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Birth Interval Dynamics in Goa : A Parity Specific Analysis'

Introduction

DIFFERENTIALS in fertility, in a population, are usually attributed to variations in the exposure to the risk of pregnancy and the interval between births when exposed. While the entry into marriage generally signals the beginning of exposure to the risk of becoming pregnant, the occurrence of the first conception and birth ensures the actual start of the process of child bearing. The future course of childbearing then depends on the behaviour of spacing and stopping after a specific parity. Hence, for a complete understanding of the process of family building, we analyse the timing and frequency of births, and the determinants of these changes. Goan fertility is one of the lowest in India, with a crude birth rate of approximately 20 per thousand. Significant differentials in birth interval lengths among Goan women have been observed (Srinivasan *et al.* 1993). Thus Goa presents an interesting case for a study of birth interval dynamics.

Typically, research on birth intervals in India has relied heavily on stochastic modelling (Pandey 1981; Srinivasan 1967; Srinivasan *et al.* 1986; etc.) with a few attempts to study the determinants after controlling for socio-economic factors (Singh *et al.* 1993). Further, it has been documented that birth spacing patterns are parity dependent, and parity dependent stopping behaviour is a powerful factor in the fertility transition (Anderson and Bean 1985). Thus, a meaningful analysis of birth intervals may be based on parity cohorts (Feeney 1983). The present paper incorporates these suggestion and analyses the birth intervals of women from three parity cohorts after including socio-economic controls. It is envisaged that separate analysis of the parity cohorts will highlight the differences between women who are at different stages of the family building process.

Background

As mentioned, earlier studies on birth intervals have focused on the use of stochastic models for estimating population fecundability. However, over the last two decades, the availability of data from fertility surveys and substantial progress in statistical methods has led to research on the determinants of birth intervals.

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The timing of births is determined by a number of factors, some biological and others behavioural. It is a widely held view that after the first birth interval, subsequent birth intervals are biologically as well as behaviourally determined until the birth process terminates. At the same time, subsequent childbearing is largely determined by initial events as well as by socio-economic circumstances; the latter may not only determine the initial events but also the biological capacity in part.

For the ease of presentation, we have schematically grouped the factors determining the birth interval into proximate and background. Among the proximate variables, the most important ones are the woman's age at the start of the interval, the survival status of the preceding child and contraceptive use. Economic and socio-cultural conditions are subsumed under background factors.

Among the initial events the age at the start of the interval and the survival status of the previous child are the most important. In most cultures, marriage is an important event which marks the beginning of the process of family formation and child bearing. The age at marriage mediates the influence of several variables on the length of the first birth interval. Early marriage being associated with slow pace of childbearing (Heckman, *et al.* 1985; Mariani 1981, 1984; Moreno 1987; Rindfuss and Morgan 1983; Singh *et al.* 1993). Since it is a well known fact that the capacity to bear children (fecundability) increases with age until a maximum (or plateau) is reached at some point in the mid-twenties, one may expect that the length of birth interval to be longer for women who start their interval below and above the age of mid-twenties. Further the onset of sterility is closely associated with ageing and exerts an ultimate force which causes reproduction to cease. That the age at the start of the interval is an important element in the reproductive process is substantiated by findings from three studies; in one, older women had a higher risk of shorter intervals (Guilkey *et al.* 1988); while in others, birth intervals were shorter for younger women (Rodriguez *et al.* 1984; Trussell *et al.* 1985).

As said earlier, the survival status of the previous child, which is considered as an initial event (or previous reproductive experience), has a direct influence on the pace of childbearing. There are behavioural and physiological effects which link the death of a child to shorter birth intervals. In some cases, the death of the child increases the motivation to have another as a replacement; physiologically, a child death leads to a shorter birth interval operating through a shortened amenorrheic period (Oheneba-Sakyi and Heaton 1993; Singh *et al.* 1993; Suchindran and Adlakha 1984).

On the other hand, miscarriages tend to lengthen an interval as it takes time to conceive again and carry that conception to successful parturition. Abstinence or contraceptive use during an interval can directly affect the length of the birth interval. For example, one study observed that those who used contraception (pill/IUD/injection) has a lower risk of pregnancy and thus, had longer birth intervals (Trussell *et al.* 1985).

Often, the previous birth interval is used as a covariate of the subsequent birth interval (Heckman *et al.* 1985; Rodriguez *et al.* 1984; Trussell *et al.* 1985) as it is believed that a woman would exhibit the same spacing behaviour. However, the preceding birth interval is itself determined by events which have occurred in the distant past. In fact, factors which are very close to the timing of the birth under examination such as the survival status of the previous child and contraceptive use during the interval are better covariates.

Among the background factors, the socio-economic status of the household is an important one though the direction of the effect on birth interval is not clear. Women from advantaged backgrounds may be better nourished and healthy and as a result more fecund; correspondingly, in the absence of contraception, their birth intervals may be shorter. On the other hand, they may suffer fewer child losses and as a consequence their birth intervals may be longer. There is a behavioural angle too as aspirations and life styles are conditioned by the socio-economic environment prevailing in the household. Aspirations and life styles are known to alter childbearing and spacing patterns. Evidence that women from varying socio-economic status groups do have different birth interval lengths comes from a study in Uttar Pradesh; it was found that women from low, low-middle and middle socio-economic status tend to have shorter birth intervals than women from very high socio-economic groups

Education has come to occupy an important place in the investigative work of the reproductive process of women. It is generally believed that women's education may affect the child spacing pattern because education facilitates the acquisition of information about family planning, and encourage attempts to control childbearing. Education of women also delays entry into marital unions and is associated with reduced infant, child and adult mortality. Research suggests that education is positively associated with birth interval length (Guilkey *et al.* 1988; Rodriguez *et al.* 1984) and it is also a primary predictor of the timing of births. In particular, it has a positive effect on the timing of first birth (Mariani 1984); however, other studies have found education to be relatively unimportant in the early stages of the family formation (Rindfuss *et al.* 1984; Trussell *et al.* 1985).

The place of residence has ambiguous effects on the length of birth intervals. Theoretically, it is expected that birth intervals will be longer where health and family planning services are easily available and residents can benefit from them. Some studies have found no rural-urban differentials in child spacing (Guilkey *et al.* 1988; Heckman *et al.* 1985; Ohenaba-Sakyi and Heaton 1993), while others have found that women who reside in urban areas were more likely to have a birth in the early segments and delaying it in the latter parts.

Religion is an important cultural factor which determines not only age at marriage but also child spacing. For example, Muslim women in Kerala were observed to have shorter intervals after the first birth and higher probabilities of progressing to the next birth (Singh *et al.* 1993). Similar evidence comes from Ghana, where women practicing traditional religions tended to have longer birth intervals (Oheneba-Sakyi and Heaton 1993).

Depending upon the cultural context of the population under study, research has identified factors as the woman's occupation, ethnicity, type of marriage and caste to influence the length of birth intervals. In general, the factors discussed above tended to be the most important determinants as some cross-country studies have shown (Rindfuss *et al.* 1984; Rodriguez *et al.* 1984; Trussell *et al.* 1985). A noteworthy observation is that the importance of these factors changes from parity to parity and from one segment to another within a parity (Rindfuss *et al.* 1984).

Data

Data analysed for the present study are from a survey conducted in 1984 in the state of Goa by International Institute for Population Sciences. The main objective of the survey was to study the levels of fertility and mortality in Goa. The survey covered 3483 households and 2588 currently married women were interviewed with the help of a stratified two-stage sampling from all over Goa (Roy *et al.* 1986). The data include the basic demographic and socio-economic characteristics of each household as well as detailed reproductive histories of currently married women. The data analysed for the present work pertains to currently married women who had less than eleven pregnancies and thus the number of currently married women analysed was reduced to 2563 (less than 1% were excluded).

We have included here only those factors that can be directly measured with the available data. We have included four background variables (socio-economic variables) and three intermediate variables as the independent variables. The four background variables taken are the place of residence, religion, educational level of women and socio-economic status of the household. Age at the beginning of the respective intervals, use of contraception during the interval and survival status of the previous child are the three intermediate variables used for the present study which can be directly observed from the data. The dependent variable is the waiting time to give birth of a particular order.

Methodology

In the first step of the analysis, the life table technique has been used by combining the closed intervals of women who had a birth of a particular birth order and open intervals of women who have not experienced the same birth order at the time of survey. The quantum aspect of fertility is indicated by the proportion of women who have a child within a given period, while the tempo aspect is indicated by the median birth interval; advantages of this methodology have been demonstrated earlier (for example, Namboodiri and Suchindran 1987; Rodriguez and Hobcraft 1980; Shcps 1965; Smith 1980).

In the second step, we examined the net effect of the variables on the timing of births through the proportional hazards model. In the usual life table, all women are assumed to have the same risk at any time. Life tables with covariates relax this assumption; they assume, instead that the risk varies among women according to individual characteristics (Cox 1972; Menken *et al.* 1981; Retherford and Choe 1993; Trussell and Hammerslough 1983). Evaluation of the influence of one or several concomitant variables measured on each individual is often an important part of such analysis. The concomitant variables enter the regression analysis as independent variables, while the survival time is treated as the dependent variable.

The proportional hazard model expresses the logarithm of the instantaneous occurrence rates (hazard rates) as a linear function of a set of independent variables or covariates. Specifically, the model takes the form :

$$\lambda(t, z_k) = \lambda_0(t) e^{z_k \beta_k}$$

where, $\lambda(t, z_k)$ is the hazard rate at time t , $\lambda_0(t)$ is the base line hazard function, β_k is a vector of covariates. The base line hazard is like the constant term in an ordinary least squares equation. For a unit increase in a given covariate, Z_k , the multiplicative change in the base line hazard rate is given by $\exp(\beta_k)$. It refers to the instantaneous rate of experiencing an event when all of the covariates take the value zero. As said the event of interest is the waiting time to give birth of particular order and thus $\lambda(t, z_k)$ is a time specific hazard rate (giving birth of a particular order per unit time) for an infinitesimally small time interval centered on time t for a covariate Z_k . This technique allows us to include both closed and open intervals, thus avoiding the bias towards short intervals if only closed intervals were included. Variables entered in the multivariate analysis for the present study are sets of categorical (dummy) variables.

We estimate the effect of the independent variables on the timing of the first, second and fifth births respectively for three parity cohorts (i.e., women with one child, women having between two and four children, and those having more than four children at the time of survey). This results into six equations, one for the first parity cohort, two for the second parity cohort and three for the last parity cohort. We repeat the analysis for all women wherein the effect of the same set of independent variables along with a parity control is examined on the timing of births. Couples who are sterilized, women who have had their uterus removed and menopausal women are included in only those analyses where they have contributed a birth. For example, a woman sterilized after the first birth is not included in the analysis of the second birth.

Findings

We begin by examining the proportion of women who have given birth to children of various orders within sixty months of the previous child's birth (in case of first birth, marriage is the beginning point), in order to understand the process of progression to higher parities. In particular, we examine the proportion of women giving birth to their first child, their second child and their fifth child respectively (see, Table 1). The median birth interval by all the variables under study have also been derived; we can thus have a preliminary idea if the differentials in birth interval lengths across the various groups of women according to their socio-economic characteristics. This measure summarises most of the information contained in the life table and can be meaningfully interpreted in terms of the quantum and pace of fertility (Rodriguez and Hobcraft 1980).

The results suggest that rural women wait for a longer time before giving birth to their first child than their urban counterparts and the difference is statistically significant (see, Table 1). The reason is that age at marriage in the rural area is lower than that in the urban areas. The progression to higher order births for urban women is slower than the rural women. This indicates that urban women will give birth to their first child very quickly and then space their higher order births. The difference in the timing of higher order births between the rural and urban women is not statistically significant though.

TABLE 1: MEDIAN BIRTH INTERVALS AND PROPORTION ATTAINING SUBSEQUENT BIRTH WITHIN 60 MONTHS BY SELECTED CHARACTERISTICS OF WOMEN

Variables	Median birth interval (Tempo aspect)			Proportion attaining birth within 60 months (Quantum aspect)		
	First	Second	Fifth	First	Second	Fifth
Place of Residence						
Rural	24.37	28.40	37.70	0.8518	0.8923	0.6725
Urban	20.47	27.83	39.14	0.8906	0.8503	0.6201
Religion						
Hindu	23.70	28.01	38.35	0.8557	0.8651	0.6571
Roman Catholic	18.86	28.53	40.67	0.8986	0.8495	0.5910
Other	21.62	28.21	28.69	0.9389	0.8616	0.7797
Educational level of (Years of Schooling)						
Illiterate	26.61	28.34	36.17	0.8184	0.8854	0.7166
1-5	21.22	26.26	37.87	0.9114	0.8705	0.6089
6-10	18.84	28.33	-	0.9102	0.8633	0.4132
11+	16.25	30.73	-	0.9298	0.7841	0.2698
Socio-Economic status						
High	17.77	33.71	-	0.8841	0.7815	0.4385
Medium	19.28	28.44	42.33	0.8989	0.8521	0.5694
Low	24.23	27.92	37.40	0.8582	0.8746	0.6783
Age at Marriage						
<18	27.96	-	-	0.7879	-	-
18-22	20.98			0.9169		
23-30	17.13			0.9039		
Age at Previous birth						
<22	-	27.63	27.16	-	0.8862	0.8295
22-27		28.69	34.61		0.8537	0.7001
28+		32.19	49.18		0.7138	0.5570
Survival status of previous child						
Died	-	23.04	29.27	-	0.9190	0.7306
Alive		28.52	38.73		0.8581	0.6443
Contraceptive use						
Using	36.14	43.19	74.25	0.8102	0.7046	0.4163
Not Using	21.01	27.19	30.02	0.8772	0.8666	0.7688
Parity						
1	29.00	-	-	0.6552	-	-
2-4	19.30	30.29	-	0.9253	0.8121	-
5+	25.36	25.81	38.27	0.8872	0.9560	0.6484

The effect of religion on the timing of births can also be obtained from the same table. Non-Hindu and Non-Roman Catholic women progress to higher order births faster than Hindu and Roman Catholic women. The Roman Catholic women have the shortest median first birth interval and their higher order birth intervals are longer. This implies that Roman

Catholic women will delay their higher order births or choose to avoid moving to higher order births. The test statistics for homogeneity indicates that there is a significant difference in the timing of first and fifth births among the women according to their religious affiliation.

We studied the effect of education on child spacing by constructing life tables separately for four broad educational groupings: no education, one to five years of schooling, 6 to 10 years of schooling and 11 or more years of schooling. The median first birth interval decreases as the educational level of women increases. Almost ninety per cent of the educated women will deliver their first birth within sixty months of marriage. There is a sharp decline in the proportion attaining higher order of births within sixty months of their previous delivery for the educated women. This indicates a tendency of educated women to space their higher order births and not to achieve higher parity.

To study the effect of socio-economic status on child spacing, the summary measures are obtained for women by their household socio-economic status. The women from high socio-economic group have a shorter first birth interval than the women from low and middle status groups. Almost same proportions of women from high and medium status attain the first birth within sixty months of marriage. The table also suggests that as the birth order increases the difference in the proportions attaining birth within sixty months and the median birth interval becomes larger among women with varying socio-economic status (i.e., from high to low).

The influence of age at marriage on the first birth interval is examined by constructing separate life tables for women according to their age at marriage. The table values suggest that about ninety per cent of the women who marry after the age 17 years have their first child within sixty months of their married life. It also indicates that the median of first birth interval decreases as the age at marriage increases.

To assess the effect of age at the start of the interval on the timing of births, we grouped the women into three groups, the first group consists of those women whose starting age is below 22, women with starting age between 22 and 27 forms the second group and women whose starting age is above 27 is the last group. The maximum number of women whose age at start of the interval is below 22 will deliver their second and fifth births within sixty months from the date of their previous delivery. It also indicates that the length of birth interval increases as the age at start of the interval increases. The effect of age at start of the interval on the timing of next birth increases with birth order.

The survival status of the previous child is known to affect the spacing of the subsequent birth and information about the survival status is available only after the first birth. The results suggest that the survival status of the previous child has a significant role in determining the pattern of subsequent birth intervals. We find that for each of the birth orders studied, the death of the previous child increases the proportion of women who subsequently have another child and reduces the length of the following birth interval. The death of the first child increases the proportion having a second child within sixty months from 86 to 92 per cent and reduces the average interval from 28.5 to 23 months. Similarly, the death of fourth child increases the proportion having a fifth child within sixty months from 64 to 73 per cent, reducing the average interval 39 to 29 months.

The magnitude of the effect of the use of contraception during the interval is studied by constructing separate life tables for those women who had used contraception (including spacing methods and breast-feeding) and those who had not. The difference in the timing of births among these categories of women is more noticeable and it is larger at higher orders. The use of contraception reduces the proportion of women having a subsequent birth within sixty months. The difference in the average birth interval among these groups is 15 months, 16 months and 44 months for the first, second and fifth births respectively. The result clearly suggests that there is a tendency to space (or avoid) higher order births. The test statistics indicate a significant difference in the timing of births among these categories of women.

The women are grouped into three categories according to the number of children ever born to them and separate life tables are constructed to visualize the child spacing pattern among women those who are at different stages of family building process. Majority of the women, who have more than one child at the time of survey have their first child within sixty months of married life. The average first birth interval is longer for the women who have only one child at the time of survey. The median values indicate that fifty percent of the women who have two to four children and who have five or more children have their first birth within 19.3 months and 25.4 months respectively (see, Table 1). But the difference in the proportion of women having the first child within sixty months of married life is very small among these women. While the average second birth interval is longer for those women who have two to four children. The difference in the proportion having the second child within sixty months after their first child is very large among these women.

We observed from Table 1 that the births of different orders are spaced differently for women according to their parity achieved at the time of survey. The assessment of differentials in the timing of births among these groups of women (i.e., parity cohorts) by their background characteristics is made by constructing separate life tables for women with different background characteristics; the summary measures are presented in Table 2. The table suggests that those women who have two to four children have a shorter first birth interval than those who have one child and more than four children irrespective of their characteristics. The largest differences in the average length of the first birth interval among women who have only one child can be observed between illiterate women and those who have studied more than five years of schooling, between those who were married before 18 years and those who were not, and between users and nonusers of contraception. The difference in the length of the first birth interval between different socio-economic status groups narrows as the parity achieved at the time of survey is increases. The timing of first birth of the parity one women is significantly affected by the age at marriage, religion, educational level and contraceptive use. In the case of higher parity women, all the variables have significant influence on the timing of first birth.

The results from Table 2 also suggest that the timing of second birth for the parity two to four women is significantly influenced by the educational level, contraceptive use and the survival status of the child. Whereas for the parity five and above, it is significantly affected by all variables, except the socio-economic status of the household. Among the parity two to four women, there is a difference in the median birth interval between those

who have experienced the death of their first child and those who have not experienced. But there is no difference in the proportion of women attaining the second birth between these groups of women.

TABLE 2: MEDIAN BIRTH INTERVALS AND PROPORTION ATTAINING SUBSEQUENT BIRTH WITHIN 60 MONTHS FOR DIFFERENT PARITY COHORTS

Variable	Median birth interval (Tempo aspect)					Proportion attaining birth within 60 months (Quantum aspect)				
	First Birth interval			Second birth Interval		First birth			Second birth	
	Parity 1	Parity 2-4	Parity 5+	Parity 2-4	Parity 5+	Parity 1	Parity 2-4	Parity 5+	Parity 2-4	Parity 5+
Place of Residence										
Rural	33.40	20.89	26.53	30.03	26.66	0.6100	0.9047	0.8668	0.8201	0.9516
Urban	26.03	18.40	23.71	30.51	24.76	0.6897	0.9388	0.9140	0.8054	0.9618
Religion										
Hindu	32.90	20.09	26.50	29.77	26.31	0.6103	0.9142	0.8683	0.8115	0.9599
Roman Catholic	22.75	17.49	20.70	31.66	23.31	0.7368	0.9339	0.9131	0.8118	0.9487
Other	19.92	21.35	22.88	34.50	25.42	0.7984	0.9538	0.9778	0.8192	0.9333
Educational level (Years of schooling)										
Illiterate	78.28	24.64	27.22	31.22	26.73	0.4885	0.8590	0.8519	0.8248	0.9452
1-5	37.39	19.73	20.81	28.10	24.70	0.6502	0.9367	0.9721	0.8087	0.9832
6-10	23.64	17.68	24.67	30.02	21.00	0.7224	0.9677	0.9444	0.8480	0.9722
11+	22.47	15.44	12.86	31.41	19.20	0.7792	0.9805	1.0000	0.7757	1.0000
Socio- Economic status										
High	35.40	16.34	19.20	34.74	17.14	0.6236	0.9675	1.0000	0.7600	1.0000
Medium	24.77	17.19	24.10	30.19	25.06	0.6148	0.9448	0.9328	0.8263	0.9412
Low	31.56	21.77	26.08	29.88	26.10	0.6258	0.9054	0.8750	0.8166	0.9571
Age at Marriage										
<18	92.60	25.69	28.34	-	-	0.3250	0.8182	0.8252	-	-
18-22	28.50	19.02	22.74	-	-	0.6963	0.9549	0.9550	-	-
23-30	23.16	15.77	16.11	-	-	0.7168	0.9721	0.9792	-	-
Age at Previous birth										
<22	-	-	-	28.98	26.36	-	-	-	0.8406	0.9472
22-27	-	-	-	31.57	24.42	-	-	-	0.8173	0.9755
28+	-	-	-	33.30	21.00	-	-	-	0.6990	1.0000
Survival status of previous child										
Died	-	-	-	26.18	21.47	-	-	-	0.8143	0.9800
Alive	-	-	-	30.19	26.37	-	-	-	0.8135	0.9521
Contraceptive use										
Using	49.22	32.20	40.50	44.86	33.43	0.6247	0.8938	0.6694	0.7131	0.8913
Not Using	18.38	18.25	24.69	28.03	25.28	0.8230	0.9257	0.8950	0.8381	0.9600

The results discussed so far had no socio-economic or biological controls. Results from the next analysis are from a Cox proportional hazards model which controls for socio-economic and proximate variables. Estimated regression coefficients from the Cox proportional hazard model for first birth interval are given in Table 3. In this table, columns 3 to 5 provide the regression coefficients for the three parity cohorts respectively, while column 2 presents the results for all women with parity as a control variable. The results for all women suggest that after the introduction of socio-economic and biological controls the effects of place of residence and socio-economic status are not significant. Considering religious affiliation, the contrast between Hindus and Roman Catholics is significant with an earlier first birth for Roman Catholic women. The educational level and age at marriage of women are considerably more important to the timing of first birth. The results suggest an increase in the earlier timing of first birth as the age at marriage and educational level of women increases. However, the effect of socio-economic status of household is not significant; the women from high socio-economic status households have their first child later compared to those from the low socio-economic status. Not surprisingly, contraceptive practice prior to first birth has an important effect on its timing. Women who initiated contraceptive use before first birth have a late first birth. An early timing of first birth is observed for women with more than one child at the time of survey. The over all difference in the timing of first birth between parity two to four women and parity five and above women is negligible.

Column 3 of the table suggests that for parity one women, educational level and age at marriage have significant effect on the timing of first birth, contraceptive use is an additional factor for women of higher parities. This is not a surprising finding considering that contraception often begins only after the birth of the first child. The magnitude of the effects of contraceptive use during the interval on the timing of first birth is maximum for the women who have 2 to four children and is minimum for the women who have one child. Across the parity cohorts studied the direction of the majority of the variables remains unchanged.

Table 4 presents the estimates from the multivariate life table analysis for the timing of the second birth. The educational level, age at first birth, contraceptive use and survival status of the first child are the most important determinants of the timing of the second birth. Women who had used contraception and those whose first child survived had a longer second birth interval. In the case of educated women the second birth interval was shorter. The second birth of the women who had more than five children occurred earlier than those having two to four children. The age at the start of the interval (i.e., the age at first birth) shows a negative effect on the timing of second birth. Among the categories of age at the start of the interval, only age over 27 years shows a significant impact on the timing of second birth; women over 27 were likely to have longer birth intervals. On the other hand, women who had their first child when they were less than 22 years old had timed their second birth in a similar fashion to those who had been between 22 and 27 at the time of the first birth. Finally, there is indication that women whose first child had died tended to have their next child very quickly. This finding lends support to the often cited hypothesis that couples bear children to replace those they had lost.

TABLE 3: ESTIMATED REGRESSION COEFFICIENTS FROM COX PROPORTIONAL HAZARD MODEL FOR FIRST BIRTH INTERVAL

Variables	All women		Parity 1 women		Parity 2-4 women		Parity 5+ women	
	β	S.E.	β	S.E.	β	S.E.	β	S.E.
Place of residence ^a	0.0077	0.0487	-0.0449	0.1254	-0.0045	0.0670	0.1406	0.891
Religion ^b								
Roman Catholic	0.1346	0.0527	0.0835	0.1342	0.1385	0.0709	0.1870	0.1026
Other	0.1188	0.1002	0.2242	0.2735	-0.0220	0.1422	0.3960*	0.1737
Educational level (Years of schooling) ^c								
1-5	0.3013*	0.0604	0.2024	0.1843	0.3486*	0.0833	0.3067*	0.1043
6-10	0.5356*	0.0764	0.4990*	0.1819	0.6065*	0.0993	0.1598	0.1954
11+	0.7264*	0.0860	0.6416*	0.2005	0.7474*	0.1097	1.0651*	0.3126
Age at marriage ^d								
18-22	0.4564*	0.0552	0.5309*	0.2024	0.5209*	0.0805	0.5112*	0.0899
23-30	0.5813*	0.0722	0.6327*	0.2106	0.5861*	0.0963	0.9160*	0.1714
Socio-economic status ^e								
High	-0.1294	0.0984	-0.3590	0.2204	-0.0764	0.1225	0.3088	0.2841
Medium	-0.0546	0.0587	-0.0311	0.1471	-0.1173	0.0800	0.1165	0.1091
Contraceptive use ^f	-0.5440*	0.0828	-0.0340	0.1821	-0.6946*	0.1123	-0.6509*	0.1756
Parity ^g								
Parity 2-4	1.1069*	0.0711						
Parity 5+	1.1910*	0.0826						
Log-likelihood	-13357.91		-1521.31		-6436.68		-3415.75	
Number of observations	2186		468		1085		633	
Number of Censored cases	179		179		0		0	

Reference category: (a) Rural, (b) Hindu, (c) Dilliterate, (d) < 18, (e) Low, (f) Not Using, (g) Parity one women.

*Significant at < 0.05 level.

The separate analysis of the timing of the second birth for women by their parity achieved at the survey is also provided in the same table (columns 3 and 4). In general, the magnitude of the effects of the variables on the timing of second birth are higher for women who had more than four children than those who had fewer children. The direction of the effect of some variables change across women of parity 2 to 4 and parity 5 and above. The important variable which has a change in direction is the age at the start of the interval (i.e., age at first birth); parity two to four women tended to have a late second birth and not surprisingly, the parity five and above women had their second child earlier. The magnitude of the effect of the use of contraception on second birth interval is greater for those women who have two to four children as compared to those who have more than four children. We can speculate that the lower parity women practice more effective contraception and hence have longer

second birth intervals. Similarly the magnitude of the effect of survival status of the child on the timing of second birth is greater for women whose parity is five and higher, though both groups tended to have longer intervals if their earlier child had survived.

TABLE 4 : ESTIMATED REGRESSION COEFFICIENTS FROM COX PROPORTIONAL HAZARD MODEL FOR SECOND BIRTH INTERVAL

Variables	All women		Parity 2-4 women		Parity 5+ women	
	β	S.E.	β	S.E.	β	S.E.
Place of residence ^a	0.0752	0.0516	0.0364	0.0649	0.1632	0.0874
Religion ^b						
Roman Catholic	0.0673	0.0572	0.0133	0.0694	0.1592	0.1042
Other	-0.0085	0.1083	-0.0348	0.1421	-0.0381	0.1724
Educational level (Years of Schooling) ^c						
1-5	0.2113*	0.0632	0.1563*	0.0826	0.2849*	0.1005
6-10	0.2334*	0.0840	0.1507	0.0963	0.5547*	0.1917
11+	0.2408*	0.0954	0.2205*	0.1080	0.4767	0.3251
Socio-economic status ^d						
High	-0.0085	0.1135	-0.0108	0.1271	0.1342	0.3435
Medium	0.0474	0.0635	0.0653	0.0811	0.0668	0.1167
Contraceptive use ^e	-0.6833*	0.0913	-0.7188*	0.1051	-0.5502*	0.1881
Parity ^f						
Parity 5+	0.5334*	0.0581				
Age at first birth ^g						
22-27	-0.0002	0.0577	-0.0983	0.0685	0.2536*	0.1055
28+	-0.4069*	0.0999	-0.4691*	0.1052	0.3215	0.3435
Survival status of first child ^h	-0.3803*	0.0877	-0.3072*	0.1363	-0.4828*	0.1167
Log-likelihood	-11449.50		-6866.45		-3451.27	
Number of observations	2007		1374		638	
Number of censored cases	289		289		0	

Reference Category: (a) Rural, (b) Hindu, (c) illiterate, (d) Low, (e) Not Using, (f) Parity two to four women, (g) < 22, (h) Died

* Significant at < 0.05 level

The regression coefficient for the timing of fifth birth is given in Table 5 and the results are confined to women of parity five and higher. While, in general, all educated women tended to have longer intervals than those uneducated, only those with six to ten years of schooling seemed to be significantly different. The survival status of the previous child also shows a negative effect, but the effect is not statistically significant. The use of contraception and age at the start of the interval show a significant effect on the timing of the fifth birth.

Contraceptive users and women older than 22 at the time of the previous birth have longer birth intervals. The Roman Catholic women have a late fifth birth as compared to the Hindu women.

Conclusion

In general, the main sources of variation in the timing of first birth are the age at marriage, level of education, use of contraception and socio-economic status of the household a woman comes from. Women who reside in rural areas and those who are Hindus tend to have longer first interval due to low level of education and age at marriage. Expectedly women who have only child at the time of survey have longer first birth interval than those who have more than one child; however, it is not possible to test whether this is due to choice or primary sterility. Similarly, the timing of second and fifth births vary according to women's age at start of the interval, contraceptive use, survival status of the previous child, educational level, socio-economic status. Women who have had more than four children at the time of survey tend to have shorter birth spacing than those who have fewer children; in particular, their second birth interval is shorter. However, there is no difference by place of residence.

TABLE 5: ESTIMATED REGRESSION COEFFICIENTS FROM COX PROPORTIONAL HAZARD MODEL FOR FIFTH BIRTH INTERVAL

Variables	All women	
	β	S.E.
Place of residence ^a	0.0511	0.0856
Religion ^b		
Roman Catholic	-0.1987*	0.1017
Other	0.0281	0.1675
Educational level (Years of schooling) ^c		
1-5	-0.0461	0.1005
6-10	-0.4039*	0.1921
11+	-0.4289	0.3139
Socio-economic status ^d		
High	-0.1041	0.2850
Medium	-0.1091	0.1098
Contraceptive use ^e	-1.6444*	0.1382
Age at fourth birth ^f		
22-27	-0.3565*	0.1393
28+	-0.6953*	0.1418
Survival status of fourth child ^g	-0.2183	0.1697
Log-likelihood	-3821.10	
Number of observations	974	
Number of censored cases	341	

Reference Category: (a) Rural, (b) Hindu, (c) Illiterate, (d) Low, (e) Not Using, (f) < 22, (g) Died.

* Significant at < 0.05 level

The results from the proportional hazards model are consistent with those obtained from univariate life table analysis. When we consider all women, the age at the beginning of the interval, use of contraception, survival status of previous child and educational level significantly determine the timing of a birth. Women who marry at later ages tend to start family building earlier than others, presumably in an attempt to make up for lost time. However, younger women have shorter birth intervals after the birth of the first child. Educated women too, tend to have relatively shorter first and second intervals and they also have fewer children. This suggests that educated women have fewer children which are compressed in the initial years of marriage. As expected, if the previous child survives then it is likely that following birth would be delayed. Women with more children are likely to have shorter birth intervals, as their pattern of childbearing tends to be one of fast progression to higher parities.

No attempt was made to study the spacing pattern over time. However, if we take into account that the women who have fewer children is a recent experience and women who have more children did so in the remote past, we can conclude that there is a tendency to space the births over time. The summary arrived from the results of the analysis made for the parity cohorts separately indicates that the major variables which affect the timing of births of different order remains the same across different parity cohorts, though the direction of some variables do change. The results also indicate that timing of lower order births are determined both by socio-economic and proximate variables studied, whereas for the higher order births significance of the socio-economic variables are reduced.

To draw policy implications, the study suggests that, as other states achieve a socio-economic profile similar to Goa, we can expect women to be better educated and marry at later ages. Simultaneously, women will have fewer children which survive and use contraceptives. This study has highlighted that sometimes these factors work in opposite directions and the length of the birth interval is determined by the sum of the countervailing forces. Also, the combined effects of these factors vary for each of the different birth intervals; for example, the first birth interval is lengthened by contraceptive use but reduced by education and higher ages at marriage. On the other hand, longer would be the second birth interval if higher be the child survival and contraceptive use; and, it is shortened with the increase in the level of education.

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