PN-AAT-222

BIOLOGICAL AND SOCIAL FACTORS AFFECTING INFANT AND CHILD MORTALITY IN JORDAN, TUNISIA, EGYPT AND YEMEN ARAB REPUBLIC

by

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July 1984

Final Report

Acknowledgements

This research was supported by the Contract Number AID-NE-C-1713 from the Near East Bureau of the Agency for International Development. We wish to express our gratitude to the National Statistical Offices of Jordan, Tunisia, Egypt, and Yemen and to the World Fertility Survey, London, for their permission to use the data. We are grateful to Carol Adelman of the Agency for International Development for several helpful comments. Thanks are due to Larry Sink for providing programming assistance and to Deb Kinnaman for typing the manuscript.

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I. INTRODUCTION

Knowledge of levels and correlates of infant and child mortality is important in the formulation of programs to improve the survival and health of children, as well as for the evaluation of the intervention policies. Unfortunately, such information is far from complete for many less developed countries. There are several reasons for this, including unavailability of reliable data as well as failure to fully exploit the existing data. In recent years, several LDC's have carried out national surveys in collaboration with the World Fertility Survey (WFS). Experience indicates that the WFS data can yield useful information on the levels, time trends, and co-variates of infant and child mortality (Martin et. al. 1983; Suchindran and Adlakha 1981). During the past three years, the authors have made detailed separate analyses of infant and child mortality based on the WFS data for four middle eastern countries, Jordan (Sullivan et. al. 1981), Egypt (Adlakha et. al. 1983), Tunisia (Suchindran and Adlakha 1984), and Yemen Arab Republic (Suchindran and Adlakha 1984a), hereafter referred to as Yemen. In this paper, we present results on levels, time trends, and demographic and socio-economic co-variates of infant mortality (probability of dying from birth to age 1) and child mortality (probability of dying from age 1 to 5) for these four countries.

A review of literature suggests that a wide variety of factors; genetic (e.g. birth weight, birth defects), demographic (e.g. mother's age, birth order), and socio-economic (e.g. factors relating to parental background, community, nutrition, access to and utilization of health facilities, etc.) are related to infant and child mortality. However, information in the World Fertility Surveys is limited to demographic characteristics and certain socio-economic characteristics. Thus, the co-variate model studied in this paper is limited to the items available

in these surveys. For all four countries the variables examined include the following: age of the mother at childbirth, order of birth, preceding birth interval, whether previous infant died, mother's education, father's education, father's occupation, mother's rural-urban residence, and mother's working status since marriage. In addition to these variables, limited information on duration of breastfeeding is also available in these surveys and is analyzed to study the effect of breastfeeding on mortality of children. Analysis of breastfeeding data is, however, carried out separately because several aspects of the data, as discussed later, limit their suitability. A brief discussion on the relevance of the factors included in the model follows.

Demographic factors, which are biological attributes of birth, are found to influence the risk of infant death particularly in early infancy. Age of mother at the time of child birth, birth order, and birth interval are the demographic factors most commonly analyzed and are included in our model. With respect to age of the mother, previous studies indicate that the risk of mortality during the first year of life of infants born to very young mothers is substantially higher and gradually decreases to reach a minimum for women 25 to 30 years old, and thereafter rises again (U.N. 1954, Suchindran and Adlakha 1981, Devanzo et. al. 1983). With regard to birth interval, short interval between births is found to be associated with higher risk of mortality (Hobcraft et. al. 1983). In the case of birth order, first births and higher birth order births experience higher mortality.

Previous literature suggests that associations of demographic factors arise, in part, due to gestational prematurity, low birth weights and complications associated with pregnancies at different ages, birth orders, and for birth intervals (Shapiro et. al. 1968, Devanzo et. al. 1983); and, in part, due to behavioral factors associated with child care. In the case of birth interval, "maternal depletion syndrome" is often cited as a mechanism causing deleterious effects on infant and child survival. A mother with repeated pregnancies and especially at short intervals does not have sufficient time for recovery both physically and nutritionally, and is more likely to have pregnancy losses and lower birth weight babies. Also, birth interval may be viewed as a measure of the amount of pressure on the mother for the care of children. When interval between births is short, there will be two very young children in the household with similar demands which will cause severe pressure on the mother responsible for their care. Similarly, the relation of the age of the mother with infant mortality may also be viewed in terms of her ability to provide necessary care for the child after birth. Young mothers, having little experience in childrearing may be less capable of providing the necessary care for their children which may result in higher mortality of their infants.

In addition to the demographic factors described above, previous studies indicate that within a family, deaths of infants are correlated (Chase 1964, Adlakha 1970, Suchindran and Adlakha 1981). This correlation among deaths of children in a family perhaps results because the children share the same environment. Also, mothers grief for the death of a child may have adverse effects on the survival of the next child (DeSweemer 1984). As a result of these findings, we have included this variable in our model.

With respect to socio-economic factors, it is well recognized in literature that in any population the incidence of mortality varies between different social and economic strata. Among the various socio-economic factors parental education, especially mother's education, has been identified as the most important factor influencing infant and child mortality (Martin et. al. 1983; Caldwell, 1979). According to Caldwell, increased education strengthens the mother's role in the decision making process resulting in reallocation of family expenditures from older members to younger members. However, differentials in mortality by various education classes may also be the result of differentials in economic means for providing necessary medical and nutritional care of infants, as will access to the factors that enable them to learn more about new ideas in child care which may be crucial to the survival of their children. Our model represents both mother's education and father's education, as well as an additional status variable pertaining to father's occupation. The model also includes a residence variable categorized as rural or urban residence, since mortality is found to vary between residential settings, which perhaps reflects differences in the environmental factors and in values and practices in child care. A variable pertaining to mothers working status in terms of whether she ever worked or never worked after marriage is included to investigate whether the mother's participation in work outside the home has any adverse effect on the mortality of her children.

II. DATA AND EVALUATION

The data used in this study are drawn from the individual women's questionnaire of the 1976 Jordan Fertility Survey, the 1978 Tunisia Fertility Survey, the 1980 Egypt Fertility Survey, and the 1979 Yemen Fertility Survey carried out by the national statistical organizations in collaboration with the WFS. The information on infant and child mortality in these surveys was obtained as a part of birth/pregnancy history for ever-married women 15 to 49 years of age. For each reported birth, information was obtained on the date of birth, sex, survival status, and if appropriate, age at death.

A limited evaluation of quality of these data was undertaken by applying various tests, which included the analysis of (1) sex ratio at birth, (2) age distribution of deaths and proportion of unknown age deaths and (3) truncation bias (for details on these tests see Sullivan et. al. 1981; Adlakha et. al. 1983). These tests indicated certain deficiencies in these data. Those relevant to this study are briefly summarized.

First, there was clear evidence that information on age at death suffered from age misreporting errors, especially, reporting of some infant deaths as deaths at 12 completed months (deaths were heaped at 12 months of age). This net transfer of infant deaths to age one appeared to progressively increase with the time prior to the survey. A simple procedure suggested by Goldman (et. al. 1980) which involves reassigning of half of the deaths at 12 months back into infancy was used to correct this problem. The procedure appeared to work well for Jordan, Egypt, and Yemen; but did not appear to be satisfactory in the case of Tunisia.

Second, in the case of Tunisia and Egypt for a significant percentage of total deaths, information on age at death was missing[1] (10% in Egypt, 5% in Tunisia) and percentage figures were generally higher for the past birth cohorts. No adjustment was made to correct this problem. Thus rates presented in this report for these two countries are to a certain extent under-estimated and analysis of co-variates is subject to the variation in the proportion of unknown age deaths by co-variates categories.

Third, the birth history data from World Fertility Surveys, as is the case with all birth histories, are subject to truncation effect because retrospective data on births collected from women 15 to 49 years old at the time of the survey is progressively truncated by age of mother for the earlier periods. This truncation effect was found to bias positively the estimates of infant mortality rates for period's prior to 1960. Further, for the study of differentials, if all data on births are used, this truncation effect could result in spurious associations for the type of variables used in this study, such as age of mother and order of birth.

Because of these data problems which progressively increased with time prior to the surveys, it was considered desirable to carry out co-variate analysis with births limited to the 10 year period prior to the survey and the analysis of trends generally for the 20 year period. These cut offs only minimize the effect of these problems and thus some caution should be exercised in the interpretation of the results presented in this paper.

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[1]Also for Yemen, for 1% of dead children, information on age at death was not availble.

III. LEVELS AND TRENDS AND SEX DIFFERENTIALS

To provide an idea on levels and trends of infant and child mortality we provide some data for each of the four countries in Tables 1 and 2. Table 1 shows infant mortality rates by sex and four five-year birth cohorts representing an approximate 20 year period preceding the surveys in the four countries. In the interpretation of these rates problems with quality of the data, especially related to age mis-reporting of deaths and missing information on the age at death should be kept in mind. As stated in Section II, some adjustments, by reassigning deaths at 12 completed months back into infancy, were made to these data. Alternative estimates of infant mortality rates for each country were made by first estimating mortality rate up to age 2 which was then converted into infant mortality rate by using the Coale-Demeny (1967) model life tables. For Jordan, Yemen, and Egypt, two sets of estimates were in close agreement with each other and provided a similar pattern of time trend. However, for Tunisia two sets were not very close, and the infant mortality rates based on 2-year mortality rates (Set II in Table 1) provided a more regular pattern of time trend than rates based on reported births and infant deaths (Set I in Table 1). For Tunisia in Table 1, therefore, we have shown both sets of infant mortality rates. In addition to age mis-reporting problems, the data for Tunisia and Egypt suffered from missing information on age at death. These unknown age deaths were excluded from the analysis and thus rates may have negative bias in them in the sense that they may be under-estimated.

On the basis of available information on literacy and rural-urban residence,[1] the four countries in terms of development may be ranked as

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[1]Percent of male and female literate and percent of population classified as urban were respectively, 80%, 50%, 59% in Jordan (1979); 66%, 39%, 52% in Tunisia (1980); 57%, 27%, 44% in Egypt (1979); 26%, 2%, 11% in Yemen (1975).

follows: Jordan, Tunisia, Egypt, and Yemen. In terms of the level of infant mortality, the ranking is exactly the same. For the most recent time period, around mid to late 70's, the IMR was 69 in Jordan, 74 in Tunisia, 142 in Egypt, and 156 in Yemen (Table 1). This type of pattern existed throughout the 1960's and mid to late 70's. During the period of about 15 to 20 years prior to the surveys, all countries experienced a decline in the IMR. However, magnitude of the decline varied between countries, the proportionate decline was slight in Egypt (11%), moderately large in Tunisia (24%), and substantially greater in Jordan (43%) and Yemen (39%).

The estimated child mortality rates in Table 2 essentially show a pattern of differences among countries which is similar to that shown by the IMR. Substantial declines in child mortality are clearly evident for each country. The proportionate decline in child mortality, however, for each country was greater than the proportionate decline in the IMR for the comparable time period. This finding is consistent with the general notion that the improved socio-economic conditions, which have occurred in these countries, have greater impact on ages more removed from the time of birth.

The separate rates for males and females show a time trend pattern which is generally similar to the rates of both sexes combined. However, a comparison of rates by sex shows an important difference. With respect to infant mortality the sex differential in the IMR for Jordan, Tunisia, and Egypt are small and show no consistant pattern. For Yemen, the IMR of males exceeds that of females, a pattern common to most populations. However, with respect to child mortality, female mortality exceeds male mortality in all four countries. This reverse pattern of sex differences is generally observed in populations in which preference for male children exists and is considered to suggest the possibility of preferential care of male offspring.

IV. MULTIVARIATE ANALYSIS OF INFANT AND CHILD MORTALITY

In this section, we describe the net effects of various demographic and socio-economic factors on infant and childhood mortality. For each country, results are presented separately for infant and child mortality. The logistic regression model, as specified below, was used to ascertain the net effects of selected variables.

$$\log \frac{q}{1-q} = B_0 + B_1 X_1 + \ldots B_\gamma X_\gamma + E \qquad (1)$$

where q is an age-specific mortality rate (infant or childhood),

X_i denotes an independent variable,

B_i denotes a regression coefficient, and

E is the error term.

The sign and standard error of the B coefficients are used to draw conclusions about the direction and statistical significance of the independent variable. To provide an indication of the effect of an independent variable on a mortality probability, we calculate relative risks,[1] risk of mortality being in a specified category as relative to a baseline category, for all variables found to be significant in the model.

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[1]The relative risk was calculated as follows: First equation (1) was transformed into the form

$$q = \frac{\Sigma e^{B_i X_i}}{1 + \Sigma e^{B_i X_i}} \qquad (2)$$

where all variables are as defined in equation (1). Second, a reference value for q was computed after assuming a reference set of values for the independent variables (X_i). Third, a second value for q was compiled after changing the value of an independent variable. The relative risk is the ratio of the two q values. A simple approximation of relative risk can be obtained by computing odds ratios (see Fliess, 1973).

Infant Mortality

Table 3 presents regression results for infant mortality. The data for the regression model are restricted to births 10 years prior to the survey date in each country. In addition, inclusion of the preceding birth interval and survivorship of the previous birth variables in the model further restricts the data set to births of order two and higher.

Results in Table 3 show that demographic factors included in the model show strong significant (with a few exceptions) relationships with infant mortality which are generally consistent with the results of the past studies.

The age of the mother at time of child birth shows a negative linear coefficient, which is significant in all countries but Yemen, and significant positive coefficient for the squared term. This indicates that the age effect on infant mortality is non-linear, i.e. risk of infant mortality initially decreases with the mother's age and increases at older ages. The relative risks of infant mortality at different ages of mothers (Table 4), which are relative to risk of infant mortality of births to 18 year old mothers show that infant mortality reaches the lowest when mothers are about 30 years of age. For example, in the case of Jordan, risk of infant mortality for births to mothers of age 30 is approximately 78 percent of the mortality rate experienced by births to mothers of age 18, or when the mothers age increases from 18 to 30, the IMR declines by about 22 percent. In Tunisia and Egypt when mothers age changes from 18 to 30, the IMR is reduced by about 42 and 35 percent, respectively. The results for all three countries show that relative risk ratios begin to rise after age 30 A higher prevalence of unwanted births among older mothers may be, in part, as suggested in literature (Devanzo, et. al.), responsible for this rise in the IMR at older ages of mothers.

The birth order shows a significant positive relationship to infant mortality, except in Jordan where the relationship is also positive, but not significant. The mortality risk ratios with base category of birth order two show that when birth order changes from two to seven, the IMR increases by 53 percent in Tunisia, 42 percent in Egypt, and 26 percent in Yemen.

The preceding birth interval shows a significant negative relationship with infant mortality, i.e. infant mortality decreases with increase in the preceding birth interval, in all four countries. The relative risk ratios, with base category of a 12-month interval, show that when birth interval increases by 12 months (for example, from 12 to 24 months), the risk of infant mortality declines by 45 percent in Jordan, 37 percent in Tunisia, 37 percent in Egypt, and 31 percent in Yemen.

The survival of the previous infant implies a lower infant mortality for the ensuing birth in all four countries. When the previous birth had died in infancy, the risk of death for the ensuing birth is greater by 86 percent in Jordan, 63 percent in Tunisia, 54 percent in Egypt, and 78 percent in Yemen; than when the previous birth had survived.

With respect to socio-economic characteristics, the model (Table 3) includes three social class status variables, mother's and father's education (years of schooling);[1] and father's occupation (agriculture, transitional, blue, or white collar); one residence variable (rural or urban); and one working status variable (ever worked or never worked since marriage). In general, these variables show weak associations with infant mortality and none of them shows consistant significant relationships

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[1]In Yemen, because of the low level of education, the data is categorized as illiterate or literate.

across all countries (Table 3). Only mother's education and place of residence tend to show significant relationships in some countries.

Some previous studies have also shown weak associations of socio-economic characteristics with infant mortality where most proximate variables, such as age of mother, birthweight, and birth interval, are controlled. A recent study, based on data from Bangladesh, found that effects of socio-economic characteristics on infant mortality are almost absent and ascribed this absence to protection afforded by breastfeeding, a practice which is universal and prolonged in Bangladesh (Phillips and Mozumdar, 1984). To a certain extent, this may account for the observed weak associations of socio-economic characteristics with infant mortality in the present study, because in the countries considered, breastfeeding is almost universal and prolonged. However, as reported in the next section, socio-economic characteristics in the present study also show weak associations with child mortality, which cannot be explained in terms of the protection that breastfeeding affords. Certain data problems that may have biased and probably dilluted the effect of socio-economic characteristics should be noted. First, the characteristics data generally apply to the survey date while mortality rates cover a longer period - 10 years prior to the survey date. It is possible that certain respondents characteristics (such as residence, occupation of fathers) may have changed. Thus, observed relationships of these variables with mortality rates are subject to the influence of this time discrepancy. Second, as reported before, for a significant number of deceased children, especially in the case of Tunisia and Egypt and to a lesser extent in the case of Yemen, information on age at death was missing. Our analysis indicates that the proportion of the un-known deaths was generally lower for those

who were better educated, were in higher status occupations, or lived in urban areas than their corresponding counterparts. Therefore, the observed differentials of socio-economic characteristics with mortality rates are less pronounced than the time differentials. Third, as with most surveys, coverage of deaths in these surveys may not be complete and may vary with social and economic characteristics of respondents, resulting in a bias similar to that described above.

In spite of these limitations, results with respect to education show that infant mortality is reduced with an increase in education in all four countries, although this decrease in infant mortality is only significant in Tunisia and Egypt. In Tunisia, change in mother's education category, from illiterate to six or more years of schooling results in a reduction of infant mortality by 39 percent (Table 4). The corresponding reduction in Egypt is 26 percent.

With respect to rural-urban residence, all four countries show that infant mortality is lower in the urban area than in the rural area, although association is not significant for Tunisia. When the mother's residence changes from urban to rural, both Jordan and Yemen show about a 30 percent increase in the risk of infant death. In Egypt, the corresponding increase is small, only 12 percent.

Child Mortality

The net effect of demographic and socio-economic variables on child mortality rates differed from that of infant mortality (Table 5).

Among the demographic variables, only the length of preceding birth interval shows significant net effect on child mortality in all four countries. The risk of child mortality reduced considerably with increase in the length of birth interval. When the previous birth interval increases

from 12 to 24 months, the risk of child mortality is reduced by 28 percent in both Jordan and Egypt and by about 38 percent in both Tunisia and Yemen (Table 6).

Unlike infant mortality, age of mother, birth order, and survivorship status of previous birth do not show any significant net effect on child mortality.

Living in urban areas is also associated with the lower risk of child mortality. However, in Jordan, this association is not statistically significant: The estimated regression coefficients show that living in rural areas almost doubled the child mortality rate in Tunisia and Yemen, and it increased the child mortality rate in Egypt by almost 38 percent.

Parental education (except for father's education in Egypt) shows no significant net effect on child mortality in all four countries. With respect to the working status of the mother, although children of working mothers experienced slightly higher mortality in Jordan, this effect is not present in the other three countries. The insignificant association of various socio-economic characteristics, in part, may be a result of the measurement and data problems detailed in the previous section.

V. BREASTFEEDING: GROSS AND NET EFFECTS ON MORTALITY

The co-variate model discussed above did not consider the breastfeeding variable, even though some information on breastfeeding was collected in the four surveys. The reason for this was that information on breastfeeding was collected only for the last and next to the last births of the respondent resulting in a sample which was very selective and of considerable small size. However, because breastfeeding is a critical factor in the survivorship of infants and children, it was decided to carry out a separate analysis; results of which are presented in this section.

Breastfeeding influences mortality in two ways. Its direct effect is through its nutritional value which influences the health of the infant, and thereby increases the chance of survival. Breastfeeding also indirectly affects the child's survival through its influence on birth spacing. Early cessation of breastfeeding increases the risk of pregnancy resulting in a short birth interval, which as discussed earlier, is found to have a deleterious effect on infant survival. Although full breastfeeding (without supplements) is found to substantially reduce the mortality of infants, very long full breastfeeding can be detrimental to a child's health for it does not provide enough energy for the older infant. Therefore, it is generally postulated that the effect of full breastfeeding on mortality becomes positive during the last months of the first year (Davanzo et al, 1983; Rowland et al, 1981).

For the last two births of the respondent, information on whether the birth was breastfed and, if breastfed, the duration of breastfeeding was collected. Several aspects of the data limit their suitability for investigating the relationship between breastfeeding and mortality. First, the information on breastfeeding is extremely limited. The data do not provide

any information on the frequency of breastfeeding and supplemental feedings or the reasons for never breastfeeding or stopping breastfeeding. Second, there is evidence that information on the duration of breastfeeding was not always accurately reported by respondents.[1] Third, the universe consisting of the last two births of women constitute a very selective population.[2] Fourth, almost all children, as shown in Table 7, are breastfed in these four countries; among the children who survived the first month of their life the percentage of breastfeeders in the four countries were as follows: Jordan, 92%; Tunisia, 94%; Egypt, 96%; and Yemen, 96%. As a result, the number of nonbreastfeeding children available for analysis is very small.

The analysis which follows is resticted to births occuring during the 10-year period prior to the survey for which data on breastfeeding are available. The analysis involves computing mortality rates for breast-feeders and non-breastfeeders for the following age intervals: the early PNN periods (1-5 months); the late PNN period (6-11 months); and the entire PNN period (1-11 months).[3] Both gross effects and net effects, net after controlling for other co-variates, of breastfeeding on mortality rates were computed.

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[1]The evidence is of two kinds: (1) the data on the duration at which breastfeeding stopped exhibited a substantial degree of heaping at 6, 12, and 18 months and (2) for several cases, the duration of breast-feeding exceeded either current age or age at death of the child. Such cases were excluded from the analysis.

[2]The post neonatal mortality rate of this population in each country were well below (about 50% below) the corresponding rate for all births during the same period.

[3]No analysis is conducted for the NN period (0 months). This is so because it is probably the case that many neonatal deaths, even late neonatal deaths, occur to infants who are too ill to breastfeed, so that the causation runs from illness to breastfeeding status rather than vice-versa.

Gross Effects

For the purpose of computing mortality rates, births were classified as breastfeeders or non-breastfeeders following two alternate procedures. In the first procedure for each age interval (i.e. early PNN, late PNN, or entire PNN) investigated, births are classified according to their breastfeeding status at the beginning of each age interval. Mortality rates for cases classified by breastfeeding status according to this procedure are presented in Table 7. For the interval 1-5 months, mortality rates of breastfeeders were lower than non-breastfeeders in all four countries. Mortality rates for breastfeeders and non-breastfeeders were almost identical during the 6-11 months, with the exception of Egypt where breastfeeders continued to experience lower mortality. During the entire post neonatal period (1-11 months), the breastfeeders experienced lower mortality rates than the non-breastfeeders.

In the second procedure, births were classified as breastfeeders or non-breastfeeders at each month of age on the basis of their breastfeeding status at the close of the previous month. This procedure involves calculation of monthly death probabilities by breastfeeding status and the calculation of mortality rates for broad age intervals from the monthly rates (i.e., life table approach). The corresponding life table estimates are also given in Table 7. The result shows that for the age interval 1-5 months, non-breastfeeders have substantially higher mortality rates than breastfeeders. However, for the age interval 6-11 months, the rate is virtually identical in Jordan, Tunisia, and Yemen.

Net Effects

We investigated the differential mortality rates for breastfeeders and non-breastfeeders further by estimating the net effect after controlling

for a number of confounding factors. Logistic models were fitted with data on births of order two and higher for which breastfeeding data were available. The model included all demographic and socio-economic variables used earlier and, in addition, a dummy variable which indicated the breastfeeding status of a child at the beginning of the age interval under investigation. A separate model was fitted for each of the age intervals 1-5 months, 6-11 months, and 1-11 months. The results are given in Table 7.

The net effect of breastfeeding follows the same pattern as the gross rates. For the early PNN period (1-5 months), the mortality rates are substantially higher for non-breastfeeders than breastfeeders, although in the case of Yemen, this large differential is not statistically significant. According to risk ratios, the mortality rate of non-breastfeeders in the early PNN period are three times as great in Jordan and Tunisia and eight times as great in Egypt than the mortality rate of breastfeeders.

For the age interval 6-11 months, the mortality rates for breastfeeders and non-breastfeeders were about the same for all countries except Egypt. For Egypt, once again, the non-breastfeeders experienced a significantly higher death rate than the breastfeeder.

The age interval 1-11 months generally followed that of the interval 1-5 months with significantly higher death rates for non-breastfeeders than for breastfeeders.

The finding that during the post neonatal period the mortality effect for breastfeeders is concentrated in the early PNN period has also been found in other studies (see e.g. Devanzo, et al, 1983). However, this result should be viewed with caution. Almost equal death rates for breastfeeders and non-breastfeeders during the late PNN period (6-11 months) may arise in spite of positive benefits being derived from breastfeeding,

because there could be a selection bias operating by which weak or ill children continue to breastfeed beyond the age at which healthy children are weaned. Also breastfeeders could suffer nutritional deficiencies due to a failure to introduce supplemental feeding during the late PNN period.

It is interesting to note that the breastfeeding effect during the 1-5 months (also in the PNN period) is significant and not greatly reduced when length of the preceding interval and the survivorship of previous birth (along with other variables) are controlled. This implies that the breastfeeding effects are mainly through the nourishment effects rather than through its influence on child spacing. Also, the birth interval effects remained significant even after controlling for both breastfeeding and the survival status of previous birth (see Appendix Tables A1, A2, A3, and A4 for full results of the logistic model).

VI. SUMMARY OF FINDINGS AND PROGRAM AND POLICY IMPLICATIONS

Summary

In this paper, we have used retrospective birth history data from the WFS surveys carried out in Jordan, Tunisia, Egypt, and Yemen to investigate levels, trends, and co-variates of infant and child mortality. The main finding of this analysis are as follows:

1. With respect to the levels and time trends, the estimates for the four countries show large variations in the mortality rates and an expected pattern of declining infant and child mortality during the period of approximately 20 years prior to the survey. Further, the proportionate decline in child mortality in each country was generally greater than the proportionate decline in infant mortality. This finding is consistent with the notion that improved socio-economic conditions generally have more impact on ages more removed from the time of birth.
2. A persistent pattern of higher female child mortality than male mortality is found in the data. This pattern suggests preferential care and treatment of male offspring.
3. The multi-variate analysis of the co-variates shows that the determinants of mortality change as the infant grows older. With respect to infant mortality, all four demographic characteristics are found to have significant impact on mortality. The higher mortality risk is found for infants born to very young mothers and very old mothers, with short previous birth intervals, of higher birth orders, and where

previous infant had died. These findings are consistent with previous studies. Among the socio-economic characteristics, the education of the mother and rural-urban residence are found to have impact on infant survival, although associations are not as strong as those found in some of the previous studies.

4. In the childhood age interval, among the demographic factors, only birth interval shows significant impact on mortality. The risk of child mortality decreases considerably with the increase in the birth interval. This effect can be interpreted as a result of factors which deplete the amount of time a mother has available for the care of a particular child. The absence of the effect of the other demographic factors on child mortality is not surprising, as mortality at childhood ages is more influenced by the environmental factors than the biological factors which are reflected by the demographic factors. However, among the socio-economic variables, only rural-urban residence is found to have an impact on child mortality. It is somewhat surprising that other socio-economic characteristics represented in the co-variate model do not have net significant impact on child mortality. Deficiencies in the data which are retrospective in nature may, in part, be responsible for the weak associations of socio-economic characteristics.

5. The analysis pertaining to the effect of breastfeeding on mortality, although it is based on the limited information, clearly shows the beneficial effect of breastfeeding on the infants survival, especially during the early months (1-5) of the infant's life. For all countries, the mortality rate for the non-breastfeeders

is substantially higher than for the breastfeeders and when the effect of the other co-variates is controlled, this substantial difference persists in Jordan, Tunisia, and Egypt.

Program and Policy Implications

The findings reported in this paper have implications for health programs designed to reduce mortality, for family planning programs, and for policy relating to breastfeeding.

Health Programs

Screening programs which identify infants and children at high risk of mortality are an accepted part of public health service. To effectively reduce mortality, screening programs must be coupled with interventions which address the special problems of high risk infants and children. An ideal screening characteristic is one which has an independent effect on mortality and which precisely identifies a sub-group of the population at high risk to mortality. The characteristics identified in this paper, which are useful for screening, are:

1. Age of mother: births to women aged 20 or below and age 35 and above have especially high infant mortality.
2. Birth order: the first birth and the birth of order seven and above experience higher mortality during infancy.
3. Birth interval: births following a birth interval of less than 24 months have a high rate of infant and childhood mortality.
4. Survivorship status of the previous birth: births following a birth that died have high infant mortality.

5. Breastfeeding: births which are never breastfed or which are weaned in early infancy have especially high mortality in the early post neonatal period.

Family Planning Programs

Our findings, especially relating to the effect of demographic characteristics on infant mortality, have implications for government policy in the areas of family planning.

The analysis shows that infant mortality of births to women at extreme ages of childbearing (under 20 and over 35 years of age) is very high. A substantially large proportion of total births varying between 1/4 and 1/3 in these countries (29% in Jordan, 27% in Tunisia, 39% in Egypt, and 33% in Yemen) occur at these high risk ages of mothers. Thus, effective national planning programs can reduce mortality by delaying first pregnancy for women who marry below age 20 and by providing the means of limiting fertility of women above the age of 35. Similarly, substantially higher mortality in infancy and childhood ages of births which occur after a birth interval of less than 24 months is a stronger case for birth spacing. A large percentage of births in the four countries (53% in Jordan, 41% in Tunisia, 39% in Egypt, and 55% in Yemen) occur after a birth interval of less than 24 months. Thus, these findings have significant implications concerning the population groups to which family planning programs are targetted and the educational components of the national maternal and child health programs.

Breastfeeding

It is difficult to draw definitive conclusions about the effect of breastfeeding on mortality because of the restricted nature of the data available. Nevertheless, our findings clearly indicate that infants who are never breastfed have an elevated risk of mortality and evidence from numerous studies indicates that breastfeeding well into infancy has beneficial effects on the physical and psychological well-being of a child. Although only a small percentage of the total births, about 5%, in these countries are not breastfed, those births experience very high risk and thus, it is appropriate to suggest that government policies which encourage and facilitate breastfeeding are warranted.

Implications for Further Research

Our investigations indicate that additional studies are needed to obtain better insights on levels, historical trends, and determinants of infant and child mortality.

Mortality Levels and Trends

Because the World Fertility Surveys are retrospective in nature, there is some evidence that the levels of mortality were under-estimated, especially for the past years and for certain subgroups of populations. Also, for varying percentages of deaths (10% in Egypt, 5% in Tunisia, and 1% in Yemen) the date of death was unknown. Thus, it is important to conduct further studies to validate the estimates presented in this paper.

Determinants of Mortality

The World Fertility Surveys were not particularly designed for the detailed investigations of infant and child mortality and thus did not include information on a number of proximate determinants of mortality, such as birthweight, duration of gestation, etc. Also, this analysis did

not consider variables pertaining to the respondent's dwelling unit or community residence. Variables reflecting these factors could be very useful and should be considered in subsequent analyses.

The Effect of Breastfeeding

Our analysis of the relationship between breastfeeding and mortality was hampered by the limited information on breastfeeding in the data. A list of the types of data which should be collected in furture surveys which investigate this relationship, is as follows:

1. Reasons for never breastfeeding and for stopping breastfeeding.
2. Suckling ability at birth and at the time of stopping breastfeeding.
3. The frequency of breastfeeding at a specified age (say, at 1 month).
4. Practices relating to supplemental feedings.
5. The general state of health of each birth.
6. Whether or not sick children are selected for continued breastfeeding at ages when healthy children are weaned.

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Table 1

Infant Mortality Rates by Sex and Birth Cohort

	Jordan	Tunisia		Egypt	Yemen
Both Sexes			**		
1976-	--	68[a]	74[a]	142[b]	156[c]
1971-1975	69	78	77	149	170
1966-1970	72	64	80	150	227
1961-1965	90	88	98	160	257
1956-1960	121	--	--	--	--
% Change	43%	23%	24%	11%	39%
Males					
1976-	--	70	77[a]	142[b]	163[c]
1971-1975	59	79	79	152	185
1966-1970	69	65	80	148	226
1961-1965	90	87	98	160	274
1956-1960	122	--	--	--	--
% Change	52%	20%	21%	11%	41%
Females					
1976-	--	66	70[a]	142[b]	145[c]
1971-1975	80	77	74	146	150
1966-1970	75	63	79	153	209
1961-1965	91	88	98	161	239
1956-1960	119	--	--	--	--
% Change	33%	25%	29%	12%	38%

Notes: 1) Estimates are based on data which are adjusted for age heaping.
2) Excludes births occurring within 12 months of the interview date.

[a]For 1976-1977
[b]For 1976-1979
[c]For 1976-1978

** These estimates for Tunisia are derived from mortality rates from age 0 to 2 and west region of Coale-Demeny model life tables.

Table 2

Child Mortality Rates by Sex and Birth Cohort

	Jordan	Tunisia	Egypt	Yemen
Both Sexes				
1971-1975	--	32.6	65.0	94.6
1966-1970	19.1	55.3	74.8	118.4
1961-1965	30.4	60.6	93.0	155.3
1956-1960	51.0	--	--	--
% Change	63%	46%	30%	39%
Males				
1971-1975	--	30.2	58.0	77.5
1966-1970	20.3	53.4	64.5	112.9
1961-1965	27.1	58.1	85.3	158.8
1956-1960	43.6	--	--	--
% Change	53%	48%	32%	51%
Females				
1971-1975	--	35.2	71.4	112.2
1966-1970	17.9	57.2	86.1	125.3
1961-1965	33.9	63.3	101.1	152.0
1956-1960	59.0	--	--	--
% Change	70%	44%	29%	26%

Notes: 1) Estimates are based on data which are adjusted for age heaping.
2) Excludes births occurring within 5 years of the interview date.

Table 3
Net Effects on Infant Mortality Probabilities
of Demographic and Socio-economic Factors

Variable	Jordan[a] (1976)		Tunisia (1978)		Egypt[a] (1980)		Yemen[b] (1979)	
	Beta Coeff	Std. Error	Beta Coeff	Std. Error	Beta Coeff	Std. Error	Beta Coeff	Std. Error
Intercept	.260	.816	1.210	.953	1.304	.486	-.771	.661
Mother's Age at Birth								
Age	-.125*	.058	-.219**	.065	-.167**	.035	-.027	.046
Age Squared	.022*	.026	.033**	.017	.092**	.016	.054**	.022
Birth Order	.024	.026	.101**	.027	.092**	.016	.054**	.022
Length of Birth Interval	-.052**	.005	-.043**	.005	-.031**	.002	-.035**	.004
Survivorship of Previous Birth								
Survived	-.336**	.063	-.295**	.069	-.289**	.033	-.357**	.051
Died	.336**	.063	.295**	.069	.289**	.033	.357	.051
Mother's Education								
None	.045	.124	.146	.240	.137	.112	.242	.208
1-5 Years	.058	.082	.256+	.146	.084	.058	-.242	.208
6+ Years	-.103	.093	-.401*	.191	-.221*	.096		
Father's Education								
0-5 Years	.081	.143	.193	.268	.066	.130	.002	.049
6-9 Years	.032	.077	.042	.145	.023	.073	-.002	.049
10+ Years	-.113	.200	-.235	.225	-.089	.108		
Mother's Work Status								
Worked	.025	.068	-.027	.060	.023	.035	.031	.048
Never Worked	-.025	.068	.027	.060	-.023	.035	-.031	.048
Father's Occupation								
Agricultural	-.135	.175	.009	.274	-.042	.132	.132	.225
Transitional	.119	.076	.060	.117	-.028	.056	-.034	.091
Blue Collar	.087	.083	.191	.126	-.046	.060	.060	.093
White Collar	-.072	.133	-.260	.213	.116	.103	-.158	.183
Place of Residence								
Urban	-.135*	.051	-.028	.055	-.125*	.055	-.156*	.077
Rural	.135	.051	.028	.055	.125	.055	.156	.077
Number of Observations	8458.		7060.		11961.		3889.	
Model Chi Square	202.06**		223.56**		563.42		221.31	
Degree of Freedom	15.		14.		15.		12.	
D Statistic[c]	0.023		0.234		0.045		0.239	

Notes: [a]The regression models of Jordan and Egypt included a dummy variable representing religion (Muslim/Christian).
[b]For Yemen, mother's and father's educational status was represented by their literacy status (literate/illiterate).
[c]The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, 1980).

Symbols: + Significant at 10% level | * Significant at 5% level | ** Significant at 1% level.

Table 4

Infant Mortality: Relative Risk Ratios for Selected Factors

Variable	Jordan	Tunisia	Egypt	Yemen
Mother's Age at Birth				
From 18 to 20	.92	.86	.90	
25	.81	.65	.73	
30	.78	.58	.65	NS
35	.84	.60	.66	
40	.99	.73	.74	
Birth Order				
From 2 to 3		1.09	1.08	1.05
5	NS	1.29	1.24	1.15
7		1.53	1.42	1.26
Length of Preceding Birth Interval				
From 12 to 24 months	.55	.63	.73	.69
36 months	.30	.39	.53	.47
Survivorship of the Previous Birth				
From Alive to Dead	1.86	1.63	1.54	1.78
Mother's Education				
From 0 to 5 years	NS	NS	.96	NS
6 years+		.61	.74	
Place of Residence				
From Urban to Rural	1.29	NS	1.12	1.30

NS = Not Significant

Table 5
Net Effects on Child Mortality Probabilities
of Demographic and Socio-economic Factors

Variable	Jordan (1976) Beta Coeff	Jordan (1976) Std. Error	Tunisia (1978) Beta Coeff	Tunisia (1978) Std. Error	Egypt[a] (1980) Beta Coeff	Egypt[a] (1980) Std. Error	Yemen[b] (1979) Beta Coeff	Yemen[b] (1979) Std. Error
Intercept	-2.742	2.232	-3.202	1.975	-.251	1.040	-2.243	1.402
Mother's Age at Birth								
Age	-.009	.169	.035	.138	-.148+	.076	.010	.099
Age Squared	-.001	.003	-.001	.002	.003+	.001	.000	.002
Birth Order	-.016	.069	.062	.047	.011	.033	-.035	.046
Length of Birth Interval	-.028*	.012	-.089**	.007	-.028**	.004	-.042**	.008
Survivorship of Previous Birth								
Survived	.079	.217	-.078	.140	-.096	.082	-.049	.113
Died	-.079	.217	.078	.140	.096	.082	.049	.113
Mother's Education								
None	.391	.393	.483	.449	-.034	.224	.364	.523
1-5 Years	-.074	.256	-.561	-.427	.054	.117	-.364	.523
6+ Years	-.317	.298	-.078	.140	-.020	.191		
Father's Education								
0-5 Years	.302	.412	-.242	.173	.428	.288	-.140	.094
6-9 Years	-.119	.227	.242	.173	.073	.159	-.140	.094
10+ Years	-.183	.344			-.501*	.240		
Mother's Work Status								
Worked	.279+	.144	-.079	.099	.024	.069	.018	.091
Never Worked	-.279+	.144	.079	.099	-.024	.069	-.018	.091
Father's Occupation								
Agricultural	.025	.477	-.028	.480	-.166	.256	.154	.494
Transitional	.051	.192	.221	.200	-.026	.112	-.377*	.185
Blue Collar	-.100	.218	.062	.232	-.127	.119	-.130	.205
White Collar	-.157	.379	-.255	.370	.319	.197	-.401	.410
Place of Residence								
Urban	-.154	.130	-.342**	.097	-.167*	.072	-.472**	.176
Rural	.154	.130	.342	.097	.167	.072	.472	.176
Number of Observations	4304.		3672.		5336.		1594.	
Model Chi Square	34.18**		75.61**		80.25**		60.80**	
Degree of Freedom	14.		13.		15.		12.	
D Statistic[c]	0.008		0.192		0.015		0.192	

Notes: [a]The regression model for Egypt contained a dummy variable representing religion (Muslim/Christian).
[b]For Yemen, mother's and father's educational status was represented by their literacy status (literate/illiterate).
[c]The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, 1980).

Symbols: + Significant at 10% level | * Significant at 5% level | ** Significant at 1% level.

Table 6

Child Mortality: Relative Risk Ratio for Selected Factors

Variable	Jordan	Tunisia	Egypt	Yemen
Length of the Preceding Birth Interval				
From 12 to 24 months	0.72	0.63	0.72	0.62
to 36 months	0.51	0.40	0.51	0.38
Place of Residence				
From Urban to Rural	NS	1.33	1.89	2.31

NS = Not Significant

Table 7
Mortality Rates by Age Intervals and by Breastfeeding Status

Age Interval (in months)	Status at the Outset of the Age Interval	Sample Size	Observed Mortality Rate	Life Table Mortality Rate	Adjusted Relative Risk	Sample Size	Observed Mortality Rate	Life Table Mortality Rate	Adjusted Relative Risk
		JORDAN				TUNISIA			
1-5	Breastfeeder	3328	15.1	16.0		3315	12.50	13.0	
	Non-breastfeeder	273	48.7	36.9	3.35	216	32.41	43.1	3.35
6-11	Breastfeeder	2715	8.6	9.3		2969	11.10	12.2	
	Non-breastfeeder	817	10.4	9.2	NS	711	15.47	14.6	NS
1-11	Breastfeeder	3328	23.3	25.3		3515	23.30	25.0	
	Non-breastfeeder	273	64.9	46.0	2.95	216	60.19	57.7	2.95
		EGYPT				YEMEN			
1-5	Breastfeeder	7531	11.6	16.7		1951	60.00	63.7	
	Non-breastfeeder	442	67.9	81.8	8.39	127	157.48	137.4	NS
6-11	Breastfeeder	6948	14.5	8.9		1527	29.50	32.6	
	Non-breastfeeder	442	62.8	40.5	5.78	414	36.23	31.8	NS
1-11	Breastfeeder	7531	28.9	25.6		1951	88.20	94.2	
	Non-breastfeeder	442	129.0	122.3	6.38	127	196.85	169.2	NS

NS = Not Significant

APPENDIX TABLES

Table A1

Net Effects on Age-Specific Mortality Probabilities of Breastfeeding and Demographic and Socioeconomic Factors

(The 1976 Jordan Fertility Survey)

Variable	Regression Results by Age Interval							
	1-11 Months		1-5 Months		6-11 Months		12-59 Months	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	-1.271	1.949	-1.525	2.410	-3.413	3.263	7.242	5.382
Breastfeeding	-.563**	.134	-.620**	.157	-.154	.198	.174	.353
Mother's Age at Birth								
Age	-.023	.137	-.009	.171	-.031	.225	-.698+	.375
Age Squared	-.000	.002	-.001	.003	.001	.004	.010+	.006
Birth Order	.013	.055	.055	.069	-.057	.092	.069	.158
Length of Preceding Birth Interval	-.046**	.011	-.060**	.015	-.026+	.015	-.000	.017
Survivorship of Previous Birth	.185	.157	.276	.174	-.115	.369	.593	.423
Mother's Education[a]								
None	.128	.282	.201	.349	-.038	.472	.595	.494
1-5 Years	.122	.185	.169	.226	.039	.317	-.595	.494
6+ Years	-.249	.212	-.370	.266	.001	.350		
Father's Education								
0-5 Years	.393	.319	.264	.389	.713	.569	-.511	.819
6-9 Years	-.131	.183	.012	.216	-.511	.359	-.690	.560
10+ Years	-.263	.261	-.276	.323		.442	1.201*	.598
Mother's Work Status								
Worked	.060	.151	.084	.186	-.007	.250	.485	.330
Never Worked	-.060	.151	-.084	.186	.007	.250	-.485	.330
Father's Occupation								
Agriculture	-.300	.403	-.376	.508	-.153	.653	-.449	1.200
Transitional	-.116	.191	-.140	.242	-.068	.308	.268	.521
Blue Collar	-.040	.174	.118	.213	-.354	.305	.387	.467
White Collar	.456	.309	.399	.393	.576	.489	-.207	.894
Residence	.123	.117	.111	.142	.143	.201	1.233**	.385
Number of Observations	3601		3601		3532		951	
Model Chi-Square	58.80**		57.41**		14.02		27.25*	
Degrees of Freedom	15		15		15		14	
D Statistic[b]	.016		.016		.004		.029	

Notes: a) Due to lack of sufficient cases, mother's education categories "1-5 years" and "6+" years were combined in the child mortality model.

b) The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, 1980).

Symbols: + Significant at the 10% level.
* Significant at the 5% level.
** Significant at the 1% level.

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Table A2

Net Effects on Age-Specific Mortality Probabilities of Breastfeeding and Demographic and Socioeconomic Factors

(The 1978 Tunisia Fertility Survey)

Variable	Regression Results by Age Interval							
	1-11 Months		1-5 Months		6-11 Months		12-59 Months	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	-.355	2.368	-1.614	3.361	.826	3.308	1.159	5.312
Breastfeeding	-.494**	.185	-.515*	.242	-.203	.205	-.014	.297
Mother's Age at Birth								
Age	-.212	.155	-.152	.217	-.246	.217	-.309	.346
Age Squared	.003	.002	.003	.003	.004	.003	.007	.005
Birth Order	.128*	.059	.168*	.077	.073	.089	-.146	.124
Length of Preceeding Birth Interval	-.023**	.008	-.064**	.016	-.002	.008	-.039*	.018
Survivorship of Previous Birth	.253	.177	.095	.250	.358	.245	.419	.346
Mother's Education								
None	.563	.605	.466	.351	.352	.305	-.834	1.018
1-5 Years	.062	.397	-.466	.351	-.352	.305	-.075	.746
6+ Years	-.625	.457	-	-	-	-	.909	.692
Father's Education								
0-5 Years	-.078	.483	.196	.693	-.189	.709	1.016+	.607
6-9 Years	-.237	.287	-.629	.453	.035	.390	-1.016	.607
10+ Years	.315	.389	.433	.525	.154	.592	-	-
Mother's Work Status								
Worked	-.162	.154	-.253	.216	-.083	.215	-.501	.321
Never Worked	.162	.154	.253	.216	.083	.215	.501	.321
Father's Occupation								
Agriculture	.002	.585	-.201	.785	-	-	-.242	.632
Transitonal	-.142	.270	-.520	.404	.287	.379	.045	.418
Blue Collar	.059	.282	.355	.351	-.313	.493	.197	.474
White Collar	.081	.435	.366	.574	-.271	.669	-	-
Residence	-.147	.127	-.104	.176	-.186	.184	.653*	.275
Number of Observations	3230		3230		3186		913	
Model Chi-Square	42.05**		51.99**		9.59		26.92*	
Degrees of Freedom	15		14		14		13	
D Statistic	.124		.227		.000		.066	

Notes: a) The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, 1980).

Symbols: + Significant at the 10% level.
* Significant at the 5% level.
** Significant at the 1% level.

Table A3

Net Effects on Age-Specific Mortality Probabilities of Breastfeeding and Demographic and Socioeconomic Factors

(The 1980 Egypt Fertility Survey)

Variable	Regression Results by Age Interval							
	1-11 Months		1-5 Months		6-11 Months		12-59 Months	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	1.405	1.255	3.001	1.736	-1.665	1.781	-.139	2.476
Breastfeeding	-.953**	.004	-1.069**	.131	-.890**	.101	-.350*	.164
Mother's Age at Birth								
Age	-.289**	.087	-.482**	.120	-.129	.123	-.250	.171
Age Squared	.005**	.001	.008**	.002	.002	.002	.005+	.003
Birth Order	.164**	.036	.143**	.054	.182**	.047	-.026	.064
Length of Preceeding Birth Interval	-.013**	.004	-.006	.006	-.174**	.006	-.019*	.007
Survivorship of Previous Birth	.169	.092	.422	.123	-.078	.138	-.334	.239
Mother's Education								
None	.140	.255	.362	.444	.057	.304	.397	.565
1-5 Years	.290*	.132	.293	.227	.323**	.160	.091	.287
6+ Years	-.430	.218	-.655+	.382	-.380	.259	-.488	.487
Father's Education								
0-5 Years	-.068	.266	.223	.472	-.132	.322	.012	.548
6-9 Years	-.043	.162	-.462	.311	.206	.189	-.154	.339
10+ Years	.111	.211	.239	.355	-.071	.261	.142	.431
Mother's Work Status								
Worked	-.025	.095	.083	.139	-.189	.129	-.080	.159
Never Worked	.025	.095	-.083	.139	.089	.129	.080	.159
Father's Occupation								
Agriculture	-.312	.303	-.382	.478	-.243	.387	-.285	.628
Transitional	-.119	.137	-.246	.217	-.045	.175	.345	.256
Blue Collar	.052	.139	.050	.213	.001	.180	-.090	.280
White Collar	.379	.232	.578	.369	.287	.295	.030	.500
Residence	.023	.083	-.001	.128	.073	.107	.703**	.167
Number of Observations	6745		6745		6649		2274	
Model Chi-Square	140.08**		100.33**		106.77**		43.48**	
Degrees of Freedom	15		15		15		15	
D Statistic[a]	.022		.015		.016		.019	

Notes: a) The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, (1980).

Symbols
+ Significant at the 10% level.
* Significant at the 5% level.
** Significant at the 1% level.

Table A4

Net Effects on Age-Specific Mortality Probabilities of Breastfeeding and Demographic and Socioeconomic Factors

(The 1979 Yemen Fertility Survey)

Variable	Regression Results by Age Interval							
	1-11 Months		1-5 Months		6-11 Months		12-59 Months	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	-2.863*	1.410	-3.403*	1.665	-6.593	10.339	-11.277	5.644
Breastfeeding	-.270	.167	-.239	.199	-.111	.193	.204	.359
Mother's Age at Birth								
Age	.075	.095	.100	.112	.038	.165	.632	.388
Age Squared	-.001	.001	-.001	.002	-.001	.003	-.011+	.006
Birth Order	.058	.042	.041	.049	.087	.076	.034	.131
Length of Preceeding Birth Interval	-.030**	.007	-.040**	.009	-.015	.010	-.054+	.024
Survivorship of Previous Birth	.296**	.109	.171	.135	.488**	.169	.163	.354
Mother's Literacy								
Illiterate	-.031	.392	-.263	.400	2.772	10.071	-	-
Literate	.031	.392	.263	.400	-2.772	10.071	-	-
Father's Literacy								
Illiterate	.112	.100	.144	.119	.038	.168	-.274	.270
Literate	-.112	.100	-.144	.119	-.038	.168	.274	.270
Mother's Work Status								
Worked	.008	.094	-.088	.112	.217	.165	-.316	.264
Never Worked	-.008	.094	.088	.112	-.217	.165	.316	.264
Father's Occupation								
Agriculture	.021	.418	.097	.526	-.202	.657	.219	1.212
Transitional	-.098	.176	-.040	.215	-.189	.292	.353	.482
Blue Collar	-.030	.184	.006	.224	-.081	.303	-.784	.645
White Collar	.149	.332	-.063	.424	.472	.505	.212	.906
Residence	.473*	.195	.414*	.222	.600	.391	.784	.906
Number of Observations	1598		1598		1499		326	
Model Chil-Square	51.12*		40.00**		21.15+		18.37	
Degrees of Freedom	13		13		13		12	
D Statistic[a]	.161		.137		.000		.000	

Notes: a) The regression models were fit with the maximum likelihood procedure so the standard R-square statistic could not be computed. However, the quantity "D" which has an interpretation similar to R-square was computed (Harrell, 1980).

Symbols
+ Significant at the 10% level.
* Significant at the 5% level.
** Significant at the 1% level.