significant differentials on PPA duration.

Multivariate analysis suggested that those mothers who have higher parity experienced with longer duration of PPA. Over 55 per cent less risk of returned menstruation was found for those mothers whose closed birth interval was more than three years as compared to mothers' of close birth interval was a year and less. Education was found to be significantly related with the duration of PPA. About 1.5 times higher risk of returned menstruation early was found among educated mothers as compared to uneducated counter-part. The longer is the duration of BF the longer is the duration of PPA. The association between BF and PPA was found to be significant. However, working mothers' and residential status showed insignificant association with PPA duration. Indeed, about 15 per cent less risk of returned menstruation was found among working mothers as compared to that of the housewife. About twice times higher risk of returned menstruation was found among mothers who belong to the higher socio-economic status than that of the lower socio-economic counter-part. Survival status of the child showed a significant relationship with the duration of PPA. The effect of sex of the child on the duration of PPA did not provide any significant difference.

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References

1. Aryal TR. Retrospective reporting of the duration of post-partum amenorrhea: a survival analysis. Kathmandu University Medical Journal. 2006;4(2):211-7.
2. Aryal, TR. Post-partum amenorrhea among Nepalese mothers. Journal of Population and Social Studies. 2007;16(1):33-64.
3. Aryal TR. Some demographic models and their applications with reference to Nepal. PhD thesis, Banaras Hindu University, India. 2002.
4. Davis K, Blake J. Social structure and fertility: an analytical framework. Economic Development and Cultural Change. 1955;4(3):211-35.
5. Aryal TR. Pattern of post-partum amenorrhea in rural Nepal. National Conference on 'Data Analysis and Methodological Problems

in Populations Research'. Banaras Hindu University, Department of statistics, India. 2001.

6. Bongaarts J, Potter RG. Fertility, Biology and Behaviour: analysis of the proximate determinants of fertility. New York: Academic Press;1983.
7. Aryal, TR. An indirect technique to estimate the duration of post-partum amenorrhea. Nepal Journal of Science and Technology. 2007;8:137-41.
8. Islam MN, Islam MM. Biological and behavioural determinants of fertility in Bangladesh: 1975-1989. Bangladesh: Bangladesh Fertility Survey. 1989.p. 29-72.
9. Aryal TR. Breast-feeding in Nepal: patterns and determinants. Journal of Nepal Medical Association, 2007;46(1):13-9.
10. Ford K, Huffman S. Nutrition, infant feeding and post-partum amenorrhea in rural Bangladesh. Journal of Bio-social Science. 1988;20:461.
11. Salway S, Roy NC, Koenig MA, Cleland J. Levels and trends in post-partum amenorrhea, breastfeeding and birth intervals in Matlab Bangladesh. Asia-Pacific Population Journal. 1993;8(2):3-22.
12. Yadava KNS, Jain SK. Post-partum amenorrhea in rural eastern Uttar Pradesh, India. Journal of Bio-social Science. 1998;30:227-43.
13. Brewis AA, Regmi G. Post-partum amenorrhea differentials and patterning in a rural Pacific Island population. Brown University, USA: PSTC Working Paper Series 93-05;1993.
14. Rahman MM. Measurement of post-partum amenorrhea in Bangladesh. Journal of Bio-social Science. 1992;24(1):17-24.
15. Srinivasan K, Pathak KB, Pandey A. Determinants of breastfeeding and post-partum amenorrhea in Orissa. Journal of Bio-social Science. 1989;21(3):365.
16. Cox DR. Regression models and life tables (with discussion). Journal of Royal Statistical Society. Series B1972;34: 187-220.
17. Aryal, TR. Age at first marriage in Nepal: differentials and determinants. Journal of Biosocial Science 2007;39(5):693-706.
18. Amenuvegbe BE. Reproductive change in Ghana: evidence from two national surveys. Canberra: ANU; 1994.
19. Singh SN. Breastfeeding and its effect on fertility. Banaras Hindu University, India: Centre of the Population Studies; 1993.
20. Trussell J, Strawn LG, Rodriguez G, Vanlandingham M. Trends and differentials in

- breastfeeding behaviour: evidence from the WFS and DHS. *Population Studies*. 1992;46:285-307.
21. Ramachandran P. *Women and nutrition in India*. C. Gopalan, Kaur (editors). Delhi: Nutrition Foundation of India; 1989.
 22. Prema K, Naidu AN, Neelakumari S, Ramalakshmi BA. Nutrition - fertility interactions in lactating women from low income groups. *British Journal of Nutrition*. 1981;45:461-7.
 23. Lesthaeghe RJ, Page HJ. The post-partum non-susceptible periods: development and application of model schedules. *Population Studies* 1980;34(1):143-69.
 24. Aryal TR. Testing the suitability of Bongaarts technique in the context of fertility performance in Nepal. *Vision of ECOSS*. 2005. 2&3(2):19-24.
 25. Aryal TR. Measurement of wanted and unwanted fertility in Nepal: pattern and differentials. *Curriculum Development Journal*. 2005; 23(37):98-103.
 26. Aryal, TR. Differentials of post-partum amenorrhea: a survival analysis. *Journal of the Nepal Medical Association*. 2007;46(2):66-73.