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Post-partum Amenorrhea among Nepalese Mothers

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Introduction

Post-partum amenorrhea (PPA) is the period from the end of a women's pregnancy until the time that she begins to menstruate. It also refers the period after a pregnancy during which conception does not occur i.e. the period of infecundable (sterility) immediately following the termination of pregnancy in a live birth or a stillbirth or an abortion (Aryal, 2001, 2006a). It is considered as temporary infecundable period where the attainment of first menstruation after delivery is treated as the termination of PPA. Davis and Blake (1956) proposed a list of eleven key variables as intermediate variables that directly affect natural fertility. These intermediate variables were divided into three categories as intercourse, conception, and gestation. The biomedical, demographic and socio-economic factors identified as explanatory variables. These factors influence fertility through the intermediate variable. PPA is one of the conception variable affect natural fertility by lengthening the inter-live birth interval (Aryal, 2006a; Bongaarts and Potter, 1983).

In a society where contraception use rate is very low, the PPA plays a vital role in controlling fertility by lengthens the inter-birth interval (Aryal, 2004a, 2005a; Potter *et al*., 1965). It can be considered as the most powerful fertility inhibiting effect variable among other various components (Aryal, 2004b, 2005b). It is well-established fact that over 50 per cent of active reproductive life span of women may be spent in an amenorrheic state (Aryal, 2006a; Islam and Islam, 1993). Historical studies have shown the secular declining trends in the average duration of PPA over time (Rahman, 1992; Salway *et al*., 1993). However, it is influenced by various factors such as type of delivery, lactation, parity, age of mother and diet. PPA is highly correlated with the breastfeeding (Aryal, 2001, 2006a). Previous studies have shown that the duration of PPA is directly associated with age of mother and her parity (Ahamed, Kabir and Moslehuddin, 1988; Aryal, 2001, 2005a; Ford and Huffman, 1988; Srinivasan, Pathak and Pandey, 1989). The duration of PPA varies according to religion/caste/ethnicity, place of residence and socio-economic status of mother (Aryal, 2001; Brewis and Regmi, 1993; Islam, 2001; Trussell *et al*., 1992). Similarly, education of mother and her husband has an inverse association on the duration of PPA (Ahamed, Kabir and

Moslehuddin, 1988; Yadava and Jain, 1998). The length of PPA was lower for Muslim mothers than that of Hindu mothers (Huffman *et al.*, 1987). On the other hand it markedly varies from society to society according to socio-economic, cultural and demographic characteristics of mothers (Aryal, 2001, 2005c, 2006a; Bongaarts and Potter 1983; Sriniwasan, Pathak and Pandey, 1989). In view of these, this paper tries to investigate the differentials of PPA duration among Nepalese mothers in relation to the characteristics of mother and her child.

Distribution of PPA is complex where it may appear unimodal more often than a bimodal (Ford and Kim, 1987; Lesthaeghe and Page, 1980; Potter and Kobrin, 1981). Talwar (1965) suggested a triangular distribution as an approximation of the duration of PPA. Barret (1969) used modified Pascal distribution, which was generalized by Potter and Kobrin (1981). They also proposed a mixture of geometric and negative binomial distribution in order to describe the bimodality of PPA duration. Lesthaeghe and Page (1980) applied Logit model for describing the duration of PPA. Ford and Kim (1987) reviewed a number of models and finally they used a mixture of two type I extreme value distribution to describe the pattern of amenorrhea period. Biswas (1971) proposed a mixture of two Gamma distribution and following Singh and Bahaduri (1971) suggested a mixture of type III distribution for this purpose.

Several researchers have discussed the major problems for applying various distributions, and most of them have been found from Ford and Kim (1987) and Biswas (1971). Rahman (1992) has fitted a modified exponential curve to describe the pattern of PPA considering several marriage cohorts of Bangladeshi mothers. Sinha (1998) proposed inflated type I extreme value distribution to describe the pattern of PPA for Indian mothers. Yadava and Islam (1999) applied type I extreme value, inflated type I extreme value distributions and modified exponential curve for describing the duration of PPA by using national data of Bangladeshi mothers. Type I extreme value distribution and modified exponential curve has been found good approximation for the PPA duration of Bangladeshi mothers. But these studies do not take into account the serious problems regarding the estimation of the parameters and test of the goodness of fit of the used models. Since modified exponential curve is deterministic in nature, which was discussed by Yadava and Islam (1999). To check the suitability of these used distributions, researchers have taken the cumulative proportions of PPA distribution. However, testing of the goodness of fit and suitability of used distribution by such methods may lead to close approximation of observed and expected distributions in most of the cases, which was discussed by Aryal (2001, 2002). The conclusion drawn in

this way may have serious drawbacks for testing the suitability of the models, and finally that leads to wrong conclusions. Due to these limitations, in this paper, we have try to see whether these distributions are fitted well or not by using frequency distribution of PPA for Nepal data.

The information of PPA period was collected either from current or retrospective status reporting of mothers. A notable point is that most of the previous studies do not account the limitations of data. Current status data are contained censored observations and the PPA duration is open ended class interval in nature as well. Most of the studies so far have been done are based on the data of current status reporting of PPA period. Of course previous studies were neglected the limitations of the data. Due to these, this paper includes both type of reporting data (current status as well as retrospective status data) to study the PPA duration.

Adequate work has not been done yet in Nepal on the duration of PPA period for Nepalese mothers despite its direct relationship with fertility and mother's as well as her child health. This may perhaps be due to the lack of reliable data or the lack of interest among researchers. Thus the main aim of this paper is to investigate the differentials and distributions of the PPA. The differentials are studied in relation to a number of characteristics of mother and her child by using both current as well as retrospective reporting data. A survival analysis technique has been used to identify the differentials of PPA. The summary measures such as mean, median and trimean have been calculated. Since trimean gives a better estimate than other averages specially when data are censored and class interval is open ended (Islam and Islam, 1993; Tuckey, 1977). The distributional patterns have been studied through probability models. For this purpose, type I extreme value distribution, its inflated distribution and Weibull distribution have been fitted to the PPA data of Nepal. Moreover, amenorrheic life-table has been constructed with the help of the model. The possible explanations have been discussed.

The data

Data are taken from a sample survey entitled 'Demographic Survey on Fertility and Mobility (DSFM) 2000: A Study of Palpa and Rupandehi Districts of Western rural Nepal'. These districts lie in the Western Development Region, and are about 250 km. west of Katmandu, the capital city of Nepal. Rupandehi district falls in

the flat of the Gangetic plain (Tarai) while Palpa district falls in the Mountainous range of the hilly region. The data were collected from eight clusters, four clusters from each district. These clusters consisted of wards of the Village Development Committee (VDC), which is the lowest administrative unit. A VDC consists of nine wards. The clusters were randomly selected and completely enumerated. The survey schedule included questions on the household composition, facilities and belongings. The tool used for data collection was a self-administered questionnaire and it was largely structured. The representative nature of the sample is well-reflected in its demographic characteristics (Aryal, 2002, 2006a). A total of 811 households were surveyed. The information on fertility and related data were also collected from each household.

A sample of 1019 ever-married women of reproductive age was interviewed. Among them the resumption of the menstruation was collected from each and every ever-married woman 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. If the answer was no, the age of the last live birth was determined. If the answer was yes, the mother was asked how many months after birth menstruation resumed. Similarly, mothers were asked for their last but one birth. A total of 642 mothers provided information on the duration of PPA for their last birth child (current status reporting) who had given at least one birth in the last 7 years preceding the survey date, of whom about 85 per cent (544 mothers) reported that their menstruation had returned and rest of 15 per cent (98 mothers) were still amenorrheic at the date of interview which were considered as the censored cases. A total of 481 mothers provided information on the duration of PPA for their last but one child (retrospective reporting) who had given birth during last 7 years. Finally 544 mothers were provided the current status reporting data of PPA period while 481 mothers were provided the retrospective reporting of PPA period. In addition to this, information on socio-economic, demographic and cultural characteristics of mother was also collected.

Dependent Variable: - The duration of post-partum amenorrhea (PPA) is considered as the dependent variable. It has also contained some censored cases. PPA duration is measured in completed months. The duration of amenorrhea is grouped into the intervals of 0-3, 4-7, 8-11, 12-15, 16-19, 20-23 and 24 and above months. i.e. in seven categories.

Independent Variables:- The independent variables, all measured at the survey date, are grouped into three categories: demographic, socio-economic and

cultural variables. Demographic variables included as parity of mother (PARITY), current age of mother (AGEMOTH), age of mother at the birth of child (AGEMOTHCHB), breastfeeding duration in months (BF), birth interval (BINTERVAL), current age of child (AGECH), survival status of child (SURVCH), and sex of child (SEXCH).

Socio-economic variables 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). Cultural variable is included as caste/ethnicity (CASTE). The categories of the variables are presented in Tables 1&2. The details of the measurement of these variables and data are found in Aryal (Aryal, 2002, 2006b).

Methodology

For the bivariate analysis, the duration of PPA was grouped into the intervals of 0-3, 4-7, 8-11, 12-15, 16-19, 20-23 and 24 and above months i.e. in seven categories. All other variables have been grouped into categories as shown in Tables 1&2. The association of the duration of PPA with each variable included in this study is first checked by the chi-square statistic in a two-way tabulation (Tables 1&2 in last column). Chi-square statistic has also been used to test the goodness of fit of the model as well as to test the significance of the explanatory variables.

Life table technique

Differentials of PPA duration are investigated by using survival analysis according to the characteristics of mother and her child. For this, life table technique is utilized to derive the survival distribution of the duration of PPA by incorporating the complete as well as censored cases. In brief, the conventional life table and used symbols are given below.

Let n_t is the number of survivors (not returned amenorrheic period) at exact t months, d_t is the number of failures (returned amenorrheic period) during the interval t to t+1, and c_t is the number of censored cases during the interval t to t+1. q_t be the

estimated probability of returned menstruation during the interval t to t+1. Then by usual definition, the probability of returning to menstruation q_t, can easily be estimated.

$q_t = \frac{d_t}{n_t}$, in case of the absence of censoring cases, and

$q_t = \frac{d_t}{(n_t - \frac{c_t}{2})}$, in case of the presence of censoring cases (Aryal and Yadava, 2005).

where $n_{t+1}=(n_t - d_t)$ in the absence of censoring cases, and $n_{t+1}=(n_t - d_t - c_t)$ in the presence of censoring cases. S_t is the estimated probability of surviving mothers (probability of not having menstruation after delivery) during interval t to t+1.

Then by definition, $S_t = \frac{l_t}{l_0}$; when $l_0=1$ and $S_t=l_t$

So, S_t and l_t are identical. It follows that

$S_{t+1} = l_{t+1} = l_t(1-q_t) = l_t \,.\, p_t = S_t \,.\, p_t$

Since n_{t+1} is same as l_{t+1} in the conventional life table. Once we know q_t, the other columns of the life table can easily be calculated. Various summary measures like mean, median and trimean based on the survival analysis are also calculated as following relation.

Simply the trimean is calculated as $T = \frac{q_1 + 2q_2 + q_3}{4}$ where q_i (i =1, 2, 3) is the i^{th} quartile of the distribution (Aryal, 2001). However, trimean gives a better estimate of PPA duration than other averages specially when data are censored and class interval is open ended (Islam and Islam, 1993; Tuckey, 1997).

The probability models for post-partum amenorrhea

The patterns of PPA duration among Nepalese mothers are studied through probability models. For this, type I extreme value distribution and inflated type I extreme value distribution have been discussed. In brief the description of these distributions and estimation technique of parameters is given below.

Type I extreme value distribution

If X denotes the length of amenorrhea, then the probability density function of type I extreme value distribution is

$$f(x) = \exp\left[-\left(\frac{x-\alpha}{\beta}\right) - \exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right]/\beta, \quad \text{for } x=0, 1, 2\ldots\ldots \tag{1}$$

where α is the location parameter and β is the scale parameter of the distribution. The cumulative distribution function of equation (1) is given as

$$F(x) = p(X \le x) = \exp\left[-\exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right] \quad \text{for } x=0, 1, 2, \ldots\ldots \tag{2}$$

Let X_i (i = 1,2, ..., N) denote the length of amenorrhea period of i^{th} mother, and N_j, sample size (j=1,2, ..., n) be the observed frequency of mother having exactly 'j' months of amenorrhea. Hence X_i be a random sample of size N, i.e. $\sum_{j=1}^{n} N_j = N$, and then the likelihood function is given by

$$L(\alpha, \beta) = \frac{N!}{\prod_{j=1}^{n} N_j!} \prod_{j=1}^{n} p_j^{N_j} \tag{3}$$

where $p_j = p[X = x_j]$

Taking logarithm both sides of equation (3) we get,

$$\log L = \log L(\alpha, \beta) = \log N! - \sum_{j=1}^{n} \log N_j! - \sum_{j=1}^{n} N_j \left[\log\beta + \left(\frac{x_j-\alpha}{\beta}\right) - \exp\left\{-\left(\frac{x_j-\alpha}{\beta}\right)\right\}\right]$$

Solving $\frac{\delta}{\delta\alpha}\log L = 0$ then, we have,

$$\hat{\alpha} + \hat{\beta}\log\left[\sum_{j=1}^{n} N_j \exp\left\{-\left(\frac{x_j}{\hat{\beta}}\right)\right\}/N\right] = 0 \tag{4}$$

and from $\frac{\partial}{\partial\beta}\log L = 0$, we get ,

$$\hat{\beta} - \frac{\sum_{j=1}^{n} N_j x_j}{N} + \frac{\sum_{j=1}^{n} N_j x_j \exp\left(-\frac{x_j}{\hat{\beta}}\right)}{\sum_{j=1}^{n} N_j \exp\left(-\frac{x_j}{\hat{\beta}}\right)} = 0 \tag{5}$$

$\hat{\beta}$ is to be estimated from the equation (5) by using Newton-Raphson iteration procedure (Scarborough, 1966), and by substituting estimated value of β in equation (4), α is to be easily estimated.

Inflated type I extreme value distribution

The mis-conception between the post-partum bleeding and the resumption of menstrual cycle causes a heaping usually at first month in PPA period (Aryal, 2001; Yadava and Jain, 1998). This may frequently occur among illiterate mothers especially in the developing countries like Nepal. In such situation, type I extreme value distribution failed to provide the better fit to the data of PPA. Keeping this view in mind, inflated type I extreme value distribution has been applied so far. A brief description of this distribution is given below.

Let X denotes the length of amenorrhea then an inflated type I extreme value distribution is defined as

$$f(x) = \begin{cases} (1-k) + k\exp\left[-\left(\frac{x-\alpha}{\beta}\right) - \exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right]/\beta \; ; & 0 \le x \le 1 \\ k\exp\left[-\left(\frac{x-\alpha}{\beta}\right) - \exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right]/\beta \; ; & x > 1 \end{cases} \quad (6)$$

where k, α and β are parameters of inflated type I extreme value distribution.

Here the first cell is just inflated by the proportion of (1-k) mothers, which may be caused by the heaping of the proportion of mothers reported their PPA period within a month. Hence, corresponding cumulative distribution function of amenorrheic mothers for X months or less is given as

$$F(x) = \begin{cases} (1-k)x + k\exp\left[-\exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right] \; ; 0 \le x \le 1 \\ (1-k) + k\exp\left[-\exp\left\{-\left(\frac{x-\alpha}{\beta}\right)\right\}\right] \; ; x > 1 \end{cases} \quad (7)$$

The parameters are estimated using moment method by equating the theoretical first and second moments to the respective observed values and the proportion of mothers in the first cell to the theoretical proportion. These expressions are given below.

$$E(x) = \frac{1-k}{2} + k(\alpha + 0.5772\beta) \quad (8)$$

The factor, 0.5772, can be computed from incomplete Gamma function and computed by several researchers (Aryal, 2001; Harter and Moore, 1967; Johnson and Kotz, 1970, Sinha, 1998).

$$E(x^2) = \frac{1-k}{3} + k\left[\frac{\pi^2\beta^2}{6} + (\alpha + 0.5772\beta)^2\right] \quad (9)$$

$$\text{and } \frac{N_1}{N} = (1-k) + k\exp\left[-\exp\left\{-\left(\frac{1-\alpha}{\beta}\right)\right\}\right] \quad (10)$$

where E(x) and $E(x^2)$ are the observed first and second order moment of the random variable X. N_1 and N are the number of mothers in the first cell and total number of mothers respectively. It is noted that if the estimated value of k falls outside the range of [0, 1], then the concept of inflation will be in discrepancy and needs for further clarification.

Weibull distribution

Type I extreme value distribution and its inflated distributions have been applied to the PPA data of Nepal. Chi-square value suggests that these distributions do not fit well to the data of Nepal (Tables 3&4 in columns 3&4). Hence, Weibull distribution has been proposed to describe the distribution of PPA for Nepal data. In brief, the model is given below.

If X denotes the length of amenorrhea period, then the probability density function of Weibull distribution is given by

$$f(x) = \beta\alpha^{-1}\{(x-\xi_0)/\alpha\}^{\beta-1}\exp\left[-\{(x-\xi_0)/\alpha\}^{\beta}\right] \quad (11)$$

and the corresponding cumulative probability distribution function is given as

$$F(x) = 1 - \exp\left[-\{(x-\xi_0)/\alpha\}^{\beta}\right] \quad (12)$$

where α and β are the scale and location parameters of the Weibull distribution respectively.

The parameters are estimated by least square methodology. On simplification of equation (12) and by taking double log both sides, we get

$$\log\left[\log\left\{\frac{1}{1-F(x)}\right\}\right] = \beta\log(x-\xi_0) - \beta\log\alpha \quad (13)$$

This is linear function and can be re-written in the form of

$Y=A+\beta X$ for $\beta>0$, (14)

Where, $Y=\log\left[\log\left\{\frac{1}{1-F(x)}\right\}\right]$, $A=-\beta\log\alpha$ and $X=\beta\log(x-\xi_0)$.

A and β can easily be estimated from equation (14). If we assume ξ_0=0, then other parameters have easily been obtained by using least square principle. The validity of the standard Weibull distribution has been discussed in different literatures for assuming the value of ξ_0=0 and α =1 (Aryal, 2001; Johson and Kotz, 1970). Here we assumed that ξ_0=0 for the approximation of the duration of PPA for Nepalese mothers.

Construction of amenorrheic life-table

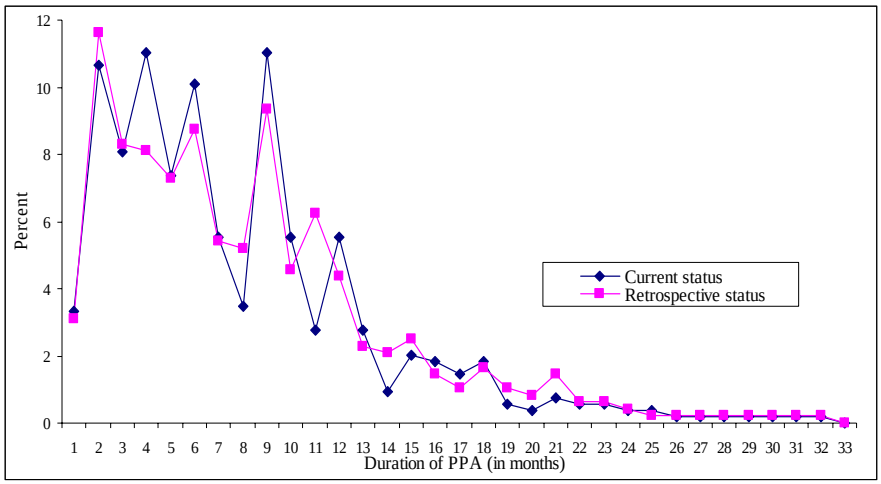
Let M_t be the proportion of mothers who were terminating amenorrheic period at t months or less. S_t be the proportion of surviving (not terminating amenorrheic period) at t months (S_t= 1-M_t). If l_o is the cohort of the life table, then $l_t=l_o*S_t$ and the probability of terminated amenorrheic period between t and t+1 months is $q_t=\frac{(M_{t+1}-M_t)}{(1-M_t)}$. The other functions of the amenorrheic life-table, L_t (person-months returned amenorrheic period by the cohort at exact t month), T_t (total person-months terminating amenorrheic period by the cohort after exact t months) and e_t (average number of months expected to return menstruation at exact t months) are computed by the usual process followed in the construction of a life-table (Aryal, 2002; Namboodiri and Suchindran, 1987).

Results

The percentage distribution of the duration of PPA by current as well as retrospective status reporting data is presented in Figure 1. Figure clearly shows a heaping at the multiple of three months in the duration of PPA period among Nepalese mothers. The heaping of the duration of PPA is similar trends for both the reporting data. However, current status data showed peaked curve than retrospective reporting data. Only three per cent mothers were reported their PPA duration less than a month. About 14, 40 and 60 per cent mothers were reported their PPA duration before three, six and nine months respectively. Three fourth mothers had reported their PPA period before a year, and about 88 and 97 per cent mothers had reported their PPA period

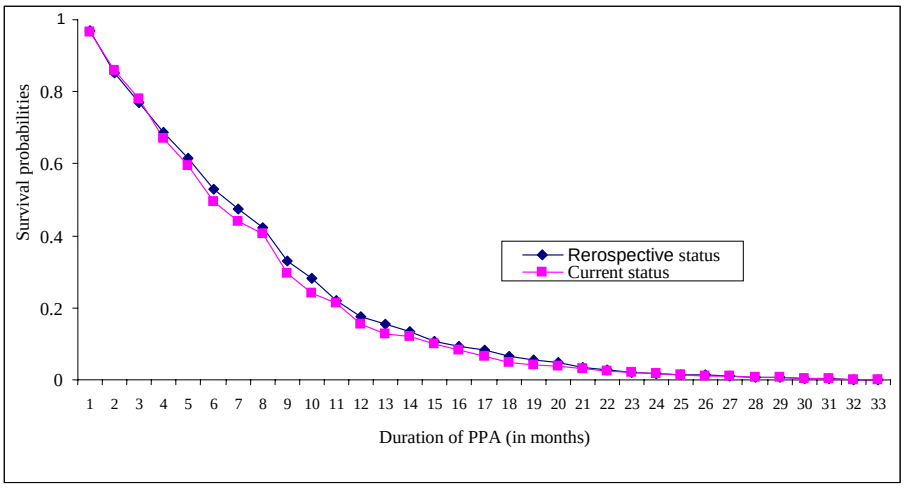
before 18 and 24 months respectively, and the rest of three per cent mothers had experienced their PPA period after two years (Tables 1&2).

Figure 1
Percentage distribution of the duration of PPA



The survival curve of PPA duration by current and retrospective status reporting data is given in Figure 2. Survival curve clearly indicates that retrospective reporting data provided higher probability of survival of PPA duration than current status data. The survival probability of PPA duration declines steeply and goes down until 12 months, and thereafter it declines with very slow pace. The summary measures like mean, median and trimean are computed to see the differentials of the duration of PPA period. Since the nature of PPA current status reporting data are contained censored cases as well as open-ended class interval, the trimean is the most appropriate measure for computing average duration of PPA. For comparison, mean and median duration of PPA are also computed. The mean, median and trimean of the duration of PPA were found to be 10.4, 8.4 and 9.2 months for current status reporting data whereas 10.6, 8.8 and 9.4 months for retrospective status data respectively (Tables 1&2).

Figure 2
Survival distribution of PPA



PPA in relation to demographic variables

The results of survival analysis are presented in Table 1. The life table estimates of the proportion of mothers who terminated their PPA at specific duration (in months) according to the characteristics of mother and her child are estimated. The analysis indicated that parity of mother, current age of mother and age of mother at the birth of the child were found to be significantly related with the distribution of PPA. The trimean duration of PPA was found to be higher among mothers of higher parity, higher age of mother, and higher age at birth of the child. The trimean of PPA was found to be eight months for mothers aged 24 years or less, and it increased gradually reaching thirteen months among mothers aged 35-49 years.

Younger mothers have had lower PPA duration than that of older mothers. The effect of the age of mother at the birth of child on the duration of PPA has a similar pattern as that of the current age of mother. This is indicative that older mothers with higher parity have had larger PPA duration than younger mothers with having lower parity. Similarly, the trimean of the duration of PPA period increased from of 7.3 months for mothers of parity 1-2 to 12.5 months for mothers of parity 7 and above. Lower parity mothers were higher chance of terminating PPA duration early than that of the higher parity mothers.

Table 1: Results of Survival Analysis of PPA duration according to the demographic characteristics of mother and her child

Data group	Categories	Non-censored cases(%)	Censored cases(%)	% terminating of PPA up to months					Mean	Median	Trimean	χ^2
	PARITY			**6**	**12**	**18**	**24**	**30**				
Last child (current status)	1-2	86.8	13.2	45.8	79.2	98.5	98.9	99.8	8.9	6.3	7.3	169.0
	3-4	84.5	15.5	42.6	77.5	95.6	98.2	99.1	11.4	9.9	10.3	df=18
	5-6	83.2	16.8	38.9	76.2	92.1	98.0	99.1	12.5	12.7	12.3	p=.00
	7+	82.1	17.9	35.4	70.9	89.4	97.5	98.9	12.8	12.7	12.5	
Last but one (retrospective status)	1-2	100.0	0.0	42.3	81.9	95.8	99.1	99.9	8.8	5.9	7.1	63.2
	3-4	100.0	0.0	39.1	78.6	92.7	98.5	100.0	11.0	9.7	10.0	df=18
	5-6	100.0	0.0	36.2	75.3	90.2	98.2	100.0	12.1	12.1	11.7	p=.00
	7+	100.0	0.0	34.4	70.9	79.1	98.2	100.0	11.8	11.2	11.1	
	AGEMOTH											
Last child (current status)	<25	80.5	19.5	44.1	80.2	97.1	99.9	99.9	9.0	6.6	7.6	175.5
	25-34	86.3	13.7	40.0	78.4	92.2	97.8	99.9	11.3	9.9	10.2	df=12
	35-49	87.6	12.4	38.7	75.2	90.0	97.6	99.8	12.8	12.5	12.5	p=.00
Last but one (retrospective status)	<25	100.0	0.0	43.1	79.9	96.6	99.1	100.0	9.4	6.8	7.9	39.8
	25-34	100.0	0.0	37.3	76.8	92.5	98.7	99.6	11.5	10.8	10.8	df=12
	35-49	100.0	0.0	36.0	75.3	89.9	96.9	99.8	12.0	12.0	11.5	p=.00
	AGEMOTHCHB											
Last child(current status)	<25	85.8	14.2	45.1	81.2	97.3	99.9	100.0	9.7	7.4	8.3	72.5
	25-34	84.2	15.8	41.0	77.4	91.9	98.7	99.9	11.5	10.2	10.5	df=12
	35-49	83.5	16.5	37.7	74.2	91.0	97.9	99.8	12.4	12.2	12.2	p=.00
Last but one (retrospective status)	<24	100.0	0.0	42.9	80.1	96.9	99.3	99.9	10.1	7.7	8.7	26.2
	25-34	100.0	0.0	38.3	76.4	92.4	98.9	99.8	11.8	11.6	11.3	df=12
	35-49	100.0	0.0	36.4	75.9	90.0	96.6	99.8	11.8	11.7	11.2	p=.03
	BF											
Last child (current status)	0-6	84.1	15.9	78.4	89.8	97.8	99.8	100.0	6.2	2.0	3.9	
	7-12	89.5	10.5	56.8	83.3	96.1	98.5	99.9	7.9	5.9	6.8	
	13-18	95.0	5.0	34.5	75.3	89.5	98.1	99.9	11.1	10.7	10.5	987.2
	19-24	98.8	1.2	35.9	59.3	89.5	96.9	96.2	12.8	12.1	12.2	df=48
	25-30	98.8	1.2	33.4	54.1	79.6	98.4	96.0	13.3	13.1	12.8	p=.00
	31-36	98.9	1.1	32.1	45.1	77.2	98.2	98.9	13.0	13.2	13.0	
	37-42	100.0	0.0	30.2	41.3	65.1	87.8	96.9	13.6	14.2	14.0	
	43-48	100.0	0.0	29.4	40.2	63.7	86.2	94.1	12.8	14.4	13.4	
	49+	100.0	0.0	28.6	43.1	57.1	85.7	94.1	13.3	10.5	12.0	
Last but one (retrospective status)	0-6	100.0	0.0	77.8	88.7	95.9	99.3	99.9	6.1	4.1	4.2	
	7-12	100.0	0.0	58.8	81.3	95.4	98.9	99.9	7.4	5.4	6.3	
	13-18	100.0	0.0	33.5	73.3	87.7	98.8	99.8	9.8	8.9	9.1	264.0
	19-24	100.0	0.0	34.9	58.6	86.9	96.5	96.4	12.0	12.1	11.6	df=48
	25-30	100.0	0.0	32.3	53.6	77.6	96.4	96.2	13.6	13.8	13.3	p=.00
	31-36	100.0	0.0	32.6	44.8	75.1	94.5	98.4	13.7	13.7	13.3	
	37-42	100.0	0.0	30.6	40.8	64.2	87.8	95.9	11.5	6.86	8.8	
	43-48	100.0	0.0	29.9	39.9	62.1	87.1	94.6	14.6	14.0	14.5	
	49+	100.0	0.0	28.0	42.8	54.9	85.1	93.1	12.0	6.0	9.0	
	BINTERVAL											
Last child (current status)	0-11	33.3	66.7	62.5	81.8	96.9	98.9	99.9	4.9	3.9	3.9	1152.8
	12-23	70.4	29.6	48.9	72.3	92.7	98.1	100.0	8.9	8.0	8.4	df=24
	24-35	91.1	8.9	38.1	67.5	85.0	90.1	95.8	12.4	12.2	12.0	p=.00
	36-47	98.4	1.6	33.6	58.0	78.7	83.9	97.9	12.6	17.0	15.2	
	48+	98.8	1.2	36.7	48.8	70.5	82.1	96.7	12.3	17.2	15.0	
Last but one (retrospective status)	0-24	100.0	0.0	58.9	78.3	97.7	98.9	100.0	9.8	8.0	8.7	98.6
	24-35	100.0	0.0	37.1	77.5	89.0	98.0	100.0	11.7	11.0	11.0	df=18
	36-47	100.0	0.0	35.6	68.0	78.7	93.1	96.8	12.8	13.2	12.6	p=.00
	48+	100.0	0.0	34.7	48.8	70.5	83.9	96.7	9.6	6.9	8.0	

Table 1: (Continued)

Data group	Categories	Non-censored cases(%)	Censored cases(%)	% terminating of PPA up to months					Mean	Median	Trimean	χ^2
	PARITY			6	12	18	24	30				
	SEX											
Last child	Male	84.6	15.4	41.1	79.2	94.1	98.9	99.9	10.5	8.7	9.3	6.2, df=6
(current status)	Female	84.9	15.1	40.2	78.1	94.2	98.6	99.9	10.3	8.2	9.0	p=.58
Last but one	Male	100.0	0.0	38.3	77.8	92.3	98.5	99.9	10.5	8.5	9.2	1.29
(retrospective	Female	100.0	0.0	38.9	79.0	92.2	98.4	99.8	10.7	9.1	9.6	df=6
status												p=.99
	CHALIVE											
Last child	Alive	83.2	16.8	30.0	55.2	72.4	85.7	94.4	10.7	9.1	9.6	129.9
(current status)	Dead	84.8	5.2	69.4	83.5	97.5	99.8	100.0	6.6	4.2	4.7	df=6
												p=.00
Last but one	Alive	100.0	0.0	31.0	53.2	71.4	84.7	93.4	11.4	11.4	11.0	120.0
(retrospective	Dead	100.0	0.0	67.4	81.5	96.5	99.8	100.0	6.4	4.4	4.9	df=6
status)												p=.00

The trimean of PPA increased with increase in the parity of mothers. The trimean of PPA increased from a minimum of 3.9 months in low breastfeeding category of 0-6 months to a maximum of 12.0 months in the breastfeeding category of 19-24 months, and thereafter remains constant PPA duration with increases the duration of breastfeeding. The percentage increment of terminating PPA period early was found among mothers of lower duration of breastfeeding than that of the higher duration of breastfeeding. The higher duration of PPA was found with higher duration of BF. Chi-square value suggests that a positive and strong association was found between the duration of PPA and breastfeeding.

This study showed that the trimean of PPA duration varied according to birth intervals. Over four months of PPA period was found among mothers of birth interval one year or less whereas eight months PPA duration was found among mothers of birth interval 12-23 months. About 34 per cent mothers were terminated PPA before six months whose birth interval was 36-47 months whereas 67 per cent were terminated PPA before six months whose birth interval was less than 11 months. The increased duration of PPA was found with increase in the birth interval. Chi-square value indicates that the association between birth interval and duration of PPA was found to be significant. The effect of sex of the child on the duration of PPA did not provide any significant difference. The survival status of the child had showed a strong effect on the duration of PPA. A very low increment of terminating PPA period was found for mothers of alive child than that of mothers of dead child. About 30, 72 and 94 per cent mothers were terminated their PPA period before 6, 18 and 30 months respectively for mothers of alive child whereas 69, 98 and 100 per cent mothers were terminated their

PPA among mothers of dead child. The longer duration of PPA was found among mothers who have not experienced child loss (9.6 months) than who have experienced child loss (4.9 months). The PPA duration and survival status of the child was found to be significantly associated.

PPA in relation to socio-economic and caste/ethnicity variables

Table 2 provides the differentials of PPA duration in relation to socio-economic and caste/ethnic characteristics of mother and her child. The educational attainment of mothers shows an inverse association with the duration of PPA. About 29, 79 and 96 per cent mothers were terminated their PPA period before 6, 18 and 30 months respectively among illiterate mothers whereas 68, 98 and 100 per cent mothers were terminated their PPA period among educated mothers. The trimean of PPA duration was eleven months among illiterate mothers whereas about five months among educated mothers. The higher is the educational attainment the lower is the duration of PPA was observed.

Table 2: Results of Survival Analysis of PPA duration according to the socio-economic and caste/ethnic characteristics of mother and her child

Data group	Categories	Non-censored cases(%)	Censored cases(%)	% terminating of PPA up to months					Mean	Median	Trimean	χ^2
	EDUMOTH			**6**	**12**	**18**	**24**	**30**				
Last child (current status)	Illiterate	81.8	18.2	29.2	59.6	78.6	83.3	96.3	11.6	10.7	10.7	172.1
	Primary	85.0	15.0	39.7	76.3	79.8	87.5	98.3	9.9	7.7	8.6	df=18
	Mid-high school	85.6	14.4	52.7	82.0	89.9	98.8	99.9	8.3	5.6	6.6	p=.00
	Inter and above	88.5	11.5	67.7	85.6	97.9	99.5	100.0	5.8	4.3	4.6	
Last but one (retrospective status)	Illiterate	100.0	0.0	32.6	51.8	79.7	88.0	97.9	11.3	10.5	10.6	55.8
	Primary	100.0	0.0	50.0	62.5	78.2	89.1	99.9	9.6	6.0	7.6	df=18
	Mid-high school	100.0	0.0	55.8	77.1	86.6	97.3	100.0	8.6	6.4	7.1	p=.00
	Inter and above	100.0	0.0	57.2	79.2	96.3	99.8	99.9	8.0	5.8	6.8	
	EDUHUSBN											
Last child (current status)	Illiterate	81.1	18.9	28.3	59.9	77.9	84.3	95.3	11.7	11.0	10.9	198.9
	Primary	83.2	16.8	38.7	77.3	79.8	87.5	97.9	10.5	8.5	9.2	df=18
	Mid-high school	85.5	14.5	54.7	81.1	90.0	97.8	99.9	9.1	6.1	7.4	p=.00
	Inter and above	90.3	9.7	68.7	84.6	97.7	98.5	99.9	6.9	4.8	5.4	
Last but one (retrospective status)	Illiterate	100.0	0.0	31.6	50.8	78.9	87.9	97.9	11.5	10.8	10.8	50.0
	Primary-	100.0	0.0	49.6	60.5	79.2	89.5	99.9	10.0	7.3	8.5	df=18
	Mid-high school	100.0	0.0	56.8	78.1	85.6	96.9	99.9	9.0	6.3	7.4	p=.00
	Inter and above	100.0	0.0	56.9	79.2	96.9	98.8	100.0	8.7	5.6	6.9	

Table 2: (Continued)

Data group	Categories	Non-censored cases(%)	Censored cases(%)	% terminating of PPA up to months					Mean	Median	Trimean	χ^2
	EDUMOTH			**6**	**12**	**18**	**24**	**30**				
	WORKMOTH											
Last child (current status)	Household work	87.2	12.8	39.9	79.2	94.8	98.9	99.5	11.5	12.2	10.9	78.6
	Employed work	80.9	19.1	40.8	78.0	93.9	98.3	99.7	11.0	9.5	9.9	df=6 p=.00
ast but one retrospective tatus)	Household work	100.0	0.0	37.8	78.2	92.6	98.3	99.9	10.1	7.9	8.7	20.2
	Employed work	100.0	0.0	39.78	77.5	91.9	98.5	99.9	11.7	11.4	11.2	df=6
	OCUHUSBN											
Last child (current status)	Agri. & labour	77.7	22.3	36.7	76.2	90.1	96.2	98.5	11.3	10.3	10.5	103.2
	Service	81.2	18.8	38.9	77.9	94.0	97.8	99.6	10.7	8.6	9.4	df=12
	Others (business, abroad, etc.)	88.5	11.5	42.7	79.8	96.2	99.2	99.9	7.3	4.8	5.5	p=.00
Last but one(retrospectiv e status)	Agri. & labour	100.0	0.0	34.2	74.2	89.3	95.4	98.7	11.0	9.5	10.0	27.4
	Service	100.0	0.0	36.9	77.6	92.1	96.9	98.8	10.4	8.5	9.2	df=12
	Others (business, abroad, etc.)	100.0	0.0	40.7	78.8	95.9	98.7	99.9	9.3	7.9	8.4	p=.49
	SOECOHH											
Last child (current status)	Low	75.9	24.1	29.2	71.0	79.2	98.2	98.9	10.6	11.3	11.2	123.7
	Middle	82.1	17.9	38.0	76.5	91.5	98.6	99.0	10.2	8.1	8.9	df=12
	High	87.3	12.7	59.3	82.1	96.8	99.9	99.9	6.9	4.9	5.6	p=.00
Last but one (retrospective status)	Low	100.0	0.0	28.7	69.8	75.7	95.9	97.9	11.7	11.2	11.0	48.3
	Middle	100.0	0.0	37.2	70.2	88.4	98.3	99.2	10.0	7.6	8.6	df=12
	High	100.0	0.0	55.7	80.9	96.1	98.9	99.9	7.0	5.0	5.8	p=.00
	RES											
Last child (current status)	Tarai	88.2	11.8	44.3	80.3	96.2	99.8	100.0	8.4	5.6	6.7	35.2
	Hills	76.8	24.2	38.5	76.2	91.4	97.5	98.9	10.8	9.2	9.7	df=6 p=.00
Last but one (retrospective status)	Tarai	100.0	0.0	43.2	79.9	95.8	99.4	100.0	9.6	5.8	7.4	16.9
	Hills	100.0	0.0	36.8	76.6	89.9	97.4	99.2	10.7	9.1	9.6	df=6 p=.02
	CASTE											
Last child (current status)	Brahmin	86.5	16.5	41.2	78.8	96.8	98.6	99.3	10.5	8.4	9.2	35.1
	Chhetry	85.3	14.7	38.8	75.8	86.1	96.2	97.9	9.9	8.6	9.2	df=12
	Dalits/ethnics	86.8	13.2	40.6	79.8	93.8	98.8	100	5.6	5.4	7.5	p=.01
Last but one (retrospective status)	Brahmin	100.0	0.0	40.3	79.2	96.2	98.5	98.9	10.6	8.7	9.4	33.6
	Chhetry	100.0	0.0	35.0	75.1	84.9	90.7	97.4	10.6	9.6	9.7	df=12
	Dalits/ethnics	100.0	0.0	39.5	80.0	91.8	98.1	100.0	6.6	5.0	5.8	p=.00
Current status data-	Total	84.7	15.3	40.44	78.86	94.12	98.71	99.63	10.4	8.4	9.2	
Retrospective status-	Total	100.00	0.0	38.46	77.96	92.31	98.54	99.98	10.6	8.8	9.4	

The chi-square value also suggested that a statistically significant association was found between educational attainment of mothers and their PPA duration. A lower duration of PPA (9.9 months) was found among employed mothers than housewife (10.9 months). However, husband's occupation showed a strong association with the duration of PPA. The PPA duration was found longer among husband engaged in agricultural and labourer (10.5 months) than that of engaged in white-collar job (9.4

months) and business & abroad (5.5 months). The association between occupations and PPA duration was found significantly related.

Over 44 and 96 per cent mothers were terminated their PPA before 6 and 18 months respectively those mothers who residing in *Tarai* whereas 39 and 91 per cent mothers were terminated their PPA those mothers who residing in *Hills. Tarai* mothers have had shorter duration of PPA (6.7 months) than *Hills* mothers (9.7 months). The socio-economic status has showed its significant effect on the duration of PPA. Over 29, 79 and 99 per cent mothers were terminated PPA before 6, 18 and 30 months respectively among mothers belong to low socio-economic status whereas 59, 97 and 100 per cent mothers were terminated PPA among mothers of high socio-economic counter-parts. Mothers belong to higher socio-economic status had experienced shorter duration of PPA (5.6 months) than that of lower socio-economic counter-parts (11.2 months). The decreased duration of PPA was found with increases the level of socio-economic status of the households. The duration of PPA in respect to caste category was found significantly difference. However, the PPA period does not differ much among Brahmin and Chhetri castes whereas Dalits (Kami, Sarki, Sunar, Damai, including occupational castes)/ethnics (Tamang, Gurung, Magur, Tharu, Chaudhary) castes have had very low PPA duration (7.5 months) than that of Brahmin (9.2 months) and Chhetri (9.2 months) caste groups.

Application of the models

The observed distribution of PPA duration showed bimodality at 3-6 months and 9-12 months for both the data sets (Figures 3&4). Type I extreme value distribution and its inflated extreme value distribution have been applied to describe the distribution of the duration of PPA for Nepal data. The goodness of fit of the models has been tested by chi-square test. The type I extreme value distribution and its inflated distributions do not fit well for Nepal data (Tables 3&4 in columns 3&4). Figures 3 and 4 clearly indicate the discrepancy between the fittings of observed and expected duration of PPA provided by both the distributions. However, these models were found to be good fit to the data of Indian and Bangladeshi mothers (Sinha, 1998; Ydava and Islam, 1999).

A large discrepancy was found between the observed and expected distribution of PPA from type I extreme value and its inflated distributions. Then Weibull distribution has been proposed to describe the distribution of PPA for Nepalese mothers. Since Weibull distribution and inflated type I extreme value distributions have

three parameters while two parameters in type I extreme value distribution. In Weibull distribution, we assumed ξ_0 =0 as indicated that the minimum value of the duration of PPA (in months) is almost equal to zero where menstruation may be returned at the time of delivery. That is why we assumed that the duration of PPA begins with zero-month. So that we kept one parameter of the distribution as ξ_0 =0 in case of Weibull distribution.

Table 3: Observed and expected distribution of PPA for current status reporting data

PPA (in months)	Obs. No. of mothers	Expected No. of mothers		
		Type I extreme value	Inflated type I extreme value	Weibull
00-01	18	8.76	18.07	17.03
01-03	58	29.66	28.59	69.18
03-06	144	103.66	101.57	128.15
06-09	104	134.16	132.36	115.98
09-12	105	110.16	109.07	86.71
12-15	50	71.54	70.65	57.71
15-18	33	41.00	40.43	34.08
18-21	13	22.08	21.72	18.72
21-24	12	11.51	11.30	9.54
24-27	3	5.91	5.79	5.03
27-30	2	3.01	2.94	2.33
30-33	2	1.52	1.49	1.03
Total	544	544.00	544.00	544.00
χ^2		66.96	72.45	12.41
d.f.		7	6	6
Parameters		α =7.3098 β=4.3890	α =7.3350 β=4.3750 k=0.9809	α =9.4150 β=1.5369 ξ_0 =0

$\chi^2_{(0.05,6)}$ = *12.59* *and* $\chi^2_{(0.05,7)}$ = *14.07*

Figure 3

Observed and expected distribution of PPA for current status data

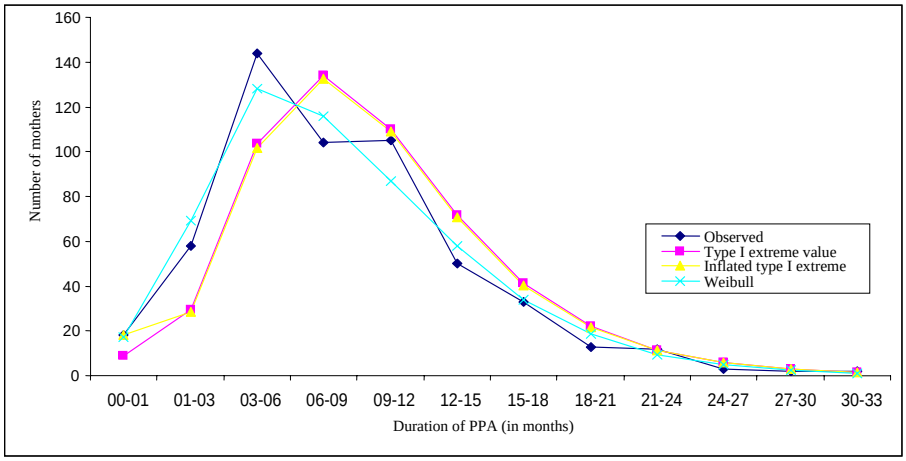
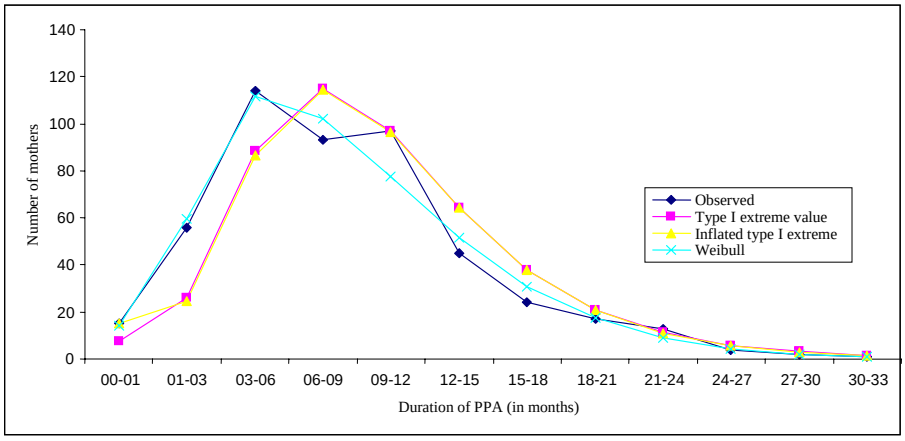


Table 4: Observed and expected distribution of PPA for retrospective status data

PPA (in months)	Obs. No. of mothers	Expected No. of mothers		
		Type I extreme value	Inflated type I extreme value	Weibull
00-01	15	7.75	15.05	14.42
01-03	56	26.02	24.76	59.43
03-06	114	88.35	86.66	111.68
06-09	93	114.96	114.29	102.39
09-12	97	96.79	96.47	77.37
12-15	45	64.52	64.15	51.43
15-18	24	38.03	37.64	30.94
18-21	17	21.04	20.71	17.71
21-24	13	11.24	11.01	8.79
24-27	4	5.91	5.76	4.22
27-30	2	3.08	2.98	1.91
30-33	1	1.60	1.54	0.81
Total	481	481.00	481.00	481.00
χ^2		65.09	64.72	10.38
d.f.		7	6	6
Parameters		α =7.4300 β=4.5300	α =7.4760 β=4.4990 k=0.9833	α =9.5476 β=1.5478 ξ_0 =0

$\chi^2_{(0.05,6)} = 12.59$ *and* $\chi^2_{(0.05,7)} = 14.07$

Figure 4
Observed and expected distribution of PPA for retrospective status data



The estimated values of parameters and chi-square value along with degrees of freedom provided by Weibull distribution are presented in Tables 3 & 4 (in last column). The suitability of this distribution has been applied by both the current and retrospective status data sets. Figure 3 clearly indicated that the closeness between observed and expected distribution of PPA provided by the Weibull distribution for the current status data. Similarly Figure 4 presents closeness between observed and expected distribution of PPA for retrospective data. The chi-square statistic at 5 per cent level of significance indicates that the proposed Weibull distribution fits reasonably well to the data of Nepal (Tables 3&4 in the last column).

The graph clearly showed a peak at 6-9 months, which may be considered as the modal class of the distribution of PPA. Mode value of the PPA was found to be 8.05 and 8.24 months for current and retrospective status data respectively. The difference of mode values obtained from the data of current and retrospective status may provide the amount of memory lapse of the reporting of PPA period. The amount of memory lapse of the reporting data was found to be about 6 days. The over-reporting tendency of the PPA duration has been observed in the retrospective reporting data whereas under-reporting tendency has been observed in the current status reporting data (Aryal, 2001). Though, the amount of over or under-reporting of PPA period was very small and insignificant.

Table 5: Amenorrheic life-table (current status reporting data)

PPA in months	M_t	S_t	l_t	q_t	L_t	T_t	e_t
0	0.0000	1.0000	10000.0000	0.0314	9843.18	84749.57	8.47
1	0.0314	0.9686	9686.3580	0.0588	9401.57	74906.39	7.73
2	0.0883	0.9117	9116.7895	0.0769	8766.46	65504.81	7.19
3	0.1584	0.8416	8416.1373	0.0914	8031.41	56738.35	6.74
4	0.2353	0.7647	7646.6848	0.1040	7249.22	48706.94	6.37
5	0.3148	0.6852	6851.7638	0.1151	6457.47	41457.71	6.05
6	0.3937	0.6063	6063.1681	0.1252	5683.61	35000.25	5.77
7	0.4696	0.5304	5304.0570	0.1345	4947.35	29316.64	5.53
8	0.5409	0.4591	4590.6457	0.1432	4262.06	24369.28	5.31
9	0.6067	0.3933	3933.4714	0.1513	3635.97	20107.23	5.11
10	0.6662	0.3338	3338.4681	0.1589	3073.19	16471.26	4.93
11	0.7192	0.2808	2807.9201	0.1662	2574.61	13398.06	4.77
12	0.7659	0.2341	2341.3090	0.1731	2138.68	10823.45	4.62
13	0.8064	0.1936	1936.0570	0.1797	1762.11	8684.76	4.49
14	0.8412	0.1588	1588.1615	0.1860	1440.44	6922.65	4.36
15	0.8707	0.1293	1292.7245	0.1921	1168.55	5482.21	4.24
16	0.8956	0.1044	1044.3787	0.1980	941.00	4313.66	4.13
17	0.9162	0.0838	837.6197	0.2036	752.34	3372.66	4.03
18	0.9333	0.0667	667.0527	0.2091	597.31	2620.32	3.93
19	0.9472	0.0528	527.5678	0.2144	471.01	2023.01	3.83
20	0.9586	0.0414	414.4531	0.2196	368.96	1552.00	3.74
21	0.9677	0.0323	323.4597	0.2245	287.14	1183.05	3.66
22	0.9749	0.0251	250.8281	0.2294	222.06	895.90	3.57
23	0.9807	0.0193	193.2872	0.2341	170.66	673.85	3.49
24	0.9852	0.0148	148.0323	0.2387	130.36	503.19	3.40
25	0.9887	0.0113	112.6908	0.2432	98.99	372.82	3.31
26	0.9915	0.0085	85.2802	0.2476	74.72	273.84	3.21
27	0.9936	0.0064	64.1626	0.2519	56.08	199.12	3.10
28	0.9952	0.0048	47.9991	0.2561	41.85	143.04	2.98
29	0.9964	0.0036	35.7063	0.2602	31.06	101.18	2.83
30	0.9974	0.0026	26.4152	0.2642	22.93	70.12	2.65
31	0.9981	0.0019	19.4357	0.2682	16.83	47.20	2.43
32	0.9986	0.0014	14.2238	0.2720	12.29	30.37	2.14
33	0.9990	0.0010	10.3548	0.2758	8.93	18.08	1.75
34	0.9993	0.0007	7.4990	0.2795	6.45	9.15	1.22
35	0.9995	0.0005	5.4030	0.2831	2.70	2.70	0.50

Table 6: Amenorrheic life-table (retrospective status reporting data)

PPA in months	M_t	S_t	l_t	q_t	L_t	T_t	e_t
0	0.0000	1.0000	10000.0000	0.0300	9850.13	85876.03	8.59
1	0.0300	0.9700	9700.2698	0.0569	9424.49	76025.90	7.84
2	0.0851	0.9149	9148.7068	0.0747	8806.82	66601.41	7.28
3	0.1535	0.8465	8464.9427	0.0892	8087.23	57794.58	6.83
4	0.2290	0.7710	7709.5142	0.1018	7317.28	49707.35	6.45
5	0.3075	0.6925	6925.0418	0.1129	6534.11	42390.08	6.12
6	0.3857	0.6143	6143.1860	0.1230	5765.26	35855.96	5.84
7	0.4613	0.5387	5387.3286	0.1324	5030.72	30090.70	5.59
8	0.5326	0.4674	4674.1194	0.1411	4344.38	25059.98	5.36
9	0.5985	0.4015	4014.6389	0.1493	3715.02	20715.60	5.16
10	0.6585	0.3415	3415.3990	0.1570	3147.32	17000.58	4.98
11	0.7121	0.2879	2879.2432	0.1643	2642.70	13853.26	4.81
12	0.7594	0.2406	2406.1602	0.1713	2200.08	11210.56	4.66
13	0.8006	0.1994	1994.0063	0.1780	1816.57	9010.48	4.52
14	0.8361	0.1639	1639.1324	0.1844	1488.02	7193.91	4.39
15	0.8663	0.1337	1336.9128	0.1905	1209.54	5705.88	4.27
16	0.8918	0.1082	1082.1766	0.1965	975.86	4496.34	4.15
17	0.9130	0.0870	869.5490	0.2022	781.63	3520.48	4.05
18	0.9306	0.0694	693.7092	0.2078	621.64	2738.85	3.95
19	0.9450	0.0550	549.5760	0.2132	491.00	2117.21	3.85
20	0.9568	0.0432	432.4325	0.2184	385.22	1626.20	3.76
21	0.9662	0.0338	338.0002	0.2234	300.24	1240.98	3.67
22	0.9738	0.0262	262.4744	0.2284	232.50	940.75	3.58
23	0.9797	0.0203	202.5290	0.2332	178.91	708.25	3.50
24	0.9845	0.0155	155.3004	0.2379	136.83	529.33	3.41
25	0.9882	0.0118	118.3574	0.2425	104.01	392.50	3.32
26	0.9910	0.0090	89.6610	0.2469	78.59	288.49	3.22
27	0.9932	0.0068	67.5218	0.2513	59.04	209.90	3.11
28	0.9949	0.0051	50.5545	0.2556	44.09	150.86	2.98
29	0.9962	0.0038	37.6350	0.2597	32.75	106.77	2.84
30	0.9972	0.0028	27.8599	0.2638	24.18	74.02	2.66
31	0.9979	0.0021	20.5097	0.2678	17.76	49.84	2.43
32	0.9985	0.0015	15.0165	0.2718	12.98	32.07	2.14
33	0.9989	0.0011	10.9355	0.2756	9.43	19.10	1.75
34	0.9992	0.0008	7.9214	0.2794	6.81	9.67	1.22
35	0.9994	0.0006	5.7081	0.2831	2.85	2.85	0.50

Tables 5 & 6 show the amenorrheic life-table constructed through model among Nepalese mothers for both the current as well as retrospective data sets respectively. These life-tables give the average expected waiting time to return their menstruation after some specified months of amenorrheic state t. Figures in column 2 (M_t) are based on the proportion of mothers who return amenorrhea period after ended the pregnancy or delivery as estimated by proposed Weibull distribution at a particular months t. It was found that the average expected waiting number of months to return menstruation among Nepalese mothers at ended the pregnancy or delivery was found to be 8.47 months for the current status data and 8.59 months for the retrospective data. For instance, among mothers those who have not yet returned their menstruation after delivery until 3, 6, 12, 24 and 30 months, they are waiting to return their menstruation of 6.74, 5.77, 4.60, 3.40 and 2.60 months respectively. It is also observed that about 40, 77 and 93 per cent mothers returned their menstruation before 6, 12 and 18 months respectively.

It is indicative that amenorrheic life-table provides interesting and additional information on the duration of PPA and also provides the trends of average expected waiting time for returning to menstruation after delivery or some specified duration of amenorrheic state at any t months. The amenorrheic life-table may be useful tool for identifying the duration of PPA period for any population if the distribution of standard population is known.

Discussion

PPA duration clearly showed a heaping at the multiple of three months, which is consistent with other findings (Rahman, 1992; Yadava and Jain, 1998). However, the heaping in the duration of PPA is less likely to be real because resumption of menstruation is not under the voluntary control of mothers (Aryal, 2001, 2004b; Salway *et al*., 1993; Trussell *et al*., 1992). A large heaping in the PPA data may be due to mis-reporting of the information, culturally prescribed norms and traditions, and memory lapse and selection bias (Aryal, 2002, 2005d). Nevertheless, it is difficult to detect the systematic tendencies of under reporting and over reporting in the duration of PPA unless the errors are gross (Aryal, 2001, 2005a; Islam, 2001).

The study revealed a consistent estimate of the duration of PPA for Nepalese mothers that reported of about 11 months (Ministry of Health, 2001). Trimean might be

the most appropriate average value for the duration of the PPA because it gives a better estimate than other averages specially when data are censored and the class interval is open ended (Tuckey, 1977). Further, the benefit for applying survival analysis for the study of PPA is that it wholly considered the censored cases as well as it provides summary measures (Aryal, 2006a). The study revealed a higher duration of PPA in case of higher percentage of censored events whereas lower duration of PPA in case of higher non-censored cases (Aryal, 2001). Theoretically, survival analysis provides a higher value of probabilities for lower percentage of censored cases and lower value of probabilities for higher value of censored cases due to censoring of the event (Aryal, 2002, 2006a; Trussell *et al*., 1992). Very few mothers were reported their duration of PPA before one month, which may be due to lack of differentiation between post-partum bleeding and resumption of menstruation (Ofosu, 1989).

The younger mothers have had lower duration of PPA than that of the older mothers and a large variation was observed according to parity of mothers**.** A number of empirical evidences also show that the duration of PPA is directly related to the age of mother and her parity (Ahamed, Kabir and Moslehuddin, 1988; Aryal, 2005d; Ford and Huffman, 1988; Salway *et al*., 1993; Srinivasan, Pathak and Pandey, 1989; Yadava and Jain, 1998). The increased duration of PPA was observed with the increase of the birth interval of mothers. Previous studies have shown a positive relationship between the duration of PPA and birth interval (Amenuvegbe, 1994; Aryal, 2004a; Ofosu, 1989). A positive and strong association was well-established between the duration of PPA and breastfeeding among Nepalese mothers, which is consistent result with the other findings (Aryal, 2001, 2006c; Islam, 2001; Yadava and Jain, 1998).

Educational attainment showed an inverse association on the duration of PPA, which is consistent finding with other researchers (Ahamed, Kabir and Moslehuddin, 1988; Yadava and Jain, 1998). Occupational status also exhibits inverse relationship with the duration of PPA. The duration of PPA varied according to caste/ethnicity and place of residence of mother. The socio-economic status showed an inverse association on the duration of PPA. The survival status of the child had showed a strong effect on the duration of PPA and a very low duration of PPA was observed among mothers with dead child. These findings are consistent with other findings (Ahamed, Kabir and Moslehuddin, 1988; Aryal, 2005c; Brewis and Regmi, 1993; Liestol, Rosenberg and Walloe, 1988; Srinivasan, Pathak and Pandey, 1989). The hypothesis is consistent with the fact that the duration of PPA varies from society to society and within the society according to a number of socio-economic and

demographic characteristics of mother (Bongaarts and Potter, 1983; Srinivasan, Pathak and Pandey, 1989). It is expected that a higher socio-economic status family probably demonstrates a better health, better education and a better nutrition. Researchers have argued that a better health of mother provides a better quality and more quantity of breast-milk, and if the mother feeds her child for longer duration, her length of PPA would be prolonged (Aryal, 2001, 2006c; Ramachandran, 1989). However, a reverse pattern has also been noticed and also identified a shorter duration of PPA among the healthy mothers (Lesthaeghe and Page, 1980).

Various summary measures like mean, median and trimean are computed by using life table technique based on both data of retrospective and current status reporting. While the differentials in the duration of PPA in relation to the characteristics of mother and her child was found more or less identical from both the data sets. This difference in the duration of PPA requires explanation. Though, this difference was insignificant and such differentials occur in the duration of PPA do not exist in the society. Practically the possible reason is that a higher per cent of censored observations contain in the current status data than retrospective one. If there was 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 so (Trussell *et al*., 1992). Hence, the reporting bias might be higher in the retrospective data due to recall lapse especially for those births which occurred long time back than current status data. This study also confirms the fact that slightly higher duration of PPA was observed for retrospective data. Weibull distribution was found to be well fitted to the data of Nepal, and this model provided the consistent modal value of about 8 months. Similarly, amenorrheic life-table was constructed with the help of the proposed model, and provided a consistent expected waiting time for returning menstruations at delivery of 8.5 months for current status data and 8.6 months for retrospective status data. The results obtained from different techniques are found consistent estimates of PPA duration for Nepal (Aryal, 2001, 2006a; Ministry of Health, 2001). For instance, the mean, median and trimean duration of PPA were found to be much closed to the modal value obtained by the model as well as the average expected waiting time to return menstruations obtained by amenorrheic life-table for Nepal data.

Conclusions

The differentials and patterns of PPA duration have been studied in this paper, and the important differentials have been identified in relation to the characteristics of mother and her child. PPA distribution clearly showed a heaping at the multiple of three months. Over 40 and 60 per cent mothers were reported their PPA period before six and nine months respectively. Three fourth mothers had reported their PPA period before a year. The mean, median and trimean of PPA was found to be 10.4, 8.4 and 9.2 months respectively for current status reporting data while 10.6, 8.8 and 9.4 months respectively for retrospective status reporting data. The trimean of PPA was found eight months for mothers currently aged 24 years and less, and it increased gradually and to reach thirteen months for mothers aged 35-49 years. The younger mothers have lower PPA duration than that of the older counter-parts. The trimean of PPA period increased with the increase of the parity of mothers. A positive and strong association was found between the duration of PPA and BF. The increased duration of PPA was found with the increase of the birth interval. The survival status of the child had showed a strong effect on the duration of PPA.

Mothers belonging in *Tarai* have had shorter PPA duration (6.7 months) than *Hills* mothers (9.7 months). Employed mothers have had lower duration of PPA than that of housewife. The decreased duration of PPA was found with the increase of the level of socio-economic status of the households. An inverse association of the duration of PPA was found with the level of education. The findings support the hypothesis that better nutrition leads to an early resumption of menstruation. It is indicative that caste/ethnicity exhibits large differential in the duration of PPA.

Weibull distribution has been proposed to study the distribution of PPA duration. This distribution has been found well fit to the data of Nepal for describing the distribution of PPA than that of type I extreme value distribution and its inflated distribution. The duration of PPA period has been estimated by using the retrospective and current status reporting data. The modal value estimated by the model was found to be about 8 months. The amount of over or under-reporting of PPA period was found to be about 6 days. Average expected waiting time for returning menstruation at delivery was found to be 8.47 and 8.59 months for data consisted of current and retrospective reporting respectively. Finally, Weibull distribution may be used to describe the distribution of PPA for Nepal as well as its neighboring countries. The

findings of this paper may help policy-makers, planners and researchers to design proper future policies and plans for improving maternal and child health, and thereby for controlling the fertility through natural ways.

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