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INFANT/CHILD MORTALITY AND FERTILITY: A SURVEY OF LINKAGES*

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ABSTRACT

The interest on the analysis of infant or child mortality and fertility linkages lies on the notion that reductions in infant or child mortality would have moderating effects on fertility. Earlier investigations tended to highlight the important biological effects of infant mortality by shortening the birth interval if the child died at the onset of the interval. The replacement hypothesis with respect to the mortality-fertility relationship appears to gain more support from the present study using parity-progression ratios. Likewise, data from selected areas of the country confirm the presence of insurance effects on fertility. Multivariate analyses suggest that fertility and mortality are causally conjoined at the level of the individual. The findings support the view of the complementarity of the population and the health programs.

INTRODUCTION

A deceleration in the rate of mortality decline has been observed in some developing countries as gleaned from data relating to the second half of the 1960s and throughout the 1970s (WHO, 1984). Although the slackening in the fall of mortality in certain countries came about only after sizable progress had been achieved in lowering the death rate, others experienced a deceleration in the decline or even a plateauing of mortality at levels very much above those observed in the more developed countries.

Such deceleration in mortality decline finds a parallel in the Philippine setting as demonstrated by Zablan (1984). Her analysis of mortality trends in the Philippines expressed in terms of changes in the life expectancy at birth identified a period of moderate increases in life expectation at birth averaging 0.42 years annually (1918 to 1938); a stage of rapid increase at an average of 0.71 to 0.82 years annually (1938 to 1968); and a period of decelerating mortality decline characterized by annual increments of 0.24 years between 1968 to 1980.

The realization that the declines in mortality evident in many developing countries seemed to have significantly tapered off too quickly and that even the past favorable trends have left behind a legacy of pronounced differentials between countries,

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as well as among population subgroups within the country, makes it an important and urgent matter to identify and document the underlying causes that tend to hinder further progress.

Despite impressive gains, a striking feature of mortality in many developing countries is the preponderance of deaths among children under five. This is so mainly due to the relatively small and slow reductions in infant and child mortality and also due to the continuation of high fertility (WHO, 1982; United Nations, 1984). The level of infant and child mortality is not independent of the prevailing level of mortality. In general, the higher the mortality level obtaining in a particular country, the greater the concentration of deaths among the population under five. Thus, in many countries in Africa where mortality is recorded to be the highest among the developing regions, the contribution of child deaths to total mortality, as suggested by available data (World Health Organization, 1981), is close to 50 per cent of all deaths occurring each year. This is in sharp contrast to evidence from a low-mortality country such as France where child mortality constitutes only 2 per cent of all deaths. In the Philippines, classified as having a moderately low mortality level, deaths to children 4 years old and below comprised 37 per cent of all total deaths in 1979 (National Census and Statistics Office, 1979). A reduction in the number of infant and child deaths by one-half can result in a 20 per cent reduction in the crude death rate for the entire country.

Compared to Malaysia and the Republic of Korea, the Philippines continues to be more disadvantaged in terms of mortality rates among the young (see Table 1). During the period 1973-77, the Philippine neonatal, infant, and childhood mortality rates exceeded the Malaysian figures for 1969-73 (71 per cent, 61 per cent, and 70 per cent, respectively). Since the Malaysian rates refer to a period just before the Philippine rates were computed, it can be said that the Philippines has a long way to go to parallel the Malaysian experience. Infant mortality remains high in Bangladesh, Pakistan, and Nepal (135, 139 and 142, respectively). Thus, a more thorough examination of the correlates of infant or child mortality, demographic or otherwise, in different geographic settings is a necessary step in the achievement of lower mortality levels.

One of the more important relationships examined is the relationship between fertility and mortality. The demographic transition theory provides one possible link between the two demographic processes with the view that a reduction of mortality will help accelerate the transition from population with a relatively high fertility to low fertility since reduced infant and child mortality is seen to have moderating effects on fertility levels. This potential relationship has been noted by the World Population Plan of Action when it declared:

"...[S]ustained reduction in fertility has generally been preceded by reductions in mortality. Although this relationship is complex, mortality reduction may be a prerequisite to a decline in fertility." (para. 21).

Research on the subject has shown that child mortality experience may affect the fertility of individual couples in three ways (Knodel, 1978, Preston, 1978), namely, (1) the physiological effect, whereby the death of an infant shortens the period of postpartum amenorrhea, because of the cessation of lactation so that in the absence of contraception, a woman is exposed to the risk of a subsequent conception much sooner than expected; (2) the child replacement effect, whereby couples continue having children in order to replace those that who die young, to achieve some number of surviving children considered to be sufficient; and (3) the insurance effect, whereby couples adjust their fertility in anticipation of possible future losses of children based on an awareness of the level of child mortality in the community independent of their own experience.

A basic argument underlying the mortality-fertility relationship is that improved child survival will contribute to increased practice of contraception and consequently to fertility decline. As long as the number of child deaths as experienced or perceived by individual couples remains large, there exists a major psychological obstacle to be hurdled in promoting family size limitation.

This relationship has been the subject of much discussion because of its seemingly great demographic significance (Preston, 1975). However, the empirical evidence suggesting a deceleration in or even stagnation of mortality decline at still high levels in many developing countries requires consideration of the reverse relationship, i.e., infant or child mortality is treated as the dependent variable, as a source of future major policy initiatives.

The main purpose of this paper is to search for new evidence on the interrelationships of infant or child mortality and fertility leading to a more comprehensive portrayal of such interlinkages in the Philippine setting.

DATA AND METHODS

Data for this analysis were obtained from the 1978 Republic of the Philippines Fertility Survey (RPFS) and the 1976 Mortality, Fertility, and Family Formation Survey (MFFFS). The 1978 RPFS was undertaken as part of the World Fertility Survey (WFS), an international research program, whose purpose was to assess the current state of human fertility throughout the world. The 1978 RPFS covered a nationally representative sample of 12,742 households and 9,268 ever-married woman in the child- bearing ages located in 716 sample barangays (villages).

The MFFFS was conducted in conjunction with the Population, Resources, Environment and the Philippine Future (PREPF) Project, a research undertaking of a consortium whose goal was to establish and analyze trend data with the end in view of preparing scenarios of the future and thereby recommending various policy alternatives designed to influence such scenarios. The survey included a representative sample of 1,500 households from two provinces, namely, Pangasinan, a more developed province with 1,000 households, and Southern Leyte, a less developed area with 500 households. A total of 1,127 ever-married women aged 15-49 years were identified from such households and were asked detailed questions on their fertility and associated socio-economic characteristics.

Table 1. Neo-Natal, Infant, and Childhood Mortality Rates (per 1000) for the period 0-4 Years Before the Survey

Country	Date of Survey	Neonatal	Infant	Childhood
Philippines	1978	24	58	85
Malaysia	1974-75	14	36	50
Republic of Korea	1974	23	42	56
Thailand	1975	39	65	91
Indonesia	1976	47	95	159
Sri Lanka	1975	37	60	86
Bangladesh	1975-76	74	135	222
Pakistan	1675	80	130	207
Nepal	1976	75	142	235
Panama	1975-76	21	33	46
Sudan	1978-79	42	79	177
Kenya	1977-78	38	87	142
Senegal	1978	50	112	262

Sources: Philippines: Gonzaga-Esclamad, de Guzman and Engracia (1984); Other countries: Rutstein (1983).

This study employed both the descriptive approach with the use of means and proportions and multivariate techniques utilizing multiple regression analysis.

DISCUSSION OF FINDINGS

Infant and Child Mortality Influence on Fertility: Revisited

Various studies which attempted to examine the influence of infant and child mortality on fertility document the operation of both the physiological or biological and behavioral or replacement effects. Analyzing 25 sets of WFS data, Cochrane and Zachariah (1983) found that in almost half of the countries covered, birth intervals were significantly shorter if an infant had died than if it had lived. This finding attests to the presence of biological effects. The authors attributed this finding to replacement or behavioral effects since the couple's use of contraception in the interval had likewise been affected. They reported that parents who had experienced an infant death were more prone to have additional children than those who had no such experience.

Analysis by de Guzman (1984), using Philippine data, provides some suppori to the above findings. The application of birth interval dynamics seemed to indicate a propensity among couples to replace deceased offspring. Although the differentials existed in all categories of child survivorship for every attained parity with a consistent pattern of the differentials. Women who had suffered infant deaths tended to manifest higher subsequent fertility. Controls for age, exposure time, and socio-economic characteristics diminished differences in the mean number of subsequent births, but nevertheless, there were indications of attempts to replace the infant deaths. The biological effect appeared to be the most conclusive finding from the birth interval analysis.

Child Replacement

The child replacement hypothesis was examined again using parity progression ratios calculated from the 1978 RPFS data. Parity progression ratios reveal the probability that a dead child or a surviving child would be followed by another birth. The need for greater precision requires that the data refer to a more or less homogeneous group of couples. Thus, the data in Table 2 have been limited to currently married women nearing completion of their childbearing (aged 40-49 years), 2283 of whom had 2 or more children. The absence of such age delimitation could be a source of a serious bias as women who happened to be at a particular parity at the time of the survey might decide to go on having other children, especially those at the peak ages of childbearing, or the experience of child mortality and subsequent births may possibly occur after the survey. Further, it is more likely that couples who have had infant deaths would experience shorter birth intervals than those whose children all survived and would therefore also manifest greater propensity to reach each successive higher parity and to reach a higher parity earlier. From the point of fertility analysis, additional precision is gained by calculating the ratios by birth order and by controlling for the age at marriage.

Table 2 presents the proportion women with n live births who progressed to n + 1 live births according to the fate of their previous children at parity n classified by at marriage. The data included infant deaths as well as child deaths (deaths among children aged 1-5) prior to parity n. In general, the proportions for similar columns decreased as a shift is made from the earlier parities to the later parities irrespective of age at marriage. Among women who married before their eighteenth birthday and who had no child deaths at any parity, the proportions were 98.3, 96.0, 94.4, 91.0, and 86.2. Among those who married much later at 22 years and over, the corresponding figures were 88.9, 83.2, 78.9 70.8, and 63.7.

Such a pattern suggests two important considerations. First, the great disparity in the reproductive behavior of the diverse groups of women calls for controlling for such important variables as age at first marriage. Second, the practice of family limitation among the women needs to be indicated. The government's family planning program started in earnest at the beginning of the 1970s when these women were in their thirties. It has been advanced that the replacement hypothesis becomes relevant only in situations where couples limit their fertility after reaching a preferred number of children; otherwise, they would continue having children until one of the spouses becomes infertile or dies, then childbearing would be independent of the number of offspring who survived or died (Knodel, 1978).

The expected configuration of greater proportions of women progressing to n + 1 parity among those who have experienced infant or child mortality irrespective of age at marriage is depicted by the data, with only three exceptions. For example, among women who married after age 21, 83.2 percent of those who never experienced any infant or child deaths moved on to have their fourth child. The corresponding figures for women who had 1 death or more than 1 death of the same marriage group were 87.0 and 94.1 percent, respectively. However, the differences in the proportions by experience of infant or child deaths among the two marriage groups that first married before their twenties were insubstantial, hence not much confidence can be placed in them. This is particularly true among the high risk women who married in the early ages of 17 years and below and who also manifested the greatest tendency to continue bearing children irrespective of mortality experience. Thus, by holding constant age at marriage, partial control for a self-selection process which could yield a semblance of replacement when in fact the couples have not attempted it, was achieved.

Some manifestation of child replacement was observed among those who married early and who progressed from the sixth to the seventh child. Statistically significant differences were also found among the women marrying between the ages of 18 and 21 years who progressed from the fourth to the fifth parity and those who went on to have their seventh child.

The child replacement hypothesis finds strong support from the data referring to women who married at the ages of 22 years and over where the differences by infant or child mortality experience were statistically significant. Child replacement became more

Table 2. Percentage of Currently Married Women Aged 40-49 with at Least Two Children Ever Born Who Progressed to Next Parity by the Number of Infant and Child Deaths: Philippines, 1978

Age at Marriage	Progression from Parity n to n+1 According to the Fate of Previous Children at Parity n														
	2nd to 3rd			3rd to 4th			4th to 5th			5th to 6th			6th to 7th		
	0 Deaths	1 Deaths	2 Deaths	0 Deaths	1 Deaths	2+ Deaths	0 Deaths	1 Deaths	2+ Deaths	0 Deaths	1 Deaths	2+ Deaths	0 Deaths	1 Deaths	2+ Deaths
Less than 18 years	98.3	98.4	100.0	96.0	97.9	100.0	94.4	93.5	99.2	91.0	96.8	96.3	86.2	89.8	96.7[c]
18-21	96.7	99.1	(100.0)	95.0	93.8	96.8	87.7[a]	92.7	97.9[c]	88.7	86.7	88.5	78.8[a]	89.6[b]	85.7
22+	88.9	91.7	(100.0)	83.2	87.0	94.1[c]	78.9[a]	84.9	90.6[c]	70.8[a]	82.1	83.7[c]	63.7[a]	73.1	76.1[c]
Total	94.3	96.9	(100.0)	91.0	94.0	98.5[c]	87.0[a]	91.2[b]	97.5	83.9[a]	90.6	92.4[c]	77.7[a]	86.0	90.9

Source: 1978 Republic of the Philippines Fertility Survey.

[a] Difference between the first and the second values significant at $p \leq .05$.
[b] Difference between the second and the third values significant at $p \leq .05$.
[c] Difference between the first and the third values significant at $p \leq .05$.

Note: Values in parenthesis were based on less than 15 cases.

marked beyond parity 3 where family limitation might also have been more acceptable or pervasive. Data on the timing of first use of contraception pointed to increasing numbers of women among those with previous child deaths who started to use family planning at higher parities suggesting motivation to limit family size after reaching a certain number of offspring (see de Guzman, 1984, Table 10.7).

Table 3. Ever Use of Contraception (Currently Married Fecund Women)

Living Children/Age	No	Yes, Inefficient	Yes, Efficient	Total
4 Living Children				
40-44	49.7	22.7	27.6	100.0
45-49	52.5	26.7	20.8	100.0
4+ Living Children				
40-44	34.2	21.1	44.7	100.0
45-49	45.1	21.1	33.2	100.0

Likewise, data from the 1978 RPFS indicate increased proportions of ever-users of contraception among women aged 40-49 with rising family size (1978 RPFS First Report, Table 4.3.1B). Concomitant with such increases was an apparent shift toward the more efficient methods of contraception. It was unfortunate that further controls for relevant socio-economic factors were not feasible with the data on hand because of the limited number of cases. While such controls were necessary to add precision, it is believed that holding constant age at first marriage and limiting the analysis to women at the end of their childbearing have been more informative in terms of the objectives of this paper.

The data in Table 2 do not allow for detecting any insurance effects on fertility which is the subject of the next subsection. The presence of child replacement effects appeared conclusive, at least for the women who delayed their marriage till after age 20. However, it is quite possible that the women who had experienced child mortality especially those with more child deaths did not only try to replace such losses, but also have made attempts to insure the survival of a sufficient number of children by progressing to the next higher parities.

The Insurance Hypothesis

Do couples adjust their reproductive behavior in anticipation of future deaths in congruence with their perception of the existing mortality conditions in the community? Do parents do something more than just replace dead children? The "insurance effect" finds its basis in the argument that couples become aware of mortality conditions existing in the community. Hence, in anticipation of losses such couples attempt to "insure" a sufficient number of surviving children for economic, social, religious, or cultural reasons which in turn may affect their family size and sex composition preferences.

The 1976 MFFFS contained questions on perception of mortality and child survival. Since these questions were exploratory, and due to limited funds, they were asked only of odd-numbered households. From among these questions, three are germane to the purposes of this paper. The responses to these three questions are analyzed below.

1) "As you see things now, do you think the number of people dying compared to those 20 years ago is increasing, decreasing, or remaining the same?"

2) "Do you think that the number of babies born today who died before reaching their first birthday compared with those born 20 years ago is increasing, decreasing, or remaining the same?"

3) "Some couples bear a large number of children to make sure that a sufficient number of them will survive to adulthood. How do you feel about this? Do you strongly agree, agree, disagree, strongly disagree or what?"

The responses to the first question were taken as an indication of the perception of prevailing mortality conditions; while the second formed the basis for a measure of the perception of the trend in infant mortality independent of the respondents' mortality experiences. The third question yielded a more direct measure of a respondent's feeling about "insurance motivation." If such responses are cross-classified with the number of children ever born (CEB), they would provide useful data for the analysis of insurance effects.

Because of the constraint mentioned earlier, only 450 ever- married women were asked the question on mortality. Of this group, 342 of whom gave meaningful responses to *all* three questions. This number comprised only 30 per cent of the total subsample of 1,127 ever-married women aged 15-49 years.

The women who perceived a declining trend in mortality manifested the lowest mean number of children ever born, whether the classification be by perception of the trend in general mortality or in infant mortality (Table 4). Controlling for fertility did not change the direction of the relationships. The differences by categories of the mortality perception measures were statistically significant with one exception. The table shows that the difference between those who perceived a decreasing trend and those who perceived an increasing trend is larger when classification is made by perception of general mortality. For all women, the differences were 1.01 children for general mortality and 0.60 children for infant mortality. Among women with 2 or more than 2 CEB, the corresponding differences were 0.91 and 0.51, respectively. Thus, the data suggest a stronger effect of the woman's perception of general mortality conditions on the number of her live births. Her perception of general mortality conditions represented a cumulation which encompassed her perception of prevailing infant mortality, a seemingly reasonable assumption on the basis of the lower fertility among women who perceived a declining general mortality trend than those who felt infant mortality was declining (4.32 vs. 4.43 for all women and 4.83 vs. 4.87 among women with 2 or more CEB). Conversely, couples who thought infant, child, and adult mortality (hence, general mortality) were more or less stagnant or were on the rise had to "insure" or "hoard" more. Consequently, they ended up having more children, on the average, than those who considered infant mortality solely.

What has been done so far is to infer from Table 3 some operationalization of the insurance strategy among couples because of the awareness that some of their children might die at some point in the future. As stated earlier, a more direct measurement of insurance effects can be done based on the third question listed above. The percentage distribution of the respondents by agreement or disagreement with the insurance motivation and the corresponding mean CEBs are shown in Table 5.

The number of those who favored insurance against future deaths was almost the same as those who were opposed, with the latter being only slightly larger. Among women who had experienced mortality of their offspring more were in agreement with insurance motivation while among women devoid of any mortality experience the reverse was quite true.

Women who believed it was necessary for a couple to have more children to insure against future losses indeed exhibited higher fertility than women who thought otherwise (Table 5 Panel A). Although the difference was only around half a child, it was highly statistically significant. The same observation can be made for women who had had mortality experience, but this time the differential was greater (Table 4, Panel B.2). Caution has to be exercised in interpreting this difference as some replacement effect might be in operation along with any insurance effect. Indeed, women who reported greater numbers of dead children were more inclined to agree with the insurance motivation than those who had fewer offspring who had died (see Table 6).

Table 4. Mean Children Ever-Born (CEB) Per Ever-Married Woman by Perception of Mortality Trend: Pangasinan and Southern Leyte, 1976

	Mean CEB	Difference[a]
A. All Women		
1. General Mortality Trend		
Decreasing	4.32	0.46
The same	4.78	0.55
Increasing	5.33	1.01
2. Infant Mortality Trend		
Decreasing	4.43	0.05[b]
The Same	4.48	0.55
Increasing	5.03	0.60
B. Women With 2 + CEB		
1. General Mortality Trend		
Decreasing	4.83	0.60
The same	5.43	0.31[c]
Increasing	5.74	0.91
2. Infant Mortality Trend		
Decreasing	4.87	0.27[d]
The same	5.14	0.24[c]
Increasing	5.38	0.51

Source: 1976 Mortality, Fertility, and Family Formation Survey

[a] The first figure is the difference between the first and second categories: the second figure, between the second and third categories; and the third, between the first and third categories. Differences are significant at p = .001 unless otherwise stated.

[b] Not significant

[c] Significant at p = .025

[d] Significant at p = .005

Table 5. Mean Number of Children Ever-Born (CEB) by Feeling About Insurance Motivation Among Ever-Married Women Aged 15-49 With 2+ CEB: Pangasinan and Southern Leyte, 1976

	Percentage Distribution	Mean CEB	Difference
A. Total	100.0		
Agree	49.1	5.49	a
Disagree	50.9	4.93	0.56
B. By Child Deaths	100.0		
1. No deaths	68.1		
Agree	31.6	4.61	a
Disagree	36.5	4.36	0.25
2. With Deaths	31.9		
Agree	17.5	7.08	b
Disagree	14.3	6.39	0.69

Source: 1976 Mortality, Fertility and Family Formation Survey

[a]Difference is statistically significant at $p \leq .005$.

[b]Difference is statistically significant at $p = .01$.

The insurance effect, to be real, has to be independent of the couple's own experience of child mortality. Evidence of such nature can be gleaned from data referring to women who never had any mortality experience (Table 4, Panel B.1). Those who agreed with insurance motivation actually attempted to insure against future losses by bearing more children than those who disagreed. The difference may not be sizable, but nonetheless it was highly statistically significant.

Table 6. Mean Dead Children Per 100 Ever-Married Women Aged 15-49 by Feeling About Insurance Motivation: Pangasinan and Southern Leyte, 1976

	Mean Dead Children	Difference[a]
A. All Women		
Agree	42.3	
Disagree	35.9	6.4
B. Women with 2+ CEB		
Agree	48.8	
Disagree	40.2	8.6

Source: 1976 Mortality, Fertility, and Family Formation Survey

[a]Differences significant at p = .001.

Mortality as a Dependent Variable

There is increasing evidence from the developing countries that measures to reduce infant and child mortality can be successfully carried out through the application of imported "medical technology." The eradication of major endemic diseases, such as smallpox and yellow fever, and the reduction of the case fatality rates of malaria, measles, and respiratory diseases among children below 5 years of age in many parts of the world attest to the benefits that potable water supply, improvements in housing conditions and sanitation, and immunization can bring. In spite of such gains, experience shows that imported medical technology to combat health problems and to reduce high mortality, particularly among infants and children 5 years old or younger, can meet only temporary and limited success unless reinforced by programs and activities geared towards the improvement of general living conditions, development of complementary community resources, and the establishment of suitable infrastructure.

The developmental process interacts with health and mortality conditions. Development is an expensive and a complicated and arduous undertaking such that short of it, the more unfortunate countries of the world have to settle for meager reductions in morbidity and mortality. It is within such contexts that the search for less expensive approaches becomes very salient and beneficial.

The study of the correlates of infant and child mortality may to provide hints of alternative approaches towards reduction of infant and child mortality. Analyses of this nature have documented differentials by socio-economic characteristics of the mother and by housing characteristics. Deplorably, many of the important variables affecting infant and child mortality are not readily manipulable, thus their implications for policy making are limited.

One finding which has important implications for policy making and may involve less expensive measures is the significant influence of the woman's reproductive behavior on the incidence of infant and child deaths among her offspring. The clear implication is that infant and child mortality could be reduced by changing the patterns of childbearing. While various studies have investigated the fertility impact on mortality, there is a need to continuously monitor changes in the differentials and effects for possible policy and program redirections.

In the Philippines, there is the additional need for a more comprehensive treatment of the subject.

Another sector which almost certainly may produce major advances in health is education. While formal schooling is considered important, shortfalls arising from high rates of school dropouts and inadequacy of educational facilities may have to be made up through a vigorous informal education program which could easily be conducted by several government or private agencies concerned with health education, nutrition for less direct out-of-school youth and the adult population.

The Effects of Parity Order and Age of Mother at Childbirth

The data in Table 7 provide some indications of the influence of fertility on mortality. The proportions surviving diminish with increasing children ever born. To a certain extent this might have been affected by the longer exposure to mortality risks of children belonging to high parity women. Two discernible patterns of the survival rates suggest the important effect of the mother's age at birth on survivorship of children. The lowest rates were observed at the extreme ages of 15 to 19 years where problems of reproduction have been documented. When read from left to right, the proportions increase up to a certain point in the intermediate ages and then fall. Such a pattern suggests that childbearing somewhere in the intermediate ages is more favorable to child survivorship than early and late childbearing. The generally lower rates among the women aged 40-49 years may be due to the longer exposure to mortality risks of children who have been born a number of years earlier and to the lower risk that the children of younger women have been exposed to, considering the declining in mortality.

The proportions surviving recorded in Table 7 refer to the average survivorship of all the children ever born to each woman at the time of the survey. As alluded to earlier one problem with such average survivorship is that it does not reflect within a specific group of women, say by age, the different mortality risks undergone by her individual children because of lower mortality. A high parity woman compared to another woman who has fewer children within the same age group may exhibit lower survivorship of children. This may, however, be due to the fact that she had the majority of her children born during the earlier period when mortality may have been relatively higher. Such limitations may be overcome by looking at proportions surviving among births to age x classified by parity order and by the age of mother at birth of the child restricted to a more or less homogeneous group of women at the time of survey. The latter restriction is necessary in order to control for the time dimension effects occasioned by mortality decline. Thus, children, irrespective of parity order, born to women when they were at ages say 20-24 years and who were aged 40-45 years at the time of the survey presumably have been exposed to the same mortality conditions.

Table 7. Mean Proportion of Children Ever-Born Surviving by Parity and Age of Mother at Time of Survey: Philippines, 1978

Children Ever-Born	Age of Mother at Time of Survey					
	15-19	20-24	25-29	30-34	35-39	40-49
0	0	0	0	0	0	0
1	.946	.979	.980	.981	.972	.883
2	.911	.952	.961	.951	.948	.976
3	(.667)	.920	.946	.955	.960	.928
4		.860	.924	.944	.954	.931
5		.874	.903	.921	.917	.921
6		(.722)	.872	.913	.930	.920
7			.825	.891	.908	.908
8			(.925)	.857	.888	.882
9			(.889)	.769	.887	.879
10			(.500)	.822	.843	.833
11				(.879)	.811	.852
12					(.878)	.845
13					(.731)	.803
14					(.812)	.819
15						.782
16						(.531)
17						(.823)
18						(.944)

Source: 1978 Republic of the Philippines Fertility Survey

Note: Proportions in parentheses were based on 5 or less cases.

This procedure of generating data for the analysis of parity effects on mortality is not without its problems. For want of homogeneity, a specific group of women, at this instance by age, has to be observed. However, it is expected that the younger the women the more limited the information because of the truncated exposure to mortality of their children ever born. In Table 7, the data are restricted to women aged 40-49 years, at the time of the survey; the age group having been expanded to increase the number of cases to obtain more meaningful results. This allowed for the calculation of cohort survival rates up to age 15. The "fine tuning" of the data to fit the necessary specifications above gives rise to a problem that afflicts statistics referring to older women. It has been known that data elicited from older women are subject to errors because of memory bias. It is possible for these women to forget to report dead children, especially those who had died during the early months or years of their life resulting in higher than expected survival ratios.

The 1978 RPFS is the third nationwide survey conducted by the University of the Philippines Population Institute in collaboration with local and international agencies. The first two national surveys (demographic in nature) were conducted in 1968 and in 1973. The accumulation of experience and increased expertise and the strict procedures followed in the 1978 RPFS were expected to have greatly enhanced the accuracy of the resulting data set. Thus, it can be seen from Table 7 that the survival rates for the women aged 40-49, are not subject to serious distortions, except for women with only one child but then the latter is based on only a few cases.

With important discontinuities, the survival rates in Table 8, show decreasing survivorship with increase in parity order, although adjacent differentials are not large. Thus, 95 per cent of first born males of women at ages 20-24 years lived to celebrate their first birthday as against 92 per cent among the third male children of women of the same ages. Among female births to women at ages 25-29, the discrepancy in the survivorship to age 10 between parity 1 and parity 6 was 10 percentage points (94 per cent as against 84 per cent). No distinct pattern was revealed by women who gave birth at ages 30- 34 years.

A comparison of the survival probabilities of parities of the same order (Parity 3 and Parity 4) across ages of mother at childbirth does not reveal a consistent pattern, although among female births those born to women at higher ages tended to be more favored by manifesting higher survival probabilities than births born to younger women.

Table 8. Mean Proportion Surviving From Birth to Age x by Sex of Child, Age of Mother at Childbirth, and Parity Order for Ever-Married Women Aged 40-49: Philippines, 1978

Sex/Age of Mother at Childbirth/ Parity Order	AGE x 1	2	3	4	5	10	15
Male							
20-24[a]							
Parity 1	.947	.928	.913	.909	.907	.900	.890
Parity 2	.942	.911	.903	.897	.893	.859	.873
Parity 3	.923	.898	.870	.870	.861	.846	.830
Parity 4	.932	.897	.890	.890	.884	.870	.863
25-29							
Parity 1	.970	.960	.960	.955	.955	.955	
Parity 2	.937	.924	.917	.917	.917	.904	
Parity 3	.936	.926	.916	.911	.906	.903	
Parity 4	.961	.944	.936	.934	.926	.907	
Parity 5	.921	.901	.901	.901	.895	.886	
Parity 6	.954	.920	.909	.897	.886	.880	
30-34[b]							
Parity 3	.930	.930	.917	.911	.911		
Parity 4	.940	.924	.916	.912	.912		
Parity 5	.936	.926	.920	.916	.907		
Parity 6	.925	.902	.893	.889	.889		
Female							
20-24[a]							
Parity 1	.949	.932	.930	.928	.921	.915	.908
Parity 2	.940	.925	.914	.912	.910	.895	.890
Parity 3	.920	.899	.872	.869	.866	.863	.860
Parity 4	.927	.886	.878	.862	.862	.860	.858
25-29							
Parity 1	.964	.959	.949	.947	.946	.939	
Parity 2	.981	.970	.963	.963	.960	.944	
Parity 3	.946	.938	.927	.919	.917	.916	
Parity 4	.966	.946	.935	.927	.920	.894	
Parity 5	.950	.927	.920	.920	.917	.910	
Parity 6	.902	.879	.868	.862	.856	.839	

Table 8. (concluded)

Sex/Age of Mother at Childbirth/ Parity Order	AGE X 1	2	3	4	5	10	15
30-34[b]							
Parity 3	.965	.953	.948	.942	.942		
Parity 4	.950	.945	.941	.941	.940		
Parity 5	.960	.953	.938	.924	.909		
Parity 6	.978	.969	.959	.944	.931		
Both Sexes							
20-24[a]							
Parity 1	.948	.930	.921	.918	.914	.907	.899
Parity 2	.941	.918	.909	.904	.901	.887	.884
Parity 3	.921	.898	.871	.870	.864	.856	.848
Parity 4	.929	.892	.885	.877	.874	.866	.862
25-29							
Parity 1	.967	.960	.955	.952	.952	.947	
Parity 2	.958	.946	.939	.939	.930	.923	
Parity 3	.941	.932	.921	.915	.912	.910	
Parity 4	.963	.945	.936	.931	.923	.901	
Parity 5	.935	.915	.910	.910	.905	.898	
Parity 6	.928	.900	.888	.880	.871	.862	
30-34[b]							
Parity 3	.948	.942	.933	.928	.926		
Parity 4	.944	.934	.927	.925	.923		
Parity 5	.947	.939	.928	.920	.908		
Parity 6	.950	.936	.927	.917	.911		

Source: 1978 Republic of the Philippines Fertility Survey.

[a] Very few women had their 5th parity at these ages.

[b] Very few women had their first and second births at these ages.

The Influence of Birth Interval Length on Infant and Childhood Mortality

The survivorship of a child has been found to be related to the length of the interval leading up to its birth. The relation is such that infants born after a very short interval, say less than 18 months, are subject to higher mortality risks, especiall·· within the first month of life.

Table 9. Mean Proportion Surviving From Birth to Age x Among Births at the End of Interval By Interval Between Births and by Sex of Child for Ever-Married Women Aged 40-49: Philippines, 1978*

Interval	AGE x					
	1	2	3	4	5	10
A. Interval Between First and Second Births						
Male	A. Proportion Surviving Among Second Births					
18 months or less	.926	.902	.892	.887	.884	.837
19-24 months	.927	.915	.902	.900	.896	.872
25 and over	.954	.945	.940	.928	.919	.899
Female						
18 months or less	.947	.935	.927	.927	.919	.860
19-24 months	.950	.939	.931	.930	.928	.862
25 and over	.972	.953	.946	.940	.930	.883
Both Sexes						
18 months or less	.936	.917	.908	.906	.900	.848
19-24 months	.939	.921	.915	.915	.908	.867
25 and over	.962	.949	.943	.934	.925	.891
B. Interval Between Second and Third						
Male	B. Proportion Surviving Among Third Births					
18 months or less	.895	.877	.855	.844	.840	.786
19-24 months	.920	.901	.878	.878	.869	.814
25 and over	.957	.948	.942	.936	.936	.867
Female						
18 months or less	.876	.856	.825	.817	.805	.751
19-24 months	.941	.921	.911	.908	.905	.858
25 and over	.976	.958	.950	.942	.937	.869
Both Sexes						
18 months or less	.886	.867	.841	.831	.826	.769
19-24 months	.930	.911	.894	.893	.888	.836
25 and over	.967	.953	.946	.940	.937	.868

Table 9. (concluded)

Interval	AGE x 1	2	3	4	5	10
C. Interval Between Third and Fourth Births	C. Proportion Surviving Among Fourth Births					
Male						
18 months or less	.910	.880	.858	.854	.846	.760
19-24 months	.958	.933	.929	.921	.917	.833
25 and over	.964	.956	.951	.943	.936	.833
Female						
18 months or less	.903	.884	.869	.859	.845	.791
19-24 months	.961	.935	.927	.918	.901	.823
25 and over	.968	.947	.936	.926	.920	.843
Both Sexes						
18 months or less	.907	.882	.863	.859	.845	.775
19-24 months	.960	.934	.928	.920	.909	.828
25 and over	.966	.952	.944	.935	.928	.838

Source: 1978 Republic of the Philippines Fertility Survey

* Intervals wherein the first child of the pair died during infancy were excluded from the calculation.

One problem which severely hinders attempts to comprehend the mechanisms through which interval effects operate has been observed by Winikoff (1983) from a number of studies. Such studies focused on the effects of the birth interval on the child at the end of the interval but failed to control or specify whether the first child had died or survived to the time of conception of the second child. Since both conscious child replacement or early cessation of breastfeeding with the concomitant return of ovulation would tend to result in shorter birth intervals where early child deaths had occurred, short spacing can sometimes be the consequence rather than the cause of child mortality. In order to prevent confounding the effects, the following analysis of birth intervals excluded those intervals in which the first child of the pair died during infancy.

Table 9 contains the proportions surviving from birth to age x among births at the end of the interval controlling for the length of the interval in months and the sex of the child. With only one exception (in Panel C, Male, Age 10), all the survival rates followed the expected gradient of increasing survival with lengthening birth interval. This suggests the strong influence of birth interval on mortality. In whatever age, the survivorship of births preceded by longer intervals tended to be higher than those preceded by relatively shorter intervals. Survivorship to age 1 among the female third births preceded by a birth interval of more than 2 years reached as high as 98 per cent. Among males, the highest survival rate, 96 per cent, was also observed to have occurred among third births for the same length of birth interval. The corresponding values for intervals of 18 to 24 months showed a maximum of 96 per cent among male and female fourth births. For the shortest interval of 18 months or less, the highest survival rate to age 1 among females was manifested by second births (95 per cent). Among males, the corresponding survival rate was 93 per cent.

In sum, the data in Tables 8 and 9 confirm the hypothesized relationship of fertility on infant and childhood mortality via the birth interval. Though the results in Table 8 are mixed, the general pattern of differentials in survival rates indicated the influence of both parity order and the age of mother at child- birth independent of each other. The deleterious effects of short intervals are portrayed in Table 8 where the survival rates rose monotonically with the lengthening of the birth interval.

When Tables 8 and 9 are taken together the remarkable consistency of the survival rates in Table 9 suggests a stronger influence exerted by birth interval length than parity order or age of mother at child birth supporting the proposition of Omran and Standley (1981) that the length of the interval between siblings may in fact be a more important determinant of early child death than the order of the birth.

A further test for the existence of birth interval effects on infant and child mortality is possible by crosstabulating the incidence of infant and child deaths by the average interval of all births excluding those intervals initiated by an infant death. The argument behind this approach is that not one interval alone affects the survival chances of a birth. In other words, there may exist an interactive mechanism in which the survival of a child is affected by the intervals surrounding that child, not even limited to the immediately previous and subsequent intervals.

Hobcraft, McDonald, and Rutstein (1984) working with results from 39 World Fertility Surveys established persistently clear associations between infant and child mortality risks and childspacing variables that referred to births before and after the index child. Wolfers and Scrimshaw (1975), upon examination of adjusted infant mortality rates concluded that succeeding inter-pregnancy intervals of less than one year entailed increased risk to the first child of a pair at least for the postneonatal period. De Sweemer (1981) noted indications of increased mortality up to 2 years if the second conception occurred when the index child was less than a year old.

Because of the operation of the biological and replacement effects that link early infant death with subsequent short birth intervals, it is highly probable that shorter intervals disproportionately occurred among women who have experienced a recent infant death. Since the risk of childhood mortality rises for children whose mothers had experienced earlier infant deaths, it is possible that this risk, rather than the risks of short intervals themselves, may be represented with no control for the death of the child of the pair. Thus, all birth intervals with infant deaths at the beginning of the interval have been purposely excluded.

The data in Table 10 demonstrate that women who had narrowly spaced their children experienced more infant deaths and child deaths (deaths to children aged 1 to 5 years) than those who spread their children more widely. The women who had a mean birth interval of less than 2 years averaged one and a quarter times more infant deaths than those who had a mean interval of more than 2 1/2 years.

If fecundity is associated with infant mortality, then women experiencing infant deaths would bear their children at a faster rate and have more of them than women not experiencing it simply because they were more fecund and consequently would have shorter average birth intervals. To minimize the possible bias arising from such a condition, the data in Table 10 were further controlled for the number of children ever born. Because of restrictions imposed by the data, the second and third categories have been lumped together to obtain meaningful results. The deleterious effects of shorter birth intervals persisted even after controlling for the number of children ever born. While in some instances the differences in mean infant or child deaths are slight, they are nevertheless statistically significant.

A short mean birth interval carries with it stresses affecting the survival of children not only during their infancy and childhood. For example, when a breastfeeding mother terminates doing so because of pregnancy, the sudden weaning of a child could constitute a nutritional and health risk for that child. Excess mortality during infancy and childhood may be due to behavioral adaptations in families burdened by many and closely spaced children who directly compete for the resources first of the mother and of the entire family or household, or may result from the biological disadvantages of maternal depletion (see Hobcraft, McDonald, and Rutstein, 1984; Mata, 1983, and WFS, 1983).

Table 10. Infant and Child Deaths Per 100 Ever-Married Women by Length of Birth Interval For Women Aged 40-49 With 3 or More Children Ever Born: Philippines, 1978*

Mean Birth Interval	MEAN Infant Deaths[a]	MEAN Child Deaths[a]
A. All women (40-49)		
Less than 24 months	52.9	28.8
24-30 months	31.5	23.1
31 and over	23.5	15.9
B. By Children Ever Born		
3 children		
Less than 24 months	10.3	4.1
24 and over	3.4	8.0
4 children		
Less than 24 months	22.1	7.4
24 and over	11.4	0.0
5 children		
Less than 24 months	25.9	10.3
24 and over	15.0	8.3
6 children		
Less than 24 months	32.1	11.3
24 and over	13.7	13.6
7 children		
Less than 24 months	26.2	21.5
24 and over	24.0	18.1
8 children		
Less than 24 months	56.3	33.3
24 and over	29.7	24.8
9 children		
Less than 24 months	61.5	29.4
24 and over	40.8	32.0
10 children		
Less than 24 months	58.9[b]	43.8[c]
24 and over	56.2	42.9
11 and over		
Less than 24 months	110.5	59.0
24 and over	89.9	46.3

* Intervals where the first birth in the interval ended in an infant death were excluded.

[a] Differences between categories significant at p = .001 unless otherwise stated.

[b] Difference between categories significant at p = .025.

[c] Difference not significant.

One study conducted in the Philippines revealed that high- birth-order children had a greater probability of malnutrition and that malnutrition was more prevalent among large families (Reynes and Davis, 1979). Omran and Standley (1976) suggested that differential reporting of symptoms of the occurrences of various diseases among children might have been due to the amount of parental attention available for each child. Mosley and Chen (1984) underscored the importance of time and attention inputs of both the mother and the other members of the families in the prevention of infant and child mortality. The resultant effects of such stresses and competitions are suggested by the persistence of survivorship differentials among births by parity, age of mother and birth interval length till the ages of 5 and 10 years (see Tables 8 and 9).

Other Determinants of Infant and Child Mortality

The data above imply that the birth interval length is a relatively more important explanatory variable of infant and child mortality compared to parity order and the age of childbirth of the mother. However, there are other factors which have been demonstrated to exert some effects on infant and child survival. It will be useful to examine the effects of socio- economic factors along with the length of the birth interval especially those factors which are closely associated with differentials in infant and child deaths. An assessment of the relative strength of the effects of various variables in affecting infant and child mortality is an important step toward policy change.

In this analysis of determinants, nine variables have been selected for inclusion in the multiple linear regressions of the dependent variable, infant and child deaths. These are: age at the first birth, woman's place of residence, region of residence, woman's education, her occupation, husband's occupation, length of the birth interval, source of water supply, and toilet facilities. Data were taken from the 1978 RPFS.

The age at first birth is a proxy for the mean age at childbearing of the woman which cannot be calculated meaningfully. Viewing fertility as a sequential process, the timing of the first birth has strong effects on both individual and aggregate levels of fertility and hence on infant and child mortality.

The region of residence and place of residence are taken as proxies for community variables such as the stage of development of the area, the availability of infrastructure for health, adequacy of health personnel, and accessibility factors. Within the geographic subdivisions are important rural-urban differences in child mortality experience.

Research in various cultural and geographic settings has consistently demonstrated a strong negative relationship between mother's education and child mortality (see for example, Caldwell and McDonald, 1981; Okediji, 1975). The impact of mother's education does not lie alone in its being a vehicle for a stronger belief in modern medicine. Its major role is expressed in terms of skills and knowledge in the adoption of appropriate measures for the prevention and treatment of diseases afflicting family members and her ability to diagnose or perceive symptoms of child illness.

The occupation of the mother is used as a proxy for time spent in the child care, preparation of food, maintaining the sanitation of the house and the environment, and other related activities. Where the mother was working, occupational status would measure the extent to which income substituted or made up for the roles which she otherwise would have performed. More than half of the sampled ever-married women were not working at the time of the survey.

The husband's occupation is taken as a proxy for income, a measure of the available resources of the family for purchasing health through market inputs such as food, medical services, and household amenities. The husband's occupation also affects the organization of home life and the resourcefulness of the family to obtain better health care.

The source of water supply and toilet facilities have been found as having important influences on child mortality (see Concepcion, 1982). These two household variables affect the infant's or child's exposure to disease vectors. In this analysis, the presence or lack of toilet has been differentiated. The sources of water supply have been categorized into piped, pump well, and artesian well as one group; rain water, spring, open well, river, stream, and lake as the second group.

The strategy adopted to assess the relative strength of various predictors in influencing infant and child mortality involves the calculation of a set of regressions with the other variables added in a hierarchical fashion, using a stepwise regression program. The common approach of including all relevant variables in a single regression and then assessing the effect of individual variables by their coefficients in the regression alone has been deliberately avoided because the procedure can yield misleading results when the regressor variables are highly correlated (see Gordon, 1968).

All the predictors are non-metric, except the age at first birth, thus each was introduced in the regression as a set of dummy variables. The category of a predictor which is not identified by any dummy variable is called the "reference category." The reference category may be chosen arbitrarily, although in certain instances a specific choice is natural. The regression coefficients of these dummy variables are interpreted in the usual way, i.e., they indicate the effect on the dependent variable when the predictor is increased by one unit while controlling for the other variables.

The predictors and their ordering in the hierarchy are as follows:

Group 1 - Age at first birth. Single continuous variable in years. Group 2 - Place of residence. Urban = 1 for urban respondents and urban = 0 for rural respondents with the latter as the reference category. Group 3 - Region of residence. Four categories represented by 3 dummy variables with Mindanao as the reference category.

Group 4 -Woman's education. Represented by two indicator variables which take the value of 1 for intermediate or high school and over and 0 if otherwise, with primary or less as the reference category. Group 5 - Woman's occupation. Three dummy variables for white collar, blue collar, and did not work; the farm category served as the reference category. Group 6 - Husband's occupation. Two dummy variables for white collar and blue collar, with the farm category as reference. Group 7 - Length of birth interval. Two dummy variables: 23-30 months and 31 and over, with less than 23 months as the reference category. Group 8 - Source of water supply, One dummy variable for "piped, pump well, artesian well". The category "rain water, spring, river, stream, and lake served as reference category. Group 9 - Toilet. One dummy variable for "with toilet". "No toilet" was taken as the reference category.

The variables have been forced into the equation in a predetermined hierarchical order. They have been entered according to an approximate temporal or causal order. Age at first birth is entered as control and is an exogenous variable. Place of residence and region of residence are basically determined prior to the other variables. The order of husband's occupation may be questioned but assortative mating operates in such a way that the socio-economic status, commonly indexed by occupation of the woman influences her selection of the man she marries which entails consideration of his occupation. What is unclear is the positioning of the variables of water supply source and toilet. This decision has been made primarily to be able to determine how much these variables add to the explanation of variations in child mortality after accounting for the other predictors.

It would have been very useful to make separate runs distinguishing women of different family sizes. The limited and unequal number of cases, however, for the different family sizes have a significant impact on observations about the magnitude of effects and on the significance of the explanatory variables or predictors.

Table 11 shows the values of multiple R^2, representing the proportion of the variance of child deaths explained by the predictors: partial R^2, which is the amount of variance explained by each predictor net of other variables entered in previous steps, and partial R, which is equivalent to the *beta* in multiple classification analysis (MCA), a measure which indicates the relative strength of a predictor vis-a-vis the other variables in affecting the dependent variable.

When all the predictors are taken together the amount of total variation explained reached 15 per cent. Age at first birth accounted for almost 5 per cent of total variation in infant and child deaths, and place of residence and region of residence, 3 per cent. The net effects of each of the predictors are indicated in column 1. Excluding age at first birth, the birth interval length demonstrated the largest proportion of total variance explained followed by woman's education (4.5 and 3.0, per cent, respectively). The variance explained individually by toilet facilities, region of residence, and place of residence hovered around one per cent but were nevertheless statistically significant. The woman's occupation, husband's occupation and source of water supply manifested only trivial net effects.

Table 11. Values of Multiple R^2, Partial R^2, and Partial R, for Child Deaths (0-5), Regressed in Selected Predictors for Women Aged 40-49 with 3+ Children Ever Born: Philippines, 1978

Step a)	Predictor	Partial R^2 (1)	Cumulative Multiple R (2)	Partial R (3)
1	Age at First Birth	.045*	.045**	.212
2	Place of residence	.009*	.054**	.095
3	Region of residence	.012*	.066**	.110
4	Woman's education	.030*	.096**	.173
5	Woman's occupation	.001	.097**	.032
6	Husband's occupation	.000	.097**	.000
7	Birth interval	.045*	.142**	.212
8	Water source	.002	.144**	.045
9	Toilet	.007*	.151**	.084

a) Indicates the regression in which predictor has been added to the earlier variables.

* Statistically significant at p = .01

** Statistically significant at p = .001

Table 12. Mean Infant and Child Deaths by Selected Predictors for Women Aged 40-49 with 3+ Children Ever Born: Philippines, 1978 (Grand Mean: 0.645)

A. Place of Residence

Urban	Rural
.622	.667
-.045 (.0519)	

B. Region of Residence

Metro Manila	Luzon	Visayas	Mindanao
.431	.606	.654	.830
-.399 (.0761)	-.224 (.0565)	-.176 (.0571)	

C. Woman's Education

Primary or less	Intermediate	High School
.858	.589	.441
	-.269 (.0505)	-.417 (.0580)

D. Woman's Occupation

Did not work	White Collar	Blue Collar	Farm*
.653	.631	.573	.681
-.028 (.0877)	-.050 (.1127)	-.108 (.1074)	

E. Husband's Occupation

White Collar	Blue Collar	Farm*
.554	.624	
-.100 (.0678)	-.030 (.0538)	.654

F. Birth Interval

23 Mos. or Less*	24-30 Months	31+
.881	.470	.372
	-.411 (.0458)	.509 (.0560)

G. Water Supply

Piped/Pump/Artesian	Rain Water, Spring, River, Open Well
.645	.770
-.125 (.0545)	

H. Toilet

With Toilet	No Toilet*
.615	.853
-.238 (.0559)	

Notes: 1) Category with asterisk is the reference category.
2) Figures under the means are deviations from the reference category.
3) Figures in parentheses are standard errors for deviations from category.

The age at first birth, birth interval and the woman's education displayed the highest values of the partial R (beta in MCA) implying their greater influence on child mortality experience compared to the other predictors. The large and significant effects of the birth interval and the age at first birth on child mortality suggest the important role played by demographic factors in affecting infant and child mortality over and above the role played by socio-economic factors (see Concepcion, 1982).

The mean infant and child deaths of the different categories of the predictors will now be examined to determine the direction and substantive significance of the above effects. The magnitudes and standard errors of the estimated effects (deviations) of the various categories of the predictors are displayed in Table 11. The effects are interpreted in relation to the reference or omitted category. The urban-rural differential in infant and child deaths was found to be meager, although it conformed to the expected configuration. The effects of region of residence were highly distinguishable exhibiting a gradient of decreasing child mortality as one moved from Mindanao towards Metro Manila. The effect for Visayan women was 0.18 of a dead child less than Mindanao women. This rose to 0.43 of a child for Metro Manilans.

As expected, the schooling of the mother was negatively related to the number of child deaths experienced. For women who had at least attended high school, the effect was more than two- fifths of a child less than women who had at most primary education. The pattern of effects for woman's occupation did not conform to theoretically based expectations. Farm work or no work at all did not matter and the blue collar workers manifested slightly higher effects than the white collar workers. The effects for husband's occupation were in the expected direction but these were not substantial. The range in effects was only 0.10 of a child.

The birth interval was negatively associated with child deaths. The differential between intervals of less than 24 months and intervals of 31 months or more exceeded half a child.

Very little differential effects were visible by source of water supply. Women living in household with toilet facilities whether these were found inside or outside the house had significantly lower child deaths than women in households without toilet. The effect for the former was almost a quarter of a child less than those for the latter.

In brief, the most important predictors of child deaths controlling for the effects of the other predictors are the birth interval, age at first birth, woman's education, region of residence, and toilet facilities.

SUMMARY AND CONCLUSIONS

An earlier attempt by the author (de Guzman, 1984) to investigate the effects of mortality on fertility, utilizing the birth interval dynamics and subsequent births, succeeded only in demonstrating a weak child replacement effect. While the tendency to replace dead children was evident from the data, the differences in birth intervals controlling for earlier infant deaths were in most cases small and statistically insignificant. The analysis of subsequent fertility disclosed higher subsequent births among women who earlier had experienced infant mortality than those who had no such experience. Controlling for various important factors significantly diminished the differentials. At best, the study highlighted the important biological effects of infant mortality shown by the shortening of the birth interval if the child had died at the onset of the interval. Where lactation was practiced, better survivorship of infants prolonged the period of post-partum sterility and thus lengthened the entire birth interval.

In the present investigation,the replacement hypothesis seems to gain more support from the parity-progression-ratios approach applied to women aged 40-49. Parity progression ratios were computed for three groups of women according to their ages at first marriage (below 18 years, 18-21 years, and 22 years and over). The ratios assumed the expected configuration of higher proportions of women progressing to the next parity among women who had experienced a child death than among those who had not. However, among women who married before age 22, the mortality- fertility relationship seemed dubious in the light of the small differences in the proportions. Among women who reported having first married before their eighteenth birthday, the differences were statistically significant in only one instance (progression from the 6th child to the seventh), and among those who married at the ages 18-21 years, statistically significant differences were noted for only two instances (progression from the 4th child to the 5th and the 6th to the 7th child). More conclusive evidence of the replacement hypothesis was manifested by the women who married later (at ages 22 and over), who had lower fertility and possibly were more prone to use family planning.

Classification of children ever born by perception of infant mortality and general mortality conditions provided some indication of the insurance effects of mortality in reproductive behavior. The belief that mortality is the same or increasing over the past twenty years was associated with higher levels of fertility. Women who believed couples should bear a large number of children to insure that a sufficient number of them would survive to adulthood also manifested higher average parities than those who disagreed with this insurance motivation. To control for the confounding effects of child replacement, the data for women with child deaths were segregated from those who did not have any such experience. Over all, the analysis of perceptions of and attitudes toward mortality confirmed the presence of insurance effects on fertility.

The reverse relationship, in which mortality was treated as the dependent variable, was a second aspect of the relationship between mortality and fertility, which previous studies have documented to be more conclusive. The present analysis examined this relationship using proportions surviving from birth to age x classified by parity order and birth interval controlling for the age of mother at childbirth and the number of children ever born. The data were restricted to women aged 40-49 years who were nearing the end of their childbearing. The survivorship of children, in general, deteriorated with increased parity order. Likewise, the proportions surviving among children of similar parity or less improved when the age at childbirth shifted towards the latter ages. The classification by birth interval demonstrated similar improvement in survival rates as one moved from the shorter birth intervals to the longer intervals. The consistent monotonic increases in proportions surviving from birth to age 10 irrespective of type of birth interval (i.e., indexed by the first and the second children, by the second and third children, etc.) imply the stronger influence of birth interval than parity order or age at childbirth. Data on mean infant and child deaths likewise pointed to significant birth interval effects.

The multivariate analysis employing hierarchical regression procedures identified the age at first birth, birth interval, mother's education, region of residence, and toilet facilities as important predictors of child mortality (deaths to children aged 0-5), in that order. The women who had at least a high school diploma were likely to have 0.42 child death less than those who had only a primary education. For women whose birth interval averaged more than 31 months, the effect was 0.51 less than among those where the interval averaged less than 23 months. Women residing in Mindanao suffered 0.40 child death more than women living in Metro Manila. Women living in households with toilet facilities, whether located inside or outside the house, experienced 0.24 of a child death less than those in households without any toilet.

No attempt was made to examine another possible causal link between fertility and mortality wherein fertility and mortality simultaneously affect each other. The effects of mortality on fertility, on one hand, and the effects of fertility on mortality on the other hand, have been successfully demonstrated by the various approaches employed in this analysis. The findings suggest that fertility and mortality are causally conjoined at the level of the individual.

The Philippines has been classified as having a moderately low level of mortality and has been listed along with Malaysia and Republic of Korea in level of mortality. Unfortunately, when Philippine infant and child mortality is compared with that of Malaysia and Korea, Filipino children are found to be very much more susceptible.

The Philippines, like most developing countries, has limited resources for health services. This study has suggested that strengthening government programs and activities, which were not instituted for health purposes, at minimal costs can have far reaching consequences on reducing of infant and child mortality. For example, the present family planning program can help lengthen the interval between births and limit the parity of women. The revitalization of informal education program activities, in the form of extension education, out-of-school youth education, skills training and development and other short-term vocational training classes which are being implemented currently by the government and the private sector, can be accomplished with more ease and bring about quicker results. The dividends from such activities will be in the form of increased education leading to increased household or family resources, better care of children, improved nutrition, improved sanitation and better disposal of waste, better utilization of available health resources, and more encouragement for longer birth intervals. It is also hoped that with upward shifts in education, especially among women, marriage will also be delayed further.

With improvements in the life styles and the general well- being of the people, along with reduced infant and child mortality, the replacement effects and, more importantly, the insurance effects of mortality will be increasingly minimized. It is also expected that the biological effects of lactation will be maximized. Hopefully, the twin objectives of increased longevity of life and reduced fertility will be achieved even as the overall development process progresses.

NOTES

[1]For the sake of simplicity, countries in the ESCAP region have been classified according to the levels of life expectancy at birth into four categories (ESCAP, 1984): high mortality ($^oe_o \leq 50$ years); moderately high mortality ($50 < {}^oe_o \leq 60$); moderately low mortality ($60 < {}^oe_o \leq 70$), and low mortality ($^oe_o > 70$).

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