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Fertility and Infant Morality An Analysis of Turkish Data*

I

This article tests some of the hypotheses relating to the impact of infant mortality on fertility, using data from a sample survey of 803 married women in Ankara city. The data show that infant mortality produces shorter intervals between births. The relationship between infant mortality and birth intervalin part is the result of motivation by parents to replace 'a dead child. This appears to be independent of differential breastfeeding, which could produce similar results. Infant mortality experience of couples also results in a high fertility syndrome : less use of contraception, higher current fertility, and high expected fertility. The relationship persists even when social and economic characterstics are held constant.

II

It is a commonplace argument that levels of infant and child mortality affect the fertility level of couples. The theory of demographic transition asserts that low infant and child mortality is a necessary condition for the achievement of low fertility.

Arguments on this topic can be broadly classified in two categories. One hypothesis links infant mortality directly to fertility limitation. It is based on the assumption that couples desire children and have at least a general notion of the number they desire. The argument, in

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brief, is that if the mortality level is high a large number of births is required to ensure the survival of the desired 'number and sex composition of children. In such a situation there is little motivation among couples to resort to any means of fertility control. Conversely, if infant mortality is low, fewer births are needed to producet he desired number and sex composition of children and the same number of births will result in more children surviving at any given age, causing pressure on couples to limit their fertility.

Another argument derives from the results of studies conducted in populations practising universal breastfeeding and no fertility control. Infant mortality affects the spacing between births and hence the total number of births, independent of any attempt by the parents to limit the size of the family. These studies show that the birth interval following an infant death is shorter than the birth interval in cases of infant survival to age one. The observed association between infant mortality and birth interval has been considered a result of the relationship between lactation and fecundity : lactation prolongs postpartum amenorrhea and thus, even in the absence contraception, tends to delay conception. The death of an infant interrupts lactation and as a consequence ovulation is resumed sooner and pregnancy follows earlier than otherwise. The reasoning here is based purely on the physiological relationship between lactation and fecundity and not on the conscious control of fertility.[1]

Data for the purpose of the present study are taken from a survey conducted in the city of Ankara in 1966. The frame for the sample was provided by the Turkish State Institute of Statistics from the 1965 census listings. All households containing a married couple were considered eligible. The sample contained 803 households. Married women served as respondents. The response rate was 99 per cent.

Information on the complete history of child bearing and pregnancy of married women was collected during the survey. For each live birth, the date of birth, sex, survivorship, and age at death were recorded. In addition, information on contraceptive use, as on future goals, was ascertained. However, no data on infant feeding practices were obtained in the survey.

The present analysis is carried out in three sections. The first deals with the relationship between infant mortality and birth interval. The other two consider the impact of infant mortality on contraceptive use and on live births respectively. The concepts and information used are described in each section.

III

Gautier and Henry, in their analysis of birth intervals based on data obtained from parish registers of Crulai in Normandy, find that the average interval following the death of an infant before age 1 was 20.7 months, while the average interval was 29.6 months if the child survived until age 1. This difference of 9 months was attributed to the effect of lactation on the anovula-tory period.[2]

Other studies in this context are : the works of Henripin[3] on data for French Canadians of the 18th century and of Smith[1] for the Malay population of the Cocos-Keeling Island. In both these studies the average interval between births was found to be shorter if the child died than if the child survived. The difference was also attributed to infecundity during lactation.

However, as these studies pertained to periods long in the past, it was assumed that prolonged breastfeeding was prevalent at those times.

A study by Potter *et al,* based on the sample survey data from Punjab in which direct information on amenorrhea was collected, shows that lactation has an effect on amenorrhea. It was noted that if a child died in the first month, the median amenorrhea period was two months, as against eleven months if the child survived the first year. Since breastfeeding is common in Punjab, this difference was attributed to the effect of lactation.[5]

The studies mentioned above indicate that infant mortality has an effect on the interval between births through lactation. Another hypothesis, suggested by Knodel, is that infant mortality might have an effect on birth interval independent of lactation. He suggests:

> The presence of an infant or young child could reduce the frequency of intercourse. The burden of work resulting from a new infant in the household might exhaust the parents' energies and thus be adverse to their desire for intercourse. It is also possible that sleeping arrangements are altered after the birth of a child; the mother may sleep in the child's room without her husband or perhaps the infant sleeps in the parents' room or even in the parents' bed and thereby inhibits coitus. In any of these events the survival of a newborn infant would have the effect of delaying a subsequent conception without a conscious attempt by the parents to space their children or limit the size of their family. Conversely, the premature death of an infant would result in a return to condition more conducive to early conception. In fact, an infant death might even cause an increase in intercourse if the parents hope to hasten a new pregnancy in order to replace the loss of the previous child [6]

In three Bavarian villages, Knodel tested the effect of infant mortality on interval by investigating the effect of the first born on the interval between second and third births. He was looking for an impact independent of lactation. Although his results were not really conclusive, Knodel noted that the interval between second and third births is longest if the first two infants survived and shortest if the first two infants died. This pattern supports the hypothesis of effects of infant mortality, independent of lactation, on the interval between the second and third births.

In the following analysis we use the data to study (1) whether the relationship between infant mortality and birth intervals observed in the case of other populations holds true for Turkey, and (2) whether infant mortality has an effect on birth intervals independent of lactation.

The 803 women interviewed in the Ankara survey had 2,692 live births, of which 728 were first births, providing us with 1,964 completed birth intervals exclusive of the intervals between marriage and first birth. These intervals are excluded because they are not affected by infant mortality.

More than one-third of the women surveyed in Ankara reported *ever using contraception or abortion.* These women were asked to specify the time they first began using any birth control method. We excluded from this analysis the intervals (N=363) after first use of contraception or abortion. In addition we also excluded intervals (N = 133) of those women who reported multiple marriges, as well as half the multiple births in which the interval was zero (**N** =18).

After exclusion of all these intervals we are left with 1,450 completed intervals free of contraceptive effects, according to the statements of the respondents.

Three data problems may materially affect interpretation of findings :

(1) *Memory Bias.* The reliability of the length of birth intervals depends on the accuracy of the reporting of births, deaths, and dates of their occurrence. Birth dates were reported in months, meaning that the computed intervals could be inaccurate by a month, at the maximum, on either side, although no bias would be involved. Between five and ten per cent of the births were reported by year and season. In these cases, month was coded by selecting random numbers associated with the reported season, i.e., three, four, or five, with the term "spring" etc. We have no reason to believe that this produced a serious distortion of the data. On *a priori* expectations, the chance of memory bias is more likely for events which had occurred long before the time of the survey. Based on a three-year moving average of infant rates, it appears that there is a recall problem associated with infant deaths that occurred 15 or more years ago. Data for 10-15 years before the survey date were found to be of good quality.[7] Therefore, some results are given separately for the whole retrospective period as well as for the last 15 years, the latter being less subject to memory bias.

(2) *Truncation Effect.* In this study, since 80 per cent of the women with at least two live births are still in their childbearing years, there are many birth intervals which are not yet completed. For example, a 28 years old woman who has an open interval of five years but who will eventually have a third birth does not get included in tabulations of the average third birth interval. The interview artificially truncates the data. Women whose fertility is not completed and who will ultimately have long birth intervals have less chance of being included in tables which are not bound by a time period.

(3) *Pregnancy Loss.* We studied only intervals between live births and they are not adjusted for fetal deaths, although this information was collected in the study. Potter *et al* find that on the average pregnancy loss prolongs the interval by two months.[8] If infant deaths and fetal loss are correlated, our analysis generates an overestimate of intervals following death. This would make it even more difficult to demonstrate that short intervals follow infant mortality.[9]

The average intervals between births, controlling for the survival outcome of the previous birth are shown for the whole retrospective period and for the period 1951-66 in Table 1.

In general, the results shown in this table are similar to those found for other populations: the average birth interval is shorter in the case of an infant death than when the child had survived until age 1. The analysis of births occurring during 1951-66 shows that the average birth interval is 8.4 months shorter in the former case than in the latter. Similar results, though with a larger difference, are shown for the entire retrospective period. The magnitude of these differences is fairly close to that found in the previous studies mentioned earlier.

Results of a study based on data from Taiwan, comparing women who breastfed their children with women who did not, indicate that, on the average, lactation prolongs amenorrhea by seven months.[10] Therefore, on the basis of this lactation effect alone the interval succeeding f infant death may be expected to be about seven months shorter than the interval would be if the child survived. If it is assumed that all women in our sample breastfed their children unless interrupted by the death of the child, then the difference of 8.4 and 10.8 months, which we observed in the average birth interval, may be presumed to be the result of this relationship between lactation and fecundity. But the assumption of prolonged breastfeeding among Ankara women is not realistic. Although we have not collected any information on breastfeeding in our study, the results of another study in Turkey show that in urban areas many women do not breastfeed their children at all, and more than half do so for six months or less.[11] In such a situation, the differential found in our data cannot be completely explained by the lactation effect alone. The differential produced by lactation should be less than seven months since many of the women whose children survived did not breasfeed.

We see in Table 2 that regardless of mother's age or birth order, birth intervals following an infant death are shorter than those where the previous child survived to age 1. There is contraction of differentials for higher ages and higher birth orders. In general, we observe a less clear-cut increase in the birth interval, by age or order, following the survival of a child compared to that in the average birth interval following a§ infant death. -This apparently cannot be explained in terms of the effect of lactation or the effect of subfecundity in older mothers, since the averge birth interval does not increase substantially by the age of the mother if the child survived. The data showing that interval following death increases with parity is, however, consistent with the idea that parental motivation may be involved. Where a death occurs early in the family-building process parents may be motivated to have another child quickly in their attempt to close the gap between present and desired family size. At higher parities the gap is smaller and the motivation less. The relevance of the hypothesis that infant mortality has some effect on birth interval independent of lactation is apparent.

One approach for testing this hypothesis is to investigate the possible effect of the suruiving children [12] on the interval between births, controlliag for birth order. In Table 3 we give the average interval between births of order 2 and 3, controlling both for the outcome of the second child and for the survival of the first child at the time of the second birth. It should be noted here that the outcome of the first child should not affect the duration of breastfeeding for the second infant. If it does have an effect, it seems likely that persons with the experience of an infant death would tend to prolong breatsfeeding because the woman would have fewer demands placed on her by other children. This would work against the motivation hypothesis.

The results of Table 3 indicate that previous experience of infant and child mortality tends to shorten the interval between subsequent births. This is true whether the birth at the beginning of the interval survives or dies before reaching age 1. For example, the average interval between births of orders 2 and 3 is 26 months when the second order birth survived infancy but the first child had died before the second birth. Yet, the interval between the second and third births is 36 months if both the first and the second child survived. This ten-month differential con-not be attributed to lactation since the second birth survived to age 1 in both cases, and, hence, the lactation period was not shortened by infant death. Moreover, the average interval between the birth of the second and the third child is very short (18.7) if both the first and the second child died and significantly longer (23.0) if only the second child died.

Suppose Table 3 is viewed as representing material relevant to both the motivation and lactation-amenorrhea hypotheses. If we assume that most women want more than two children then the cells of the table may be relabelled as follows:

First Birth Outcome	*Second Birth Outcome*	
	Survived	*Died*
Died	some motivation (one child) + "lactation" (26 months)	much motivation (no children) + "no lactation" (19 months)
Survived	little motivation (two children) + "lactation" (36 months)	some motivation (one child) + "no lactation" (23 months)

The pure "lactation" effect is relatively small (26 months-23 months), which may not be surprising for these data give the estimates of relatively low levels of lactation in the Ankara population. Larger effects are noted for the motivation hypothesis.

The fact that the same pattern as found in Table 3 is observed for intervals three to four and four to five (Tables 4 and 5) increases the reliability of the findings, even though in some categories we have too few cases for the differences to be statistically significant.

The pattern observed in Tables 3, 4, and 5 could be the result of some selective process: high status persons have lower infant mortality, more survivors, and longer birth intervals; or older persons have more surviving children and longer intervals. Unfortunately the sample size is too small fora meaningful cross-tabulation of the data given in Tables 3, 4, and 5 with the additional controls of status and age. To achieve the purpose we use the technique of multiple-classification analysis, analogous to multivariate analysis but applicable in situations where independent variables are qualitative or classificatory.[13] The technique gives the deviation of each category mean of each predictor from the overall mean; these are termed "unadjusted deviations." Also given are deviations after adjusting for the effect of predictors either individually or in combinations; these are termed "adjusted deviations". The difference between unadjusted and adjusted deviations signifies the relationship caused through the factors'for which adjustment is made. The limitation of the technique is that it does not take interaction effects into account.

Variables for which adjustment is made are status score of husband at the time of birth,[14] education of the mother, and age of the mother at the time of same birth. Using the same data as shown in Tables 3, 4, and 5, Table 6 shows the relationship between birth outcome, previous surviving children and birth interval. After adjustment for age and status variables, the results are virtually identical with those shown previously. This is not surprising bacause no contraception was reported by respondents in these birth intervals. There appears to be both a "lactation" and a "motivation" effect. Differences are as large after adjusting for age and status as they were before the adjustment. Since the relationship cannot be explained by age or status and since the data are for intervals in which no contraception was reported, one or both of Knodel's explantions seem appropriate here : either a child's survival interferes with parental sexual behaviour, or the experience of a child's death motivates a couple to replace children who have died, or both. Thus, in addition to any lactation effect on the length of birth interval, infant and child mortality have an additional net correlation with the length of birth intervals.

Our analysis has thus far been based on birth intervals prior to any use of contraceptives by respondents; couples who had ever practised induced abortion were also excluded. However, we give average birth intervals, controlling for infant death, after the women began to use contraceptives, or had an induced abortion, in Table 7. Here also the average intervals are shorter if the infant died at the beginning of the interval than if the child survived infancy. The fact that such a pattern exists for women with some contraceptive experience suggests that the use of contraceptives was less common in the interval following infant death. This gives additional support to the parental motivation hypothesis.

IV

It is a common argument that one of the necessary conditions for the transition from high to low levels of fertility by birth control is a substantial decline in infant mortality.[15] Some authors have attributed fertility differential between nations and between groups within a nation to the varying risks of child mortality. For example, according to one scholar :

> Contrary to current belief which attributes the differences in fertility to a direct influence of social class and other related phenomena, we emphasize the security provided by the revolutionary discoveries in the field of medicine and public sanitation. The greater the extent to which families are medically insured against infant and child deaths, the higher the proportion oriented to practise birth control, and the earlier they undertake such a decision regardless of class position.[16]

Based on these theoretical contentions we formulate the hypothesis: infant mortality has a negative influence on the use of contraceptives and a positive effect on the number of live births. Before getting into the analytical tests of this hypothesis, we shall briefly describe the concepts and data we have used.

The following analysis is based on data for women with at least two live births. Women with one live birth were dropped from analysis because they had no previous experience of infant mortality and the information obtained from them about future fertility is probably less reliable.

In order to study the effect of infant mortality on contraceptive use and number of live births, women are divided into two groups (1) those with at least one infant death among the first four births, and (2) those with no infant deaths. Infant death after the fourth birth are not considered because they might be the result of high fertility itself.

A woman is considered *contraceptive user* if an affirmative response was obtained to the question:"Have you or your husband used any method to limit the number or to plan the spacing of children?" The results are presented separately for women reporting contraceptive use alone and those reporting contraceptive use plus induced abortion.

Fertility is measured in terms of live births. We used two measures of the number of live births : (1) number of live births up to the time of the survey, and (2) total number of live births expected which is the sum of the number of live births up to the time of the survey and the number of additional births expected at that time. The actual completed fertility of the women may differ from expected fertility due to fecundity impairments or contraception failure; yet these data represent the realistic goals of couples in the present situation.

Table 8 shows the percentage of women who had used some contraceptive method or induced abortion, by the current age of the mother and the experience of infant mortality. The percentage who used some method of birth control is reduced for women who had at least one infant death compared to those who never had an infant death. This pattern is consistent for all three age groups. In the first two age groups percentage variance in the use of contraceptives explained by infant mortality, is statistically significant. In the third age group, with women of the age 45 or more, differences in the correct direction are also notable though the corresponding variance explained is not statistically significant.

A plausible explanation for the relationship observed is that the incidence of death reduces the motivation for fertility control on rather pragmatic grounds. When one or more deaths occur among the early births, the gap between family size and desired family size is dosed rather slowly and the need to resort to family planning is lessened. Another possible explanation of these differentials in contraceptive use is that both the survival of infants and the use of contraception are positively correlated with social status and modernization variables and the results observed above may be an artifact of this relationship. Therefore, we controlled for socio-economic variables to see whether the relationship still holds true. Education and community background and husband's income are used as separate control variables, and the results are given in Table 9 for the women under 45.

Controlling for community background does not change the direction of the relationship observed earlier. In all categories of community origin, women with no infant deaths are more likely to use contraception than women with some experience of infant mortality. In the urban group, differences are smaller. When we control for income and education, differentials in the use of contraceptives exist in the low and middle income and educated categories, while for high income groups the differentials either are not pronounced or disappear.

In the lower status groups, it is clear that the absence of infant mortality is more likely to bring about contraceptive procedures, presumbly resulting from differences in parental motivation. In the upper status groups where six to eight of every ten women have used family limitation regardless of the infant mortality experience, this is clearly not the case. It is possible that when the use is so common the data contain a great deal of spacing limitation rather than simply numbers limitation. Our hypothesis is keyed to the latter. Since differentials in use by infant mortality are in general noted in most of the population we do not intend to reject the hypothesis that high infant mortality results in lower levels of family limitation.

V

Various studies using national or regional data have investigated the relationship of infant mortality and fertility using the crude measures of fertility. A few of the studies which suggest that infant mortality variations may be the cause of fertility variations between nations and regions are by Knodel and Van de Walle,[17] Heer,[18] and Robinson.[19] All the three studies show a positive relationship between fertility and infant mortality when other characteristics are controlled. These studies use aggregate data.

Analysis using data on Turkish couples confirm the findings of these studies. Infant mortality appears to have significant impact on the fertility of couples. Data in Table 10 suggest a strong positive relationship between infant mortality experience and fertility. In each category of age shown in the Table wives who exeprienced some deaths of their infants had more live births at the time of survey and also expected to end up with more live births by the end of their reproductive period than those who did not have any deaths of their infants.

The differences observed in the live births and expected live births by mortality experience are substantial in magnitude. For example, data for women of 45 and older show 2.6 more live births for those with mortality experience as compared to those with no experience. The experience of infant deaths explains a significant percentage of variance in live births as well as expected live births, ranging from 11 to 30 per cent.

Women who lost infants by death appear to try to make up for the lost children by having more live births. This is consistent with the results presented earlier on the relationship of infant mortality with birth interval and with fertility control practices. We observed that the experience of infant deaths results in short birth intervals as well as less use of fertility control methods. As a consequence of this, one would expect high fertility for women with the experience of infant mortality. Table 10 thus presents an additional evidence that infant mortality affects fertility and could be indicative of some motivation on the part of parents to replace the dead child. The number of additional children expected (from interview until family is completed) is larger among women with infant mortality. These data support the view that persons recognize the impact of infant mortality.

The results observed in Table 10, however, could be spurious, because of the relationship between socio-economic status (SES) and infant mortality experience. The association also could arise due to differences in duration of marriage by infant death experience. The longer the marriage, the greater the number of births and the probability of experiencing infant deaths.

Data for women under 45 years of age in Table 11 show that when any of the variables such as education, income, media exposure, community of birth, or duration of marriage is used as a control variable, the relationship of mortality experience with number of live births and expected live births is still quite pronounced. In all the 15 comparisons (5 variables x 3 categories), couples who have had an infant death have had more live births and expected to have more live births. In 13 of the 15 comparisons they expect to have more anditional births. This seems to be an explicit recognition of the problem. Furthermore, the summary results from the multiple classification analysis given in Table 12 when adjusted for the couple's education, husband's income, media exposure, and duration of marriage (all combined), show that the relationship of mortality experience with live births and expected live births is only slightly accounted for by these variables. The "adjusted" deviations are only slightly less than the "unadjusted" diviations. The net effect of experience results in 1.1 more live births and 1.4 more expected live births among women with infant mortality experience compared to women with no such experience.

These data demonstrate that the mortality level of infants affects the fertility level. Hence, some variations in the fertility of different nations or various groups of the population within a nation may be due to variations in the level of infant and child mortality.

Data in Table 11 also indicate that SES differentials of fertility exist after controlling for the experience of infant deaths. Couples of high status have lower fetility (measured in live births and expected live briths) regardless of the infant mortality experience. The differentials of fertility by SES are greater among those who experienced deaths than among those who did not. For example, in the case of couple's education, among women with some experience the average number of live briths for three categories of education (no primary, at least one primary, and at least one more than primary) are 8.5, 5.0 and 3.7 respectively. The difference between extreme categories is 2.1, which is greater than the difference of 1.7 observed for women with no experience, where the average number of live briths for the three categories of education are 4.5, 3.7, and 2.8. Stated differently, differences in live briths are larger than differences in serviyjng britks (surviving briths plus additional). From these data we conclude that SES differentials in fertility are due in part to their association with infant mortality.

The brief analysis carried out in this section suggests that (a) couples with experience of deaths of their children tend to make up for the loss of children ; (b) SES differentials of fertility are in part due to the association of SES with infant mortality and a decline in infant mortality differential will probably result in a narrowing of fertility differentrils by the SES ; (c) SES factors have an association with fertility which cannot be explained by variation in the level of infant mortality

VI

Analysis of data from a sample survey in the city of Ankara provide some interesting results. It confirms the finding of earlier investigations that infant mortality is related to shorter birth intervals. However, it suggests that the shorter birth interval is not entirely the result of lactation but is in part due to the motivation of parents to have a child in place of a dead child soon, or to factors related to the survival of child which may interfere with the sexual behavior of couples, or both. In view of the indirect approach used in this study for detecting the impact of infant mortality on brith interval independent of lactation, our results are tentative. Yet, our data conclusively suggest that motivation factors are important in the interpretation of the association between infant mortality and birth interval. Further investigation, therefore, is needed for examination of the influence of breastfeeding on fecundity which should be based on individual records of menstruation and lactation.

Our investigation of the impact of infant mortality experience on use of cotraception and live births indicates that couples' experience of infant mortality also results in less use of contraception, higher current fertility, and high additional expected fertility. The relationship exists when we control for socio-economic characteristics. This finding, of course, tends to support the notion that fertility declines only after a decline in mortality.

Table *I*. Average Interval (in months) following Outcome of Previous Birth for the Whole Retrospective period and for 1951-66[a]

	Whole Retrospective Period		1951-66	
Outcome	Average Interval	Number of Intervals	Average Interval	Number of Intervals
Child died before age 1	23.0	(243)	23.2	(1 57)
Child survived age 1	33.8	(1207)	31.6	(735)
Difference	10.8		8.4	
Standard Errors of Average Birth Interval[b]				
Child died before age 1	0.8		1.0	
Child survived age 1	0.6		0.6	

[a] This table and Tables No. 2-6 are based on intervals in which women reported no use of contraception or abortion.

[b] S.E. $= \sigma / \sqrt{n-1}$

Table 2. Average Birth Interval (in months) following Infant Survival or Death and the Difference between Birth Intervals, by Age of Mother and by Birth Order at the Beginning of Interval for Whole Retrospective Period and for 1951—66.

Age of Mother	*Whole Retrospective Period* Infant Survived	Infant Died	Difference	*1951-66* Infant Survived	Infant Died	Difference
			Average Interval			
Below 20	32.6	22.0	10.6	31.1	22.0	9.1
20-24	33.5	21.4	12.1	31.1	22.4	8.7
25-29	36.1	28.3	7.8	32.4	28.4	4.0
30+	34.3	25.2	9.0	33.9	*	*
			Standard Errors of Average Birth Intervals[a]			
Below 20	1.1	1.3	...	1.1	1.7	
20-24	1.0	1.2		1.0	1.4	*..
25-29	1.6	3.1		1.4	3.9	...
30+	2.1	2.7	...	2.1	*	...
			Number of Birth Intervals			
Below 20	358	84	...	214	54	...
20-24	493	99	...	311	70	...
25-29	246	36		147	21	...
30+	110	24	...	63	12	...
Birth Order			*Average Interval*			
1	33.2	19.4	13.8	31.2	19.4	11.8
2	34.5	21.3	13.2	31.7	20.5	11.2
3	35.6	27.4	8.2	31.9	27.3	4.2
4	35.4	23.0	12.4	33.6	*	*
5+	31.3	26.8	4.5	30.4	26.5	3.9
Standard Errors of Average						
1	1.0	1.1	...	1.1	1.5	
2	1.4	1.3	.*	1.4	1.6	
3	1.9	2.1	...	1.7	2.7	
4	2.1	3.4	..	1.7	*	
5+	2.9	3.6		1.5	3.2	...
Number of Birth Intervals						
1	439	75		250	45	
2	292	57	...	169	39	
3	184	48		120	31	
4	126	22	...	83	16	
5+	166	41		113	26	...

*Number of birth intervals less than 20.

•S.E. = <>lXo.l

Table 3. Average Interval (in months) between Second and Third Biith, by Outcome of Birth Order 2 and Number of Surviving Children at Time of Second Birth (Whole Retrospective Period)

Number of Surviving Children at Time of Second Birth	*Outcome*				*Standard Errors of Average Birth Intervals*[a]	
	Infant Survived		*Infant Died*			
	(N)	*Average Interval*	*(N)*	*Average Interval*	*Infant Survived*	*Infant Died*
None	(54)	26.2	(23)	18.7	2.1	1.8
One	(238)	36.4	(34)	23.0	1.6	1.8
Difference		10.2		4.3		

[a]S.E. $= \sigma\sqrt{n-1}$

Table 4. Average Interval (in months) between Third and Fourth Birth, by the Outcome of Birth Order 3 and Number of Surviving Children at Time of Third Birth (Whole Retrospective Period)

Number of Surviving Children at Time of Third Birth	*Outcome*				*Standard Errors of Average Birth Intervals*[a]	
	Infant Survived		*Infant Died*			
	(N)	*Average Interval*	*(N)*	*Average Interval*	*Infant Survived*	*Infant Died*
None or one	(68)	30.0	(27)	25.8	2.4	2.7
Two	(115)	38.9	(21)	29.4	2.6	3.2
Difference		8.9		3.6		

[a]S.E. $= \sigma/\sqrt{n-1}$

Table 5. Average Interval between Fourth and Fifth Birth, by Outcome of Birth Order 4 and Number of Surviving Children at Time of Fourth Birth (Whole Retrospective Period)

No, of Surviving Children at Time of Fourth Birth	*Outcome*				*Standard Error of Average Birth Intervals*[a]	
	Infant Survived		*Infant Died*			
	(N)	*Average Interval*	*(N)*	*Average Interval*	*Infant Survived*	*Infant Died*
None or one	(35)	30.4	(11)	20.8	2.7	*
Two	(39)	33.8	(7)	23.9*	2.6	*
Three	(52)	40.0	(4)	27.8*	4.3	*

*Number of cases less than 20.

[a]S.E. $= \sigma\sqrt{n-1}$

Table 6 Multiple Classification Analysis of Birth Intervals between Orders 2-3, 3-4 and 4-5 by Previous Serviving Children and Outcome of Birth at the Beginning of the Interval Adjusting for Wife's Age", Wife's Education, and Husband's Status[0]

Outcome of Birth at the Beginning of Interval								
Previous	*Infant Survived*				*Infant Died*			
Surviving Children"	*Number of Intervals*	*Average Interval*	*Unadjusted Deviation*	*Adjusted Deviation*	*Number of Intervals*	*Average Interval*	*Unadjusted Deviation*	*Adjusted Deviation*
Interval between Second and Third Birth								
None	(54)	*26.2*	-6.1	-5.8	(23)	18.7	-13.6	-12.6
One	(238)	36.4	4.0	3.9	(34)	23.0	-9.4	-9.2
Interval between Third and Fourth Birth								
None or one	(68)	30.0	-4.0	-3.2	(27)	25.8	-8.2	-6.2
Two	(116)	38.9	4.9	3.9	(21)	29.4	-4.6	-4.0
Interval between Fourth and Fifth Birth								
None or one	(35)	30.4	-3.2	-3.3	(11)	20.8*	-12.7	-15.3
Two	(39)	33.8	2.0	0.6	(7)	23.9*	9.7	9.5
Three	(52)	40.0	6.4	7.2	(4)	27.8*	-5.8	-6.2

*Number of Intervals is less than 20.

"Variables are measured at the beginning of the interval.

Table 7 Average Interval (in months) Following Outcome of Previous Birth among Contraceptive Users (Plus Abortion) for Whole Retrospective Period and for 1951-66

Whole Retrospective Period	*1951-66*			
Outcome	*Average Interval*	*(N)*	*Average Interval*	*(N)*
Child died before age 1	22.5	(48)	22.8	(33)
Child survived age 1	39.6	(315)	36.9	(194)
Difference	17.1		14.1	
	Standard Error of Average Birth		Intervals"	
Child died before age 1	1.6		1.4	
Child survived age 1	1.6		1.9	

S.E.= oVn-l

Table 8 Percentage of Contraceptive Users or Abortion among Women with at Least Two Children, by Experience of Infant Deaths and Current Age" Current age (in Years)

Experience of Infant Death among First Four Births	*Under 30*			*30-44*			*45 and over*		
	(N)	*Users Only*	*Users or Abortion*	*(N)*	*Users Only*	*Users or Abortion*	*(N)*	*Users Only*	*Users or Abortion*
No	(143)	38	44	(177)	53	63	(85)	36	45
Yes	(66)	23	29	(84)	31	46	(37)	24	32
Total	(209)	33	39	(261)	46	58	(122)	33	41
% variance explained by experience of infant death		2.3	2.3		4.4	2.6		1.2[a]	1.4[6]

"Sterilized women have been excluded.

[6]Not significant at 5% level of significance.

Table 9 Percentage of Contraceptive Users and Users of Abortion among women[a] under 45 Years of Age with at least Two children, by Experience of Infant Death, Controlling for Community of Birth, Education, and Husband's Income

Characteristics	*Experience of Infant Death among First Four Live Births*	*(N)*	*% Users Only*	*% Users or Abortion*
Couples' Community of Birth				
Both village	——	(176)	20	30
	No	(98)	26	31
	Yes	(78)	13	28
Mixed		(75)	40	56
	No	(57)	46	61
	Yes	(18)	22	39
Both Urban	——	(219)	57	63
	No	(165)	59	67
	Yes	(54)	50	54
Couples' Education				
Both no primary school	—.—	(115)	18	28
	No	(63)	22	32
	Yes	(52)	13	23
One no primary, other some school or both some primary		(199)	34	44
	No	(131)	41	48
	Yes	(68)	19	37
At least one primary and one more than primary		(156)	65	73
	No '	(126)	63	73
	Yes	(30)	70	70
Husband's Income per month				
Less than $ 70		(267)	26	36
	No	(167)	32	40
	Yes	(100)	16	29
$ 70-139		(141)	51	60
	No	(105)	56	64
	Yes	(36)	36	50
$ 140 or more		(62)	76	84
	No	(48)	75	84
	Yes	(14)	79*	78*

[a]Sterilized women have been excluded.

*Number of cases is less than 20.

Table 10 Average Number of Live and Expected Live Births'* for women[6] with at least Two Live Births by Experience of Infant Death and Current Age of Women

Current Age (in Years)									
		Under 30			*30-44*			*45 and over*	
Expected					*Expected*				*Expected*
Experience of Infant Death	(N)	*Live Births*	*Live Births*	- *(N)*	*Live Births*	*Live Births*	*Live (N)*	*Births*	*Live Births*
No	(143)	2.9	4.3	(177)	4.0	4.7	(85)	3. 9	3.9
Yes	(66)	4.3	6.4	(84)	5.5	6.5	(37)	6. 5	6.5
Total	(209)	3.4	5.0	(261)	4.5	5.3	(122)	4 .6	4.6
% variance explained by experience of infant death		20.5	18.0	...	12.2	11.4	...	28 .1	28.1

"Expected live births=live births + additional live births expected.

[6]Sterilized women have been excluded.

Table 11 Average Number of Live, Expected Live, Surviving, and additional Births for Women[1]* under 45 Years of Age with at least two Live Births by Experience of Infant Mortality, controlling for (a) Community of Birth, (b) Education, (c) Income (d) Media Exposure and (e) Duration of Marriage

Characteristics (1)	*Experience of Infant Deaths among First Four Live Births* (2)	*Average* *(N)* (3)	*Live Births* (4)	*Expected'' Live Births* (5)	*Surviving Live Births* (6)	*Additional Expected LiveBirths* (7)	*Expected Surviving Births* (8)
	(a) Couple's Community of Birth						
Both urban		(219)	3.4	4.2	2.9	0.8	3.7
	No	(165)	3.0	3-7	2.9	0.7	3.6
	Yes	(54)	4.4	5.7	2.9	1.3	4.2
Mixed	Difference[d]		1.4	2.0	0.0	0.6	0.6
		(75)	3.5	4.6	3.1	1.1	4.2
	No	(57)	3.2	4.3	3.0	1.1	4.1
	Yes	(18)	4.1	5.4	3.2	1.0	4.2
Both village	Difference		1.2	1.1	0.2	-0.1	0.1
		(176)	4.9	6.5	3.6	1.6	5.2
	No	(98)	4,4	5.9	3.5	1.5	5.4
	Yes	(78)	5.6	7.3	3.3	1.7	5.0
	Difference		1.2	1.4	-06	0.2	-0.4

Table 11Continued.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(b) Couple's Education							
Both no primary,		(115)	5.1	6.6	3.8	1.5	5.3
	No	(63)	4.5	5.8	4,0	1.3	5.3
	Yes	(52)	5.8	7.5	3.5	1.6	5.2
	Difference	...	1.3	1.7	-0.5	-0.4	-0.1
One no primary, one some school or both primary		(199)	4.1	5.5	3.4	1.4	4.8
	No	(131)	3,7	5.0	3.5	1.3	4.8
	Yes	(68)	5.0	6.5	3.2	1.5	4.7
	Difference	...	1.3	1.5	-0.3	0.2	-0.1
At least one primary and one more than primary	...	(156)	2.9	3.6	2.6	0.7	3.3
	No	(126)	2.8	3.3	2.7	0.5	3.2
	Yes	(30)	3.7	4.5	2.3	0.8	3.1
	Difference		0.9	1.2	-0.4	0.3	-0.1
	(c)	Husband	's Income	per month			
Under §70	...	(267)	4.4	5.9	3.4	1.5	3.9
	No	(167)	3.9	5.2	3.5	1.3	4.8
	Yes	(100)	5.3	6.9	3.2	1.6	4.8
	Difference"		1.4	1.7	-0.3	0.3	0.0
$70-139	...	(141)	3.7	4.5	3.2	0.8	4.0
	No	(105)	3.3	4.7	3.2	0.7	3.9
	Yes	(36)	4.8	5.9	3.2	1.1	4.3
	Difference		1.5	1.9	0.0	0.4	0.4
$140 or more	...	(62)	2.9	3.4	2.5	0.5	3.0
	No	(48)	2.6	3.0	2.6	0.4	0.3
	Yes	(14)	3.9	4.6	2.4	0.7	3.1
	Difference		1.3	1.6	-0.6	0.3	0.1
(d) Media Exposure							
Low	....	(202)	4.7	6.3	3.8	1.5	5.1
	No	(121)	4.2	5.7	3.8	1.3	5.1
	Yes	(81)	5.6	7.2	3.4	1.6	5.0
	Difference		1.4	1.5	-0.4	0.3	0.1

Table 11 Concluded

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Medium		(140)	3.8	4.9	3.2	0.8	4.0
	No	(97)	3.4	4.4	3.2	0.7	3.9
	Yes	(37)	4.8	6.2	3.1	1.1	4.2
	Difference		1.4	1.8	-0.1	0.4	0.3
		(128)	2.9	3.5	2.6	0.5	3.1
	No	(102)	2.7	3.2	2.7	0.4	3.1
	Yes	(26)	3.7	4.6	2.4	0.7	3.1
	Difference		1.0	1.4	-0.3	0.3	0.0
(e) Duration of Marriage (in years)							
Less than 10		(142)	2.7	4.3	2.3	1.6	3.9
	No	(105)	2.5	3.9	2.4	1.4	3.8
	Yes	(37)	3.3	5.4	1.9	2.9	4.0
	Difference[d]		0.8	1.5	-0.5	0.7	0.2
10-19		(258)	4.3	5.3	3.4	1.0	4.4
	No	(166)	3.6	4.6	3.4	1.0	4.4
	Yes	(92)	5.4	6.8	3.4	1.4	4.4
	Difference		1.8	2.2	0.0	0.4	0.0
20 or more		(70)	5.5	6.0	4.4	0.5	4.9
	No	(49)	5.1	5.6	4.5	0.5	5.0
	Yes	(21)	6.2	7.0	4.0	0.8	4.8
	Difference		1.1	1.4	-0.5	0.3	-0.2

[a]Sterilized women have been excluded.

[b]Expected live births = live births + additional expected live births.

[c]Expected surviving births = surviving live births + additional expected live births.

[d]Difference between those with and without experience.

Table 12. Multiple Classification Analysis of Infant Mortality Experience on Live Births and Expected Live Births : Unadjusted and Adjusted Deviations for Socioeconomic Characteristics" and Duration of Marriage for Women[6] under 45 Years of Age with at least Two Children

Experience of Infant Death	*(N)*	*Live Births*			*Expected Live Births*		
		Average	*Unadjusted Dev.*	*Adjusted Dev.*	*Average*	*Unadjusted Dev.*	*Adjusted Dev.*
No	(323)	3.5	-.5	-A	4.5	-.6	-.4
Yes	(150)	5.0	1.0	0.7	6.5	1.3	1.0
Difference between those with and without experience		1.5	1.5	1.1	2.0	2.0	1.4

[a]Socioeconomic characteristics include couple's education, husband's income and mass media exposure.

[b]Sterilized women have been excluded.

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14. *Status Score of Father at Time of Birth* is a conversion of average income and average education reported for 1966 occupation converted to'a standard score having a mean of 50 and standard devision of 10. Fathers who were farmers when the child was born were kept in a separate group.

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