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An Indirect Approach to Study Inter-Relationship between Infant Mortality and Fertility

THE relevance of infant mortality to fertility has long been noted. Several J-studies have highlighted the relationship between the survival of an infant and the length of the subsequent birth interval. The average interval between births is found to be comparatively shorter when the child died before age 1. This relationship has been attributed partly to infecundity during lactation. Knodel's analysis (1968) of family history records of three Bavarian parises provides evidence on inter-relationship between infant mortality, fertility and lactation for a period prior to the one of transitional decline in marital fertility. He suggests that breast feeding can prolong birth interval substantially. According to him, there are two ways in which infant mortality could affect birth interval independently of lactation. Firstly, when infant mortality is low, fewer births are needed to produce a given number of children, creating a pressure for fertility control through some form of contraception or abstinence. Secondly, infant mortality, may affect birth interval independently of deliberate family limitation. The presence of a young child may reduce the frequency of intercourse, the pressure of household work so created may tell upon parents' energies and their sexual desires. Further, sleeping arrangements might alter in a way inhibiting coitus. The death of an infant, on the other hand, might cause an increase in intercourse leading to early conception for replacing the loss of the child. A recent analysis of Turkish data by Adlakha (1973), confirms the finding that infant mortality leads to shorter birth intervals. This anaylsis suggests that couples' experience of infant mortality results

in less use of contraception, higher current fertility and high additional expected fertility.

Concerning the influence of fertility on infant mortality, Knodel (1968) finds that infants born after short intervals are subject to comparatively higher mortality risks. The reason for this is that the previous child in the household claims some of the care that mother could otherwise devote to the new born infant. When the preceding child is older, that is, birth interval is longer, his claim on mother's attention need not adversely affect the new born. Wyon and Gordon (1962) observe that fertility has an effect on infant mortality on the basis of their survey for Punjab but they do not give underlying reasons.

It is evident, thus, that infant mortality may affect birth interval either through or independently of lactation. In the latter case, the influence may be a result of deliberate attempt by the parents to limit their family size.

Fertility on the other hand may influence infant mortality in two possible ways. Shorter birth intervals might weaken mother's health, affecting in turn, the physical constitution of the infant and lessening at the same time her ability to provide adequate care to the infant. The adequacy of care is also adversely affected by the presence of a young child in the household at the time of a birth. This might affect adversely the chances for survival of the new born infant.

This paper seeks to find out the extent to which these relationships between infant mortality and fertility (birth interval) hold true for Indian population. The data for the purpose are taken from a survey conducted in the district of Baroda in 1968. All households with married women, above 45 years in age and whose marriages had remained intact until wife's 45th birthday, were considered. Completed fertility histories of 913 v/omen in the sample, living in the rural and urban areas of Baroda district, were obtained. The data collected include the date of birth, sex, survivorship and age at death for each live birth. In addition, information on contraceptive use and details about the socio-economic characteristics of the respondent were also obtained.

The population was comprised mostly of agricultural workers, clerks and factory workers, and belonged to poor economic classes. Majority of the women (68 per cent) in the rural and urban areas were illiterate and rest had education up to primary level only.

The present analysis, excludes a small number of women reporting use of contraception, multiple marriages, and twin births. The analysis covers the remaining 845 women reporting 4570 completed birth intervals. The intervals between marriage and first birth are excluded because they are not affected by infant mortality. The intervals between live births were adjusted for fetal deaths. Since only women with completed fertility are considered, there is no chance of inclusion of truncated birth intervals. The present data are, thus, free from the effects of truncation, fetal deaths and contraception. The only factor that limits interpretation of the findings is memory bias affecting the accuracy of reporting births, deaths and dates of their occurrence.

The analysis is carried out in two sections. The first deals with the possible influence of infant mortality on fertility and the other considers the possible influence of fertility on infant mortality.

The Influence of Infant Mortality on Fertility

The results shown in Table 1 indicate that birth intervals following infant survivals are substantially longer than those following infant deaths regardless of birth orders. The combined results for all birth orders show relatively more persistent difference between the mean interval following an infant survival and that following a birth of child who failed to survive the first year of life. A separate tabulation for all intervals excluding the last might show firmer relationship between infant mortality and fertility. This is because the last interval of a completed family tends, generally, to be distinctly longer irrespective of the preceding number of children.

What are the possible reasons underlying this relation between infant mortality and birth interval ? Data are inadequate, in this regard, for testing directly the hypotheses noted earlier. However, one indirect approach to the question would be to investigate the possible effect of the fate of the first birth on the interval between the second and third births. It is clear that the death or survival of the first birth cannot affect the interval between 2nd and 3rd births through lactation. Therefore, holding the fate of the second child constant may provide an indication of the effect of infant mortality on birth interval independent of any effect of lactation. The relationship between fate of second child and the interval between the second and third births, when the fate of the first child is held constant provides an indication of the effect of

TABLE 1—INTERVALS BETWEEN SUCCESSIVE BIRTHS ACCORDING TO THE OUTCOME OF THE CHILD BORN AT THE ONSET OF THE INTERVAL AND LIVE BIRTH ORDER

Birth order	*Infant dies before age 1*				*Infant survives*				*Difference*
	MBI	±	*SE@*	*N*	*MBI*	±	*SE@*	*N*	
1-2	2.18	±	0.08	199	2.61	±	0.06	596	0.43**
2-3	2.16	±	0.09	173	2.52	±	0.05	570	0.36**
3-4	1.94	±	0.07	156	2.57	±	0.05	538	0.63**
4-5	2.13	±	0.08	141	2.61	±	0.05	496	0.38**
5-6	2.17	±	0.11	95	2.50	±	0.05	452	0.33*
6-7	2.06	±	0.10	94	2.47	±	0.06	356	0.41**
7-8	1.92	±	0.08	71	2.39	±	0.06	271	0.47**
8-9	1.95	±	0.13	38	2.46	±	0.09	192	0.51*
9+	1.71	±	0.14	17	2.30	±	0.12	115	0.59«»
Total	2.08	±	0.03	984	2.51	±	0.02	3586	0.43**

NOTES:

N The number of Birth Intervals.

@ Mean Birth Interval *(MBI)* i Standard Error *(SE)* and *SE* = o/v'^-T-

**This difference between the mean interval following infant survival and the mean interval following a birth which dies before age 1 is significant at least at the 0.01 level using a ?-test for the difference between means.

*This difference is significant at the 0.05 level. nsThis difference is not s ignificant at the 0.05 level.

infant mortality on the birth interval through lactation together with motivation by parents to replace a dead child and other factors impinging on the sexual behaviour of couples.

In Table 2 we give the average interval between the second and third births, by the fate of the first and second births. This table suggests that when the fate of the second child is constant, the difference in the mean interval of 2 and 3 birth orders between, when first child survives the first year of life and when it dies during that year, are not significant at the 0.05 level. The effect of infant mortality on the birth interval independent of lactation, thus, cannot be established.

TABLE 2-INTERVAL BETWEEN THE SECOND AND THIRD BIRTHS ACCORDING TO THE FATE OF FIRST AND SECOND BIRTH

Fate of First birth	*Fate of second birth*							*Difference*
	Infant survives				*Infant dies before age 1*			
	MBI	±	*SE@*	*N*	*MBI*	± *SE®*	*N*	
Infant survives	2.56	±	0.06	457	2.22	± 0.09	101	0.34*
Infant dies before age 1	2.34	±	0.09	113	2.07	± 0.10	72	0.27*
Difference	0.22[ns]				0.15[ns]			

@ Mean birth interval ± Standard Error *(SE)* and $SE = \sigma/\sqrt{n-1}$

* The difference is significant at the 0.05 level using a /-test for the difference between means.

ns This difference is not significant at the 0.05 level.

However, when the fate of first child is held constant, the corresponding difference related to the survival of child of second birth in the first year of its life is significant at the 0.05 level. This suggests that the relationship between infant mortality and birth interval attracts the combined influence of lactation and motivation of parents or factors impinging on the sexual behaviour of couples. Interestingly enough, the interval between the second and third births is the longest when the first two infants survive and the shortest when they die before age 1. It would, on the whole, appear that the relationship between infant mortality and fertility, may, in part, be one of fertility influencing infant mortality rather than vice versa.

The Influence of the Fertility on Infant Mortality

This section provides some evidence about the possible influence of fertility on infant mortality. Table 3 shows the average length of the interval between successive births and the fate of child born at the end of interval by live birth order. It is evident that the difference in the mean interval between when the child born at the end of the interval survives and when it fails to survive up to one year of age is significant at least at the 0.05 level, regardless of the order of the birth interval. Fertility can thus have a substantial effect on infant mortality. To test the hypotheses noted earlier in this connection, the same procedure has been followed as the one adopted by Knodel (1968). The results of these calculations are presented in Table 4.

TABLE 3-INTERVAL BETWEEN SUCCESSIVE BIRTHS AND THE FATE OF THE CHILD BORN AT THE END OF THE INTERVAL BY LIVE BIRTH ORDER

Birth order	*Infant dies before*				*Infant survives*				*Difference*
	MBI	±	*SE®*	*N*	*MBI*	±	*SE@*	*N*	
1-2	2.19	±	0.08	186	2.60	±	0.06	609	0.41**
2-3	2.07	±	0.07	166	2.54	±	0.05	577	0.47**
3-4	2.07	±	0.07	148	2.52	±	0.05	545	0.45**
4-5	2.07	±	0.07	113	2.50	±	0.05	524	0.43**
5-6	2.02	±	0.07	98	2.51	±	0.05	449	0.49**
6-7	1.94	±	0.09	87	2.49	±	0.06	362	0.55**
7-8	1.94	±	0.08	47	2.35	±	0.06	295	0.41**
S-9	1,83	±	0.09	29	2.45	±	0.09	201	0.62**
9+	1.67	±	0.11	18	2.31	±	0.12	114	0.64*
Total	2.05	±	0.03	892	2.51	±	0.02	3676	0.46**

@ Mean Birth Interval ± Standard Error *(SE)* and $SE = \sigma/\sqrt{n-1}$.

* This difference is significant at the 0.05 level using a *t-test* for the difference between means.

**This difference is significant at the 0.01 level.

TABLE 4-PROPORTION OF CHILDREN DYING BEFORE AGE 1 BY THE LENGTH OF THE PREVIOUS BIRTH INTERVAL

Previous Birth Interval (in years)	*Previous infants dying before the next birth*		*Previous infants surviving at the time of the next birth*	
	Proportoin of children dying before age 1	*N*	*Proportion of children dying before age 1*	*N*
-1.5	0.4586	181	0.2752	367
1.5-2.5	0.4130	644	0.1456	1854
2.5-3.5	0.2276	246	0.1034	832
3.5-4.5	0.2791	43	0.0576	191
4.5+	0.1429	42	0.0357	168
Total	0.3631	1156	0.1389	3412

A study of the above table clearly indicates that the proportion of children dying before age one declines sharply as the length of the previous birth inter-

val increases irrespective of previous infant's survival upto the time of the next birth, except where the sample size is small. The statistical relationship between fertility (birth interval) and infant mortality in both the categories has been subjected to chi-square ($x^{!}$) tests of independence in contingency tables. The tests show that the relationship between fertility and infant mortality is highly significant in both the categories, namely, the one where previous infant had survived and the other in which it did not survive upto the time of the next birth. This finding does not support the reasoning that the persence of a young child in the household at the time of a birth might consume some of the care and attention that the mother would otherwise be devoting to the newborn infant, reducing thereby the chances for survival of new born infant.

The possible reasons underlying the relationship between fertility and infant mortality are, thus, related to the fact that births in a rapid succession weaken the health of the mother rendering her incapable of giving adequate care to a new born infant during the critical period of infancy. At the same time, the poor health of the mother might weaken the physical constitution of a new born infant, thus reducing thereby its chances for survival. Perhaps the reason for the consistent higher infant mortality in the group where previous infant dies before the next birth is that mortality risks among siblings are highly inter-correlated.

The results suggest that the influence of infant mortality on fertility through motivation of the parent to replace dead child soon or factors interfering with the sexual behaviour of couples is not significant. The observed relationship between infant mortality and fertility can be treated to effects of lactation and to the influence of fertility on infant mortality. Babies born within short intervals are subject to comparatively higher mortality. Births in a rapid succession tend to weaken the mother's health, which, in turn, affects rather adversely the physical constitution of new born and subsequently reduces the capacity of the mother to take care of the new bom during the critical period of infancy and reduces thereby its chances for survival. These tentative findings emphasize the need of closer investigation of a number of related factors like breastfeeding, ammenorrhea, use of contraception, health and sexual behaviour.

References

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