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Determinants of Higher Order Birth Intervals in Pakistan

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Abstract

Birth interval pattern can be used to draw attention on the significant characteristics of reproduction and dynamics of fertility transition. The focus of current paper is to study the effect of socioeconomic, demographic and proximate determinants on the length of birth intervals for Pakistani women. Cox Regression Model is used for modeling the birth intervals. It is evident from higher order birth interval models that age of women, preceding birth interval, education of women and survival status of preceding child are major determinants of all birth intervals. In the Proximate Determinant Models, period of breastfeeding and age of women have played significant role in the determination of all birth intervals. Enhancement in women's education, discouraging gender biasness, improvement in health facilities and promotion of long breastfeeding period can be helpful in expanding the birth spacing.

Keywords

Abstinence, Amenorrhea, Breastfeeding, Cox regression model, Parity, Proximate determinants of fertility

1. Introduction

Fertility analysis is very important for policy makers to get guidance for population control and also for the evaluation of family planning programs. Knodel (1987) had presented the idea of three fertility inhibiting behaviors during early transitional period of fertility. These are starting, spacing and stopping behavior of fertility. Intentional long birth spacing limits child bearing and is known as 'spacing behavior' of fertility.

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Birth interval analysis is more susceptible technique for measuring fertility than other conservative methods of measuring fertility (Rodriguez and Hobcraft as cited in Nath et al., 2000). Pattern of birth intervals not only provides pace of child bearing but also chances of transition to higher parity. In developing countries if urgent results are required for fertility consideration then birth interval analysis is preferred over total children ever born to women (completed parity).

Singh et al. (2011) had found that infant mortality, period of breastfeeding, use of contraceptives, women's age at marriage, birth order and gender of preceding child were major birth interval dynamics in Manipur, India. Eini-Zinab and Agha (2005) explored that current age of women, education of women, survival status of preceding child and maternal age at the time of delivery were responsible for the postponement of second child in Iran. Ramesh (2006) had used both open and closed birth intervals for understanding the dynamics of fertility in Orissa, India and concluded that effect of various factors on the determination of birth interval length varies with parity. Kiani and Nazli (1988) had concluded that spacing behavior of fertility had not shown any change in the marital fertility of Pakistani women.

Pakistan is confronted with the problem of rapid population growth which is a great hindrance to the economic growth. Increase in adolescent population and reduction in dependency ratio exhibit that phase of population transition has got started. Pakistan has entered in the early stage of fertility transition from the past two decades (Ali and Buriro, 2008). The average of more than six children per women has started to turn down in late 1980's (Arnold and Sultan, 1992; Feeney and Alam, 2003). The total fertility rate declined from 6.0 to 5.4 children in 1992-96. In the last decade, this decline became more rapid and reached 4.1 children per women in 2006-07 (Ali and Buriro, 2008). But still it is far away from replacement level of fertility. In Pakistan, approximately 33% of women had birth interval less than two years. In spite of Governmental campaigns on family planning issues for past few years, there is little contraction in the length of closed birth interval. Desire for long birth interval is now increasing in Pakistan (Catalyst Consortium, 2003). In the past, more attention was paid to study the stopping behavior of fertility while spacing behavior of Pakistani women was ignored. The decline in fertility could very well be due to spacing behavior rather than only due to stopping behavior of fertility. There is need to study the factors which affect birth intervals. It will help in understanding the spacing behavior of fertility of Pakistani women and identifying the factors which are useful in declining the fertility through long birth intervals. It will also identify the factors which are

creating hindrance in long birth intervals. Potential factors and covariates which can affect birth interval length are illustrated under the two broad classes of socio-economic/ demographical factors and biological factors (Proximate Determinants). Both of these are elaborated under separate headings as follows.

1.2 Socio-economic and Demographic Determinants of Birth Interval: Women's age, education and length of previous interval had great effect on the subsequent birth spacing (Rodriguez et al., 1983). Age at first birth, urban residence and sex of previous child were taken as predictor for birth interval by Rindfuss et al. (1983). Consequences of marital age on fertility are influenced by biological factors and maturity of couple's behavior towards reproductive decisions (Kallan and Udry, 1986).

Urban and rural attitudes about reproductive decisions may also differ. If social and cultural norms are one reason, the others may be awareness and access to health facilities. Certain trends are expected, for instance, long exclusive breastfeeding in rural area so it widens the interval. Characteristics of women which are potential candidates for modeling the birth intervals are maternal age at first birth, parity, education of women, work status of women and place of residence (Birth Spacing three to five saves lives, 2002).

Education is linked with awareness of an individual regarding health and reproduction. Effect of both education and age at marriage was found significant on birth spacing (Hirschman and Rindfuss, 1980; Rindfuss et al., 1983). Educated women may have long birth interval than uneducated women due to delay in marriage, employment status, use of contraceptives and awareness about reproductive health. But Bumpass et al. (1986) had reported short second birth interval for women with higher education. Ramarao et al. (2006) had named the reason of short interval for highly educated women as 'compressing the child bearing'. Education of husband is important factor particularly in those societies where woman takes her reproductive decision with the consent of her husband. Gender composition also influences birth interval (Maitra and Pal, 2004).

Birth spacing and child survival are correlated to each other. Death of previous child shortens birth interval. Maitra and Pal (2004) named it the phenomenon of 'the child replacement effect'. There is also a biological reason of short interval. Death of preceding child disrupts breastfeeding. Duration of amenorrhea is also reduced in this case. Both of these can result in short interval (Santow, 1987).

Work status of women had shown short interval in some of the countries. On the other side, Mturi (1997) and Setty-Venugopal and Upadhyay (2002) had reported long interval for employed women. According to the theory of opportunity cost it would be long. But if child rearing is not conflicting with work then it would not be long.

Quantity/ Quality theory of fertility may also affect spacing behavior similarly as it affects stopping behavior. Usually birth intervals are expected to be short for lower income group than higher income group. Relationship between birth spacing and women's occupation is not clear and quite uncertain (Bavel and Kok, 2004).

Inclusion of preceding previous interval in birth interval model is criticized because if its impact is meaningful then what about marriage to first birth interval. Purpose of its inclusion is, in fact, to measure the indirect effect of breastfeeding and contraception on birth spacing. Trussell et al. (1985) had also included this variable even in the presence of some Proximate Determinants i.e. breastfeeding and contraceptive use. Demographers did not think the necessity of previous birth interval in the model if data on both contraceptive usage and breastfeeding are available in surveys (Richards, 1982 as cited in Trussell et al., 1985). But information on all Proximate Determinants is not available so their effect can be captured through previous birth interval.

1.2 Proximate Determinants (Biological Factors) of Fertility for Birth Interval:
Biological factors which contribute towards fertility are breastfeeding practice, deliberate fertility control through contraception, coital frequency, abortions and reproductiveness (Baschieri and Hinde, 2007). Davis and Blake (1956) have defined some biological and behavioral factors through which social, economic and cultural factors influence fertility. Davis and Blake (1956) had defined relationship between socio-economic and biological or intermediate fertility variables. This relationship is shown in the diagram (Figure 1).

Breastfeeding is widespread in developing countries. Diversification is found in its period and regularity pattern due to cultural norms. Ramarao et al. (2006) had enlisted many studies which had shown wider birth interval due to breastfeeding. Postpartum amenorrhea (PPA) is also a biological factor which affects birth spacing. Its minimum period may be of month and maximum may exceed over a year (Singh et al., 2007).

Postpartum abstinence is frequently exercised in many societies. People also believe that sexual relationship during breastfeeding period pollutes the milk and is harmful for child health (Regassa, 2007). Setty-Venugopal and Upadhyay (2002) reported that postpartum amenorrhea and abstinence both lead to birth spacing of up to two years.

Objective:

- The focus of current paper is to study the effect of socioeconomic and demographic factors on the length of higher order birth intervals for Pakistani women. The analyses provide insight into spacing behavior of fertility through parity specific birth interval analyses.
- Effect of biological factors is investigated by fitting separate model on these factors. It will helpful in understanding whether the effect of these factors varies across parities.

2. Data and Methodology

2.1 Data: Source of data is Pakistan Demographic and Health Survey which was conducted in 2005-06. Two Stage Stratified Sample Design was used for selection of sample. One thousand sample points were chosen using Probability Proportional to Size Sampling from rural and urban stratum. Distribution of 1000 sample points was given as: Punjab (440), Sindh (260), NWFP (180), Baluchistan (100), and Federally Administered Tribal Areas (20). From these 1000 sample points, 105 households were chosen with the help of Systematic Random Sampling from each sample point. Ten households were chosen from these 105 households using Systematic Random Sampling for women reproductive history related questionnaire. Information about reproductive health, including birth histories data was collected from 10023 women of age 15-49. Birth history data include twenty entries, one for each birth. Preceding birth interval is calculated as the difference in months between the current birth and the previous birth.

Birth interval for higher order births is defined as time since previous birth (Woldemicael, 2008). All birth intervals are closed. Birth interval models are fitted parity-wise i.e. models for second, third, fourth and fifth births. It is assumed that pattern of transition above parity five is same. For socio-economic model, data is not truncated. Factors and covariates used for analysis of socioeconomic model are current age of women, age of women at marriage,

region (Punjab, Sindh, NWFP and Baluchistan), education of both spouses, wealth index, occupation of both spouses, preceding birth interval, gender of preceding child, and survival status of preceding child. Proximate Determinant Model is fitted on age of women, age of women at marriage, preceding interval, period of breastfeeding for preceding child, period of amenorrhea for preceding child and period of abstinence for preceding child.

It is preferred in this paper to report the results of only higher order birth intervals (2^{nd}, 3^{rd}, 4^{th} and 5^{th}) to understand the spacing behavior of fertility. Because first birth interval is most of the times inconsistent and irregular due to cultural norms and bans of society (Singh et al., 1993 as cited in Nath et al., 2000). In Pakistan there is evidence of not using contraceptives at the start of marriage (PSLM, 2005-06). A woman has to prove her fecundability so couples start planning the child soon after marriage irrespective of their education, work status and wealth index status. Birth interval analysis is carried up to 5^{th} birth because it would capture most of the birth transition.

Information about the period of breastfeeding, amenorrhea and abstinence is available only for births from January 2001 till the date of survey. That is why Proximate Determinant Model is fitted only for births after January 2001.

2.2 Methods: Detail about methods is given as follows;

2.2.1 Product Limit Survivorship Function: Chakraborty et al. (1996) had used Product Limit Survivorship Function to study the differential pattern of birth intervals in Bangladesh. The Product Limit Estimates provide better estimates than life table analysis. The Product Limit Estimate of the Survival Function (Kaplan and Meier, 1958) is defined as

$$S(t_i) = \prod_{j=1} (1 - \frac{d_j}{n_j})$$

Chakraborty et al. (1996) had defined the terms in Product Limit Survivorship according to birth interval analysis as follows.

d_j = number of women having births at time t_j.

n_j = number of women just prior to time t_j exposed to the risk of having birth.

t_j = time since the previous birth of a child to that woman.

2.2.2 Log-Rank Test: It is used to compare Survival Distribution of various categories of factors (Nathan, 1966). For the two groups, Hypotheses are given as

$H_0 : S_1(t) = S_2(t)$

$H_1 : S_1(t) > S_2(t)$

Khan and Raeside (1998) had used Log-Rank Test to compare Survival Distribution across various categories of factors for the determinants of first and subsequent births in urban and rural areas of Bangladesh. All above measures are based on duration only. If research question is to investigate the determinants of birth interval, then Cox Proportional Regression Model is used.

***2.2.3 Cox Regression Model*:** Cox Regression Model (Cox, 1972) is used to study the effect of factors and covariates on birth interval lengths. In demographical studies, Life Table technique was very popular to analyze birth intervals. It becomes quite difficult when purpose is to investigate effect of covariates on the birth interval. Cox Regression Model can be used efficiently to model birth interval with biological and socio-economic covariates (Richards, 1982 as cited in Trussell et al., 1985 and Rodriguez et al., 1983). Reason for preferring Hazard Model over Multiple Linear Regression and other models for categorical data is, its uniqueness for handling Censored observations. Many demographers had used Cox Regression Model for birth interval analysis particularly when exact Survival Time Distribution is unknown (Eini-Zinab and Agha, 2005; Hemochandra et al., 2010; Suwal, 2001 and Trussell et al., 1985). Its use in birth interval analysis determines the risk of having a birth.

Cox Regression Model is also called Duration Model. It assumes that ratio of the Hazard Function is constant (proportional) for two subjects. The Hazard Function for set of regressors $X = (x_1, x_2, ..., x_p)'$ is defined as

$$h(t, x_1, x_2, ..., x_p) = h_0(t).g(x_1, x_2, ..., x_p)$$

$$h(t, X) = h_0(t).g(X)$$

where $h_0(t)$ is Hazard Function when all covariates are ignored. If $g(X) = 1$, it is called baseline Hazard function. Hazard Ratio of two individuals with different factors or covariates X_1 and X_2 is defined as

$$\frac{h(t, X_1)}{h(t, X_2)} = \frac{h_0(t).g(X_1)}{h_0(t).g(X_2)} = \frac{g(X_1)}{g(X_2)}$$

It is Proportional Hazard Ratio. If $g(X) = e^{b'X}$ then Hazard Function is given as

$$h(t, X) = h_0(t).e^{b'X} \quad (2.1)$$

where $b = (b_1, b_2, ...b_p)$ are regression coefficients. Simplifying (2.1) generates a Regression Model

$$\log \frac{h(t)}{h_0(t)} = b_1 x_{1i} + b_2 x_{2i} + ... + b_p x_{pi} \quad (2.2)$$

Proportionality assumption is essential to be verified prior to the application of Cox Regression Model. Non-Proportional Hazard Model is recommended in case of violation of assumption. Proportionality assumption is also related to the nature of covariates used in the Hazard Models.

3. Results

In descriptive analysis average length for all birth intervals is computed. Second birth interval is the shortest among all birth intervals (Table 1). Length of second birth interval is approximately 28 months. Marginal difference is observed in the length of third, fourth and fifth birth interval length. The average length of these birth intervals is one month more than average length of second birth interval. It means birth spacing behavior of Pakistani women is almost same for different parities.

3.1 Non-Parametric Analysis (Kaplan-Meier Product Limit Estimate of Survival Time): Kaplan-Meier average survival time is given in Table 2. This will help in understanding the average length of birth intervals among various categories of factors and covariates. Average birth interval increases consistently with the age of women for all parties. The average birth interval length for Bangali women of more than 35 years of age was approximately 18 months for higher order birth intervals (Chakraborty et al., 1996).

Average birth interval is short for the women getting married after the age of twenty five. For second birth interval, there is absolute decline with the increase in age at marriage. Consistent increase in the length of birth interval for age and marital duration was also observed for Jordan (Youssef, 2005). Marginal difference in the length of birth interval is observed for the women belonging to different regions of Pakistan. Women belonging to Punjab and NWFP have short second and third birth intervals than Balochi and Sindhi women. Minimum average birth interval for fourth birth is for the women belonging to NWFP. Up to parity four, Balochi women have longest birth interval as compared to other provinces. For fifth birth, Balochi women have minimum birth interval as

compared to their counterparts in other regions. After parity two length of birth interval is longer for urban women as compared to the rural women. Average interval for rural and urban women of Bangladesh was almost the same i.e. approximately three years (Chakraborty et al., 1996). After parity three consistent increase is found in the length of birth interval with an increase in the educational level of women. Difference of three months was observed in average birth interval between illiterate and highly educated women in Bangladesh (Chakraborty et al., 1996). In Jordan uneducated women had two months shorter birth interval than educated women (Youssef, 2005). Length of interval is consistently more for the women whose husbands are educated beyond primary level. Husband with no formal education had highest average birth interval length in Jordan (Youssef, 2005).

Women belonging to poor and poorest wealth quintile have longer second birth interval. Apart from parity two women belonging to the highest wealth index have at least three months longer birth interval as compared to those belonging to lower categories of wealth index. Women belonging to higher category of income had at least 21 months shorter birth interval as compared to women who belonged to lowest income group in Jordan (Youssef, 2005).

Birth interval length is not consistent for different parities among different occupational categories of women. Only one common finding is that mostly (for second, third and fifth birth intervals) longest birth interval length for different parities is for manual worker. Fourth birth interval is longest for professional women. Women whose husbands belong to professional occupation group have comparatively long third, fourth and fifth birth interval as compared to the other occupational categories. Youssef (2005) had also found that in Jordan professional husbands' had longer birth interval than other categories of occupation.

Women whose husbands do not work have shown short interval for third and fourth birth intervals. There is, on the average, one month contraction in the birth interval length of next birth if preceding child is girl. Similarly in Bangladesh average birth interval was found to be one month shorter if preceding birth was girl (Chakraborty et al., 1996).

Death of preceding child has great effect on birth spacing. The average birth interval for next birth is declined by at least four months in such cases. Decline of

fourteen months was observed in average birth interval due to death of preceding child in Bangladesh (Chakraborty et al., 1996). In Jordan, decline of five months was found (Youssef, 2005). Increasing trend is observed in birth interval length with an increase in the preceding birth interval, duration of breastfeeding, amenorrhea or abstinence. The maximum difference in average birth interval length is observed for the breastfeeding factor. Women who breastfeed their child have at least five months longer next birth interval than those who do not. In Jordan those who breastfeed the child had four months longer birth interval than those who did not (Youssef, 2005).

By comparing difference in average birth interval length, it is found that for Pakistani women, major contribution in the length of birth intervals is due to biological factors and child mortality (death of preceding child).

3.2 Log-Rank Test: There is significant variations in the failure time (occurrence of birth) of different categories for age of woman, education of woman, education of husband, wealth index, preceding birth interval, survival status of preceding child and period of breastfeeding for all parities (Table 3). It means significant variability exists between birth intervals among various categories of these factors. Gender of preceding child and period of amenorrhea have significant variation among their categories up to fourth birth whereas region, age at marriage, occupation of woman, occupation of husband and period of abstinence do not have significant variation among their categories for all parities. Log-Rank Test for second and third birth interval had shown significant difference among various categories of gender of preceding consecutive births and household income (Nath et al., 2000). Khan and Raeside (1998) had concluded that long rank test for higher order births had shown consistently significant difference among various categories of factors in both urban and rural areas like age at first birth, education of both spouses and death of preceding child in Bangladesh. Women's work status, region of residence and sex of preceding child had shown significant variation among different categories in rural areas (Khan and Raeside, 1998).

Direction and magnitude of individual factor on birth interval length is studied through Multivariate analysis. Some factors are observed to behave differently in the Multivariate analysis. In Multivariate analyses, when the remaining factors are controlled some factors which were significant in Univariate analyses, became insignificant.

3.3 Multivariate Analysis (Cox Regression Model for Socio-economic and Demographic Determinants of Birth Intervals): After fulfillment of all assumptions (proportionality, linearity of covariates, detection of outliers and multicollinarity) required for Cox Hazard Model, Multivariate analysis is carried out. Table 4 shows results of subsequent birth interval. All factors and covariates are taken as fixed for this model.

Significant determinants of second birth interval are age of woman, age at marriage, region, residence, education of woman, gender of first child and survival status of first child. Third birth interval is significantly determined by age of woman, age at marriage, preceding birth interval, region (Punjab), education of woman, wealth index (poorest, middle) and survival status of second child. In the determination of fourth birth interval age of woman, preceding birth interval, education of woman (no), education of husband (primary), occupation of husband (no, agriculture), gender of third child and survival status of third child has played significant role. While in the determination of fifth birth interval age of woman, preceding birth interval, region (NWFP), education of woman and survival status of fourth child contribute significantly.

The increase in woman's age is significantly positively associated with birth spacing for all higher order births (2^{nd}, 3^{rd}, 4^{th} and 5^{th}). It not only measures fecundability but also accounts for effect of those Proximate Determinants of fertility which cannot be measured (Bumpass et al., 1986 as cited in Chakreborty et al., 1996). The effect of increase in women's age at marriage on birth spacing has negative impact i.e. short interval. Increase in age of women has resulted in significantly short second and third birth intervals. For higher order parities, its effect becomes weak.

Long preceding birth interval has resulted in significantly long third, fourth and fifth birth intervals. Preceding interval is used as a substitute for factors whose direct effect is difficult to capture such as effectiveness of family planning methods, breastfeeding patterns, coital frequency and fecundity (Trussell et al., 1985). Trussell et al. (1985) had reported positive relationship between preceding and subsequent birth intervals for Malaysia and Philippines. In the present analyses, preceding birth interval is included to capture indirect effect of those factors which are unavailable. Strong effect of preceding interval shows that it has successfully captured the effect of those biological factors.

Region has significant effect in the determination of second birth interval. Punjab and NWFP have shorter birth interval length while Balochistan has long birth interval up to parity four. Shortest second birth interval is for women who belong to NWFP. Third birth interval is significantly short for Punjabi women as compared to Balochi women. Women belonging to NWFP have significantly long fifth birth interval as compared to Balochi women. The difference in birth interval might be due to difference in breastfeeding period. The pattern of birth interval among provinces is found similar as reported by median duration of breastfeeding among children born in the past three years. Ali and Sultan (2008) have found that Punjabi women have shorter median breastfeeding period (17 months) as compared to Balochi women (20.7 months).

Urban women have shown significantly shorter second interval as compared to rural women. Only fifth birth interval is insignificantly longer for urban women than for the rural women. In univariate analyses (Kaplan-Meier) for parity above two, urban women have shown longer interval than rural women. This difference is marginal. But nature of relationship is changed when rest of variables are controlled in the multivariate analyses i.e. short birth interval for urban women. The reason of long interval for rural women is actually not related to rural urban differentials (Trussell et al., 1985 and Woldemicael, 2008). The reason given in support of result is prevalence of romantic/love marriages in urban areas (Suwal, 2001). Sleeping arrangement in rural areas also causes delays in birth interval (Suwal, 2001). Moreover, in current analyses birth interval of only live births is included. Unavailability of health facilities may cause miscarriages in rural areas which results in long birth interval for live birth. Ali and Sultan (2008) have reported that median breastfeeding duration is found to be shorter in urban (18 months) areas than rural (19.4 months).

Education of women has shown positive association with birth spacing. The effect of education is significant in all models except for fourth birth interval. The impact of education of husband, like education of woman, has positive but insignificant effect on birth spacing for second and fourth birth intervals. For third and fifth birth intervals effect of husband's education is reversed. Gangadharan and Maitra (2001) argued for this negative effect of husband's education that a man with high education usually marries with highly educated woman. Educated women generally have delayed marriages and older women have short birth interval. So age of woman at marriage may be the reason behind positive effect of husband's education. Suwal (2001) had found short second birth interval in Nepal for the woman whose husband was secondary or post-secondary educated. Khan

and Raeside (1998) had also found short third and fourth birth interval for a woman in rural area of Bangladesh whose husband was more educated.

Wealth index has shown consistent positive effect on birth spacing but after the birth of second child. Women who belong to higher wealth index have insignificantly long birth interval. Birth interval among rich people is wider due to involvement of more expenses in child upbringing due to high life style. Distribution of inherited property also affects the fertility choices of rich couples. They want less but rich children. Second and third birth spacing had got wider with increase in income level for the non-contracepting Indian population (Nath et al., 2000).

Effect of women's occupation on the determination of birth interval length is insignificant in all models. Women who are not engaged in any work or who belong to professional or agriculture sector have short second and third birth intervals as compared to manual workers. For fourth birth interval professional and nonworking women have long interval as compared to manual worker. Women working in agriculture sector have longest fifth birth interval length. The reason of little difference may be attributable to biological factors such as short breastfeeding period among professional workers as compared to agriculture workers, manual workers and those who do not work. Daily wagers and in service women both had shorter fourth birth interval as compared to women engaged in agriculture sector in Nepal (Suwal, 2001).

The effect of husband's occupation on the length of birth interval is also not noticeable. A woman whose husband belongs to professional occupation group has largest fourth and fifth birth interval as compared to a woman whose husband is a manual worker. Women whose husbands do not work or belong to agriculture sector are at significantly higher risk of having a fourth birth. Trussell et al. (1985) had reported short birth spacing for professional husband in Malaysia and Indonesia as compared to agrarian husband.

If preceding birth is male then length of next birth interval is longer as compared to preceding female birth. The effect is significant for second and fourth birth intervals. The result seems to be universally true. Hemochandra et al. (2010) stated that psychological and emotional pressure works behind this result. It significantly increases the chances of birth if previous born child was girl (Maitra and Pal, 2004). Female child is discriminated by short breastfeeding period as

compared to male child which also lessens the next birth interval (Nath et al., 2000). If previous child dies then next birth interval is significantly shorter. Child replacement factor and stopping of breastfeeding result in resumption of ovulation which is the major cause of short interval (Hemochandra et al., 2010 and Khan and Raeside, 1998).

Covariate survival curve for second, third, fourth and fifth birth interval (Figures 2, 3, 4, 5) shows gradual decline which means decline in survival rate (short survival time). The chance of not having a subsequent birth of child decreases with increase in birth interval. The decline is sharper after three years. It means majority of married women have next birth within three-year interval. After eight years it approaches the bottom line and remains constant at zero for all further durations.

3.4 Cox Regression Model for Proximate Determinants (Biological Factors) of Birth Intervals: Analysis of effect of biological factors on birth interval is no doubt very important for understanding the reproductive behavior. Period of breastfeeding, amenorrhea and abstinence are available only for births from January 2001 till the date of survey, for biological model only those cases are selected who had given births after 2001.

Proximate Determinants which play major role in transition to next births are age of women, age at marriage and period of breastfeeding. This is true for all parities. There is increase in birth interval length with an increase in age of women and period of breastfeeding. Increase in the preceding birth interval and period of abstinence contract the birth intervals. Strength and nature of relationship of preceding birth interval is changed in the biological model. It can be concluded from this change that in socioeconomic model this factor has very well captured the influence of biological factors. But when model for biological factors is fitted its effect is diminished due to inclusion of very important biological factor i.e. period of breastfeeding. Apart from parity two, significant negative relationship is found between period of abstinence and birth interval. It means with extended period of abstinence, the possibility of conception for next birth increases. Period of amenorrhea has shown inconsistent influence on birth intervals. If duration of amenorrhea is less than abstinence it may increase birth space (Setty-Venugopal and Upadhyay, 2002). But in the current analysis median duration of amenorrhea is equal to median duration of abstinence only for second birth interval.

4. Conclusion

The effect of most of socioeconomic and demographic factors is not same for all birth intervals. It is evident from higher order birth interval models that age of women, preceding birth interval, education of women and survival status of preceding child are major determinants of most birth intervals. The effect of these factors is same in all birth interval models. Effect of delay in women's age at marriage shortens the birth interval length. Its effect is significant only for the early birth intervals. Thus spacing behavior shows that delay in the marital age is not useful in lowering fertility of Pakistan because contraceptives are less prevalent. Late marriages can result in lower fertility only for those populations where deliberate fertility control methods are widespread (Coale, 1992 as cited in Dommaraju, 2008). Enhancement of women education can help to lower the fertility.

Region of residence played vital role in the determination of only second birth interval. An urbanization factor is not playing its role in declining the fertility by controlling the spacing behavior. Influence of husband's education is not significant. For some birth intervals nature of relationship is even unexpectedly negative for this factor. Occupational effect of both spouses is also unexpected. It is not necessary that women or their spouses working in modern sector contract birth spacing. It means modernization factor is not playing its role. Quality and quantity theory has little impact in Pakistan as wealth index has shown insignificant effect on birth spacing. Next birth interval is long if previous birth is male. Same results hold in all birth interval models. But it is significant only in second and fourth birth interval models. Son preference is evident from this result. If previous child has died then next birth interval is significantly shorter which shows that maternal health is at higher risk in Pakistan. It is also observed that birth spacing between two consecutive births is at least six months shorter than Governmental policy for birth spacing of at least three years. It should be widened because declining fertility could very well be due to spacing behaviour and not necessarily stopping behaviour.

Thus short birth intervals increase fertility which has many adverse effects other than rapid population growth. In case of shorter birth interval the competition among children starts for facilities. It is called sibling competition effect. In this competition female child usually remains deprived. It also affects the efficiency of

mother regarding the child brought up and also decreases probability of child survival.

Birth interval length is found to be significantly longer in case of increase in preceding breastfeeding period. Government should educate women for exclusive breastfeeding period of six month and at least two years with weaning (WHO, The World Health Report, 2006). It widens not only birth interval but also breast milk increases the chance of child survival by increasing the immunity of child. And in case of child survival birth interval is also expanded (Maitra and Pal, 2004).

5. Recommendations for Future Research and Policy Implication

All these recommendation are given in the context of Pakistan.

- The effect of frequency and use of contraceptives can be studied on birth intervals.
- Government should motivate couples to increase the birth interval length in case of death of preceding child and also strengthen health programs. It is necessary for the maternal and child health. If long birth interval is promoted in case of death of preceding child, it will cause decline in fertility.
- Family planning programs should be made more effective to get the favorable results (longer birth intervals) for age of women at marriage, urbanization and modernization factors.
- Birth interval length is shorter than three years for all higher order births. There is need of effective policy for promotion of long birth space (at least 4 to 5 years) between two consecutive children. Lady health visitors can be used for this purpose.

6. Limitations

Limitations are mentioned as follows;

- Effect of contraceptives is not studied due to unavailability of data within birth interval.
- Proximate Determinants like period of breastfeeding, amenorrhea and abstinence are only for those births which occurred after January 2001.

- Due to exclusion of older birth cohorts sample is less representative which may have introduced bias.

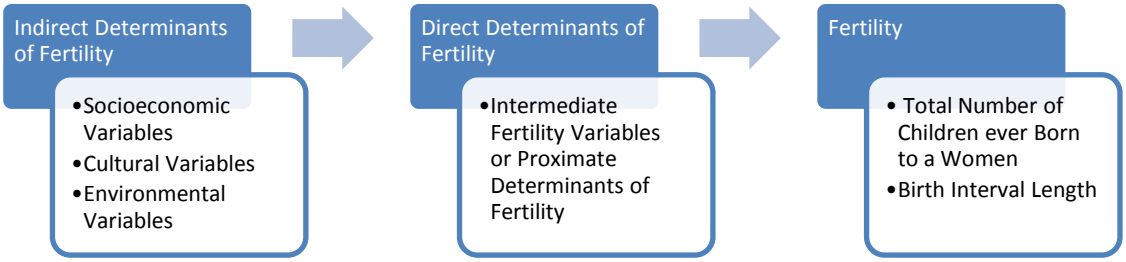

Figure 1: Relationship between socio-economic and intermediate fertility variables

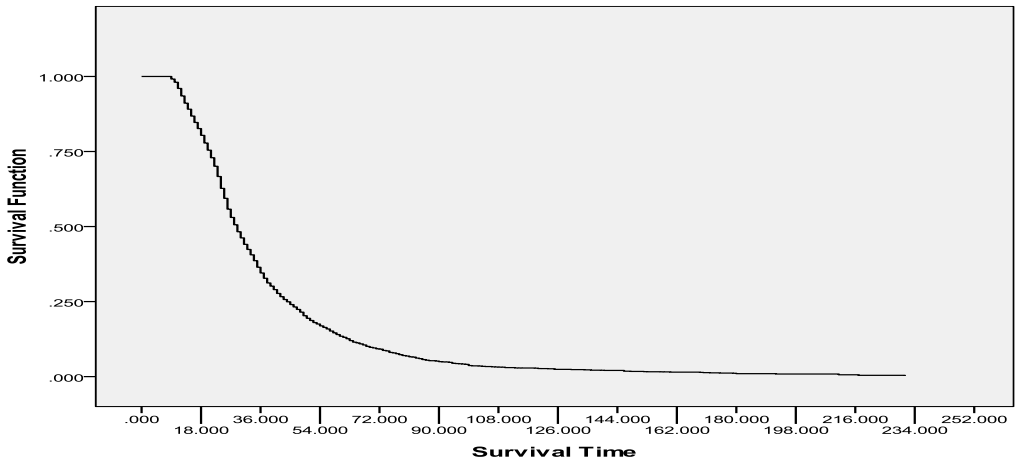

Figure 2: Survival curve for second birth interval

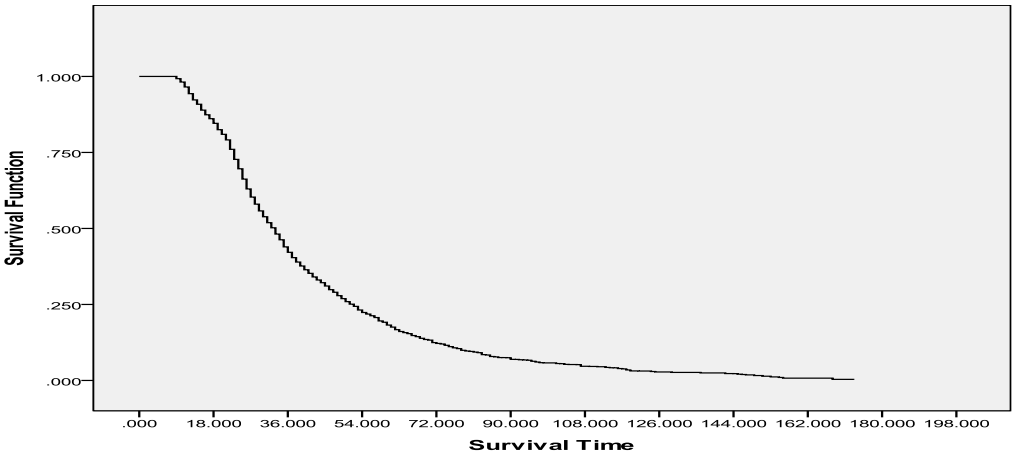

Figure 3: Survival curve for third birth interval

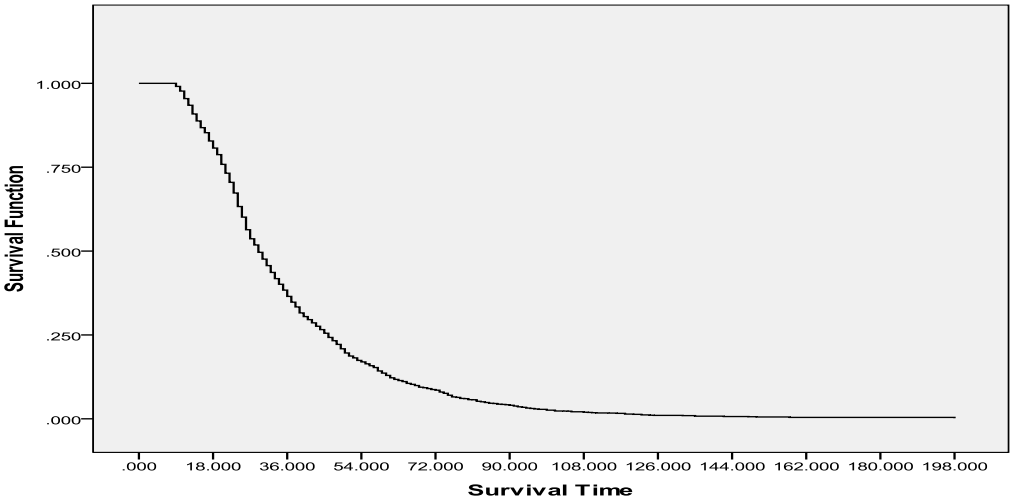

Figure 4: Survival curve for fourth birth interval

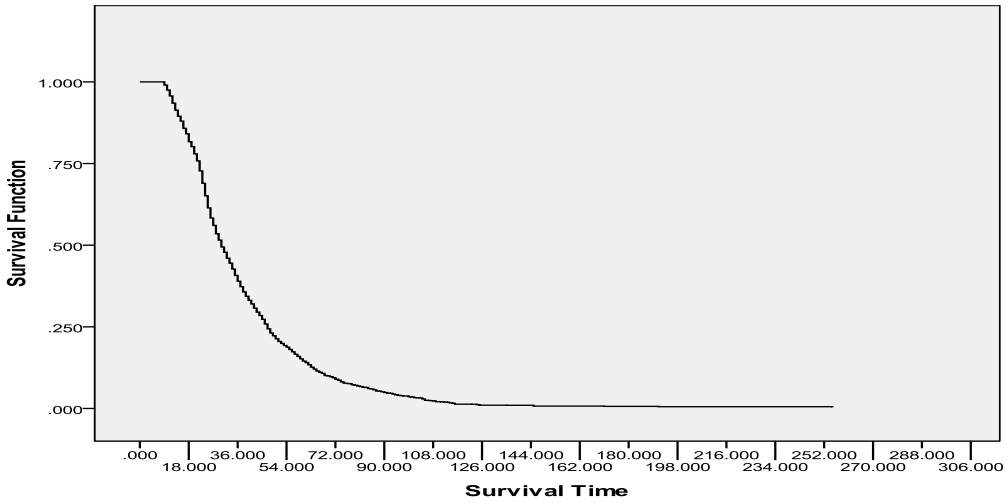

Figure 5: Survival curve for fifth birth interval

Table 1: Average birth interval length in Pakistan 2006-07

Birth Intervals	**Average Period (in months)**
Second	27.99
Third	29.22
Fourth	29.11
Fifth	29.77

Table 2: Kaplan-Meier Estimates of mean survival time by socio-economic/ demographic and Proximate Determinants for higher order birth intervals

Factors/ Covariates	Levels	Second Interval		Third Interval		Fourth Interval		Fifth Interval	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
age of woman	≤ 24 months	24.755	.400	25.443	.637	23.750	.950	25.219	1.841
	25-34	27.361	.276	28.420	.314	28.637	.373	28.069	.473
	35+	29.131	.324	30.003	.319	29.435	.317	30.273	.360
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Age of women at marriage	≤ 18 months	28.818	.268	29.243	.282	29.001	.299	29.569	.344
	19-21	26.702	.388	29.275	.466	29.210	.505	30.289	.704
	22-24	26.565	.591	29.319	.718	29.383	.868	29.637	1.091
	25+	26.277	.695	27.929	.805	28.488	1.06	27.489	1.138
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Region	Punjab	27.828	.310	28.589	.322	29.323	.378	29.794	.448
	Sindh	28.196	.405	29.819	.473	28.894	.480	29.833	.634
	NWFP	27.278	.413	29.217	.465	28.432	.522	29.801	.582
	Baloch.	29.363	.615	29.960	.686	29.465	.658	28.385	.755
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Residence	Urban	27.000	.304	29.667	.377	29.650	.418	30.893	.538
	Rural	28.635	.267	28.895	.272	28.700	.293	28.959	.339
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Education of woman	No	28.343	.253	28.838	.257	28.365	.268	29.099	.314
	Primary	27.240	.526	27.967	.583	29.957	.744	30.796	.925
	Secon.	26.582	.475	30.475	.676	31.872	.850	32.518	1.232
	Higher	28.478	.783	35.172	1.318	34.540	1.71	35.237	2.869
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Education of husband	No	28.749	.358	29.012	.358	28.611	.369	29.015	.411
	Primary	27.515	.486	28.175	.501	27.281	.507	28.987	.642
	Secon.	27.331	.342	29.022	.399	29.773	.475	30.737	.576
	Higher	27.866	.463	31.072	.627	31.334	.737	30.824	1.104
Overall		27.987	.202	29.179	.222	29.051	.242	29.653	.291
wealth index	Poorest	29.366	.475	28.515	.476	27.796	.478	28.947	.631
	Poorer	28.374	.458	28.796	.465	28.348	.501	28.500	.548
	Middle	27.431	.463	28.574	.485	29.005	.530	28.656	.563

Factors/ Covariates	Levels	Second Interval		Third Interval		Forth Interval		Fifth Interval	
		Estimate	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**	**Estimate**	**S.E.**
	Richer	27.572	.449	28.613	.457	29.312	.542	30.118	.655
	Richest	27.299	.407	31.587	.586	31.205	.661	33.260	.935
Overall		27.998	.201	29.192	.221	29.052	.241	29.638	.290
Occupation of woman	Not working	27.899	.238	29.313	.268	28.999	.292	29.505	.349
	Professional	27.979	.543	28.652	.559	30.792	.662	29.935	.780
	Agriculture	28.371	.584	28.980	.614	27.441	.630	29.612	.791
	Manual	28.819	1.17	29.800	1.212	28.540	1.11	30.668	1.459
Overall		28.000	.202	29.195	.221	29.053	.241	29.641	.290
Occupation of husband	not working	27.803	.952	27.728	1.072	28.051	1.31	28.988	1.191
	Professional	27.661	.307	29.583	.369	29.738	.402	30.838	.557
	Agriculture	29.192	.492	29.449	.507	28.094	.483	27.993	.523
	Manual	27.735	.332	28.809	.344	29.046	.399	29.571	.447
Overall		27.999	.201	29.191	.221	29.052	.241	29.638	.290
Preceding birth interval	<21 months	27.559	.292	27.074	.338	26.602	.392	27.722	.457
	21-41	27.794	.325	29.767	.303	29.623	.319	30.105	.412
	>41	29.580	.514	33.724	.805	33.255	.792	33.542	.857
Overall		27.998	.201	29.202	.222	29.052	.241	29.638	.290
Gender of Preceding Child	Male	28.473	.281	29.773	.313	29.858	.351	30.098	.396
	Female	27.487	.289	28.575	.312	28.220	.329	29.155	.425
Overall		28.000	.201	29.192	.221	29.052	.241	29.638	.290
Survival Status of Preceding Child	Dead	23.941	.534	23.180	.585	22.732	.682	22.869	.879
	Alive	28.629	.216	29.943	.236	29.792	.255	30.419	.305
Overall		28.000	.201	29.192	.221	29.052	.241	29.638	.290

Factors/ Covariates	Levels	Second Interval		Third Interval		Forth Interval		Fifth Interval	
		Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Period of Breastfeeding for preceding child	0 month	18.652	1.65	21.063	2.883	20.053	2.018	17.917	1.932
	1-6	19.602	.801	20.524	1.039	20.288	1.06	20.816	1.339
	7-12	20.438	.426	23.306	.673	24.140	.811	23.622	.848
	13-18	26.085	.585	25.404	.714	26.254	.933	25.671	.940
	19-24	30.509	.748	30.406	.759	30.772	.831	30.745	.956
	>24	26.750	1.833	26.879	2.164	30.167	2.790	31.696	2.806
Overall		23.939	.338	25.347	.408	25.855	.468	25.979	.519
Period of Amenorrhea for preceding child	0-1 months	22.093	.486	23.143	.868	23.544	.847	24.050	.974
	2-3	22.982	.641	24.433	1.105	24.490	.943	25.143	1.090
	>4	26.792	.544	27.991	.639	28.071	.630	27.994	.713
Overall		23.887	.323	25.851	.479	25.716	.461	26.044	.521
Period of Abstinence for preceding child	0-1 months	23.015	.457	24.516	.556	24.618	.590	24.733	.673
	2-3	24.082	.516	25.868	.654	26.910	.835	26.891	.914
	>4	25.081	1.024	25.760	1.406	28.435	1.449	26.628	1.759
Overall		23.678	.326	25.138	.406	25.785	.464	25.675	.522

Table 3: Comparison of Survival Distribution using Log-Rank Test for higher birth intervals

Factors/Covariates	Second Interval Chi-square	Third Interval Chi-square	Fourth Interval Chi-square	Fifth Interval Chi-square
Age of woman	46.939**	28.980**	18.269**	14.000**
Age at marriage	30.703**	1.465	.485	2.889
Region	8.559**	7.307	2.160	2.680
Residence	15.668**	3.436	3.936*	9.632**
Education of woman	10.671*	34.702**	30.540**	16.339**

Factors/Covariates	**Second Interval Chi-square**	**Third Interval Chi-square**	**Fourth Interval Chi-square**	**Fifth Interval Chi-square**
Education of husband	8.681*	14.080**	24.076**	7.905*
Wealth index	16.011**	26.222**	20.277**	27.850**
Occupation of woman	0.943	1.909	13.361**	.682
Occupation of husband	8.441*	4.245	7.527	13.101*
Preceding birth interval	13.916**	79.180**	73.399**	38.178**
Gender of Preceding Child	7.130**	7.046**	12.855**	2.744
Survival Status of Preceding Child	89.775**	127.249**	108.142**	100.700**
Period of Breastfeeding for preceding child	151.214**	57.749**	55.465**	56.358**
Period of Amenorrhea for preceding child	28.222**	13.563**	9.124**	5.645
Period of Abstinence for preceding child	4.722**	1.932	8.404*	3.446

* * If p<0.01 * If p<0.05 + If P< 0.1

Table 4: Cox Hazard Model for higher order birth intervals, Pakistan 2006-07 (Odd Ratios)

Factors/ Covariates	**Levels**	**Second Birth Interval**	**Third Birth Interval**	**Fourth Birth Interval**	**Fifth Birth Interval**
Age of woman	None	.987**	.989**	.994*	.993*
Age at marriage	None	1.026**	1.015**	1.007	1.006
Preceding birth interval	None	1.000	.993**	.993**	.993**
Region	Punjab	1.117**	1.120*	1.085	.924
	Sindh	1.110*	1.002	1.062	.929
	NWFP	1.140**	1.043	1.103	.888+
	Baloch.	1.000	1.000	1.000	1.000
Residence	Urban	1.107*	1.041	1.076	.979
	Rural	1.000	1.000	1.000	1.000
Education of woman	No	1.257**	1.529**	1.265+	1.644**
	Primary	1.189*	1.536**	1.180	1.529*
	Secondary	1.211**	1.343**	1.103	1.466+
	Higher	1.000	1.000	1.000	1.000
Education of husband	No	1.021	.913	1.006	.960
	Primary	1.043	.942	1.132+	.979
	Secondary	1.020	.966	1.005	.938
	Higher	1.000	1.000	1.000	1.000
Wealth index	Poorest	.932	1.139+	1.089	1.002
	Poorer	.966	1.075	1.029	1.082
	Middle	1.026	1.121*	1.038	1.066
	Richer	.993	1.046	1.091	1.015
	Richest	1.000	1.000	1.000	1.000
Occupation of woman	no work	1.067	1.036	.994	1.028
	profess	1.158	1.128	.948	1.042
	agri	1.132	1.051	1.043	.896
	manual	1.000	1.000	1.000	1.000
Occupation of husband	no work	1.032	1.123	1.205*	1.063
	profess	1.018	1.016	.988	.938

Factors/ Covariates	Levels	Second Birth Interval	Third Birth Interval	Fourth Birth Interval	Fifth Birth Interval
Occupation of Husband	Agri	.987	1.001	1.118*	1.088
	manual	1.000	1.000	1.000	1.000
Gender of Preceding Child	Male	.945*	.959	.877**	.947
	Female	1.000	1.000	1.000	1.000
Survival Status of Preceding Child	Dead	1.413**	1.525**	1.673**	1.646**
	Alive	1.000	1.000	1.000	1.000
N		**7518**	**6225**	**5040**	**3837**

* * If p<0.01, * If p<0.05, + If P< 0.1,
1.000 indicates reference category

Table 5: Cox Hazard Model (Proximate Determinant Model) for higher order birth intervals, Pakistan 2006-07 (Odd Ratio)

Factors/ Covariates	Levels	Second Birth Interval	Third Birth Interval	Fourth Birth Interval	Fifth Birth Interval
Age of woman	None	.665**	.892**	.923**	.959*
Age at marriage	None	1.475**	1.102**	1.050**	1.047**
Preceding birth interval	None	1.036**	1.000	1.005+	1.001
Period of Breastfeeding for preceding child	None	.998*	.982**	.983**	1.000
Period of Amenorrhea after preceding child	None	.988	1.000	.995	1.001
Period of Abstinence after preceding child	None	1.001	1.011**	1.005**	1.004+
N		729	382	439	343

* * If p<0.01, * If p<0.05, + If P< 0.1,
1.000 indicates reference category

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