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Levels, Trends and Differentials of Infant and Child Mortality in Egypt

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BREAST-FEEDING AND INFANT MORTALITY FACT SHEET: EGYPT
(WORLD FERTILITY SURVEY, 1980)

	BREAST-FEEDING						MORTALITY RATE/1000[3]		
	Percent of Sample[1]		Percent ever Breast-Fed (Urban & Rural)	Mean Duration (in months)[2]					
	Urban	Rural		Urban	Rural	Total Sample	Neonatal	Post-neonatal	Infant
TOTAL SAMPLE	100.0	100.0	89.2				63.3	84.2	147.5
1. AREA OF RESIDENCE									
Urban	39.5		87.2	13.9		13.9	44.3	79.5	123.8
Urban Migrant	9.5		87.7	16.8					
Always Urban	30.0		87.0	13.2					
Rural		60.5	90.5		19.0	19.0	74.5	86.9	161.4
2. REGION OF RESIDENCE									
Cairo	16.6		88.5	13.3					117.6
Alexandria	4.4		84.4	10.5					
Cities									
Lower Nile	5.3		83.5	13.9					118.0
Upper Nile	2.9		87.5	14.4					157.7
Towns									
Lower Nile		5.4	90.5	15.6					118.0
Upper Nile		5.0	85.6	17.2					157.7
Villages									
Lower Nile		35.1	91.3		17.6				123.4
Upper Nile		25.4	89.3		21.0				209.8
3. SEX OF CHILD									
Male	54	51	89.2			17.5	69.1	78.7	147.9
Female	46	49	89.1			16.2	55.1	92.0	144.2
4. WORK STATUS OF MOTHER[4]									
Does not work/ never worked	7.2	76	89.2	14.3	19.2		63.2	85.4	148.6
Works at home/worked	14	18	91.8	10.6	18.7		63.9	79.2	143.1
Works away/worked	74	6	86.0	9.8	15.7				
5. EDUCATION OF MOTHER									
Zero			90.2	16.4	19.9		68.5	89.1	157.6
1 to 3/1 to 5[5]			90.6	14.4	19.7		60.3	84.9	145.7
4 to 6/6 and over			88.9	12.8	16.6		35.8	47.8	83.6
7 to 9			84.1	10.5	7.0				
10 and over			80.3	8.5	10.3				
6. FATHER'S OCCUPATION									
Modern	23	8	83.3	10.1	16.1		45.1	69.8	114.9
Transitional	22	15	91.2	15.4	18.5		59.0	91.1	150.1
Mixed blue collar	48	17	88.4	14.2	17.9		56.4	81.8	138.2
Agricultural	7	60	90.9	17.2	20.0		75.1	86.9	162.0

[1]Based on sample of last 2 live births in 4 years preceding the interview.
[2]Based on current status technique.
[3]Based on births between 1970-1979.
[4]For mortality rate, work status is either never worked or worked
[5]For mortality rate, education is either zero, 1-5 or 6 years and over.

SOURCES: Akin, J.S., Bilsborrow, R., Guilkey, D. and Popkin, B.M. (1983). "Breast-feeding Patterns and Determinants in Egypt."

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I. Introduction

According to census counts Egyptian population nearly doubled from 19 million in 1947, to slightly over 38 million in 1976 (Nour, 1979). Rapid population growth during this period is attributed to decline in infant mortality and in the crude death rate rather than to changes in the fertility rate (NAS, 1982). Although in recent decades declines in infant and child mortality have occurred, a large variation still exists among different population subgroups (Nour, 1979 and NAS, 1982). Because of lack of reliable data a study of differentials of infant and child mortality by various socioeconomic factors until now, was not possible. Knowledge of their differentials is an important step in the formulation of programs and policies to improve the survival and health of the population. Because infant mortality is influenced by the reproductive behavior of couples a study of infant mortality may have implications for population policy programs.

In this paper we study the levels, trends, and differentials of infant and child mortality in Egypt. The data used in this study are from the 1980 Egypt Fertility Survey conducted as a part of the World Fertility Survey. A brief description of the data and its quality is given in Section II. Section III presents information on time trends in infant and child mortality for Egypt and for the major regions of Egpyt. Infant and child mortality differentials by selected demographic and socioeconomic variables are given in Section IV. Section V presents the results from multivariate regression analysis performed to study the net effects of selected demographic and socioeconomic factors.

Mortality rates for four age intervals of life are presented in the paper. The definitions of these rates are consistent with conventional demographic usage. Infant mortality rates (${}_1q_0$) represent the probability of

dying between birth and one year of age. Neonatal rates represent the probability of dying between birth and one month of age, while post-neonatal rates represent the probability of a birth dying in the last 11 months of infancy (i.e., neonatal and post-neonatal rates sum to the infant mortality rate). Child mortality rates ($_4q_1$) represent the probability of a child, who survives to age one, dying between age one and age five.

A few points about the EFS data which affect our analysis should be clarified.

First, the data evaluation in Section II finds that the data on age at death suffers from two problems: 1) there is evidence of age misreporting (heaping at 12 completed months of age) and 2) for a significant number of deaths age at death was not known. Approximate adjustment was made to correct the former defect. No adjustment was made for those deaths for which no information on age at death was available. They were excluded from the estimates presented in the text and they are, therefore, understated to some extent. However, some estimates on trends and regional differences were made by making some allowance for this defect. These adjusted estimates are given in the Appendix.

The second point concerns the types of data available for the study of the determinants of mortality. A wide variety of factors are related to infant and child mortality levels. These can be grouped under the headings of genetic, demographic and socioeconomic factors. Genetic factors, which include such things as birth defects and birth weight, are particularly important in determining mortality rates within a few days of birth. Demographic factors refer to the attributes of a birth which are biologically determined (e.g., mother's age at birth and birth order). In general, these factors influence the state of health of a newborn and are particularly influential in determining neonatal mortality rates. Socioeconomic factors

are those characteristics of the parents or household which determine the quality of the environment to which an infant or child is exposed. A great many variables representing socioeconomic characteristics have been shown to be associated with infant and child mortality. Some of the variables found to be strongly related to mortality are the following: social class, parental education, household income, mother's work status, housing conditions, availability of piped water, breastfeeding and supplemental feeding practices, prenatal maternity care and access to preventive and curative health services. These factors usually impact more strongly on late infant and early child mortality than on neonatal mortality.

In the individual woman's survey there is no information about genetic influences on mortality but there is a rather complete set of variables on demographic factors and a fair number of variables representing socioeconomic variables. The socioeconomic factors on which we have no information are: household income, housing conditions, availability of piped water, supplemental feeding practices, prenatal care and access to health services. Thus, variables which specifically represent these factors are not included in our analysis.

The third point concerns the type of information available for studying the relationship between breastfeeding and mortality. The information on breastfeeding is extremely limited and the sample is very selective. As a result analysis of the effects of breastfeeding on mortality was carried out separately from the main analysis pertaining to differentials.

II. Evaluation of the Mortality Data

The individual woman's questionnaire obtained pregnancy history data from ever married women 15-49 years of age. For each reported birth, data were collected on the date of birth, sex, survival status and, if appropriate, age at death. The coding of age at death is in terms of completed months of age. We evaluate the quality of these data by the analysis of 1) sex ratios at birth, 2) age distributions of deaths and proportion of unknown deaths, 3) truncation bias, and 4) ratio of deaths in the neonatal and post-neonatal periods. For the purpose of data evaluation, the data are grouped into one decennial birth cohort (1946-55), four quinquennial birth cohorts (1956-65, 1961-65, 1966-70 and 1971-75) and one three year birth cohort (1976-1979).

Sex Ratio at Birth

The retrospective information on vital events could suffer from sex-selective recall of births because the attitude favoring male children prevails in many societies. Sex ratio at birth, which varies between a relatively narrow band of 100 to 107, is commonly used to detect this problem. Sex ratios by period of birth from the EFS data are shown in Table 1. For all births the sex ratio is 107. This figure is reasonable, judging from information on sex ratio at birth for other countries. Furthermore, the sex ratio of reported births for different periods in Table 1 vary between 106 and 109 and do not show any monotonic increasing or decreasing patterns. This analysis, therefore, does not show any obvious sex-selective recall of births in this data set.

Age Reporting of Deaths

An investigation of the data on age death finds two kinds of problems: 1) there is evidence that information suffers from age misreporting and 2) for significant proportion of the total deaths reported in the survey, information on age at death is missing.

With respect to the age misreporting problem, in the EFS responses on age at death were coded in completed months of life. Figure 1 presents a graph for each birth cohort of the percentage of deaths in each month during the first 24 months of life. The important point is to note the heaping at 6, 12, 18 and 24 months of age. The degree of heaping is most pronounced at 12 months, indicating a net transfer of deaths out of infancy which would tend to negatively bias infant mortality rates. Moreover, heaping at 12 months is more pronounced in the earlier birth cohorts than the recent birth cohorts, a situation which would result in an understatement of the magnitude of infant mortality declines.

We experimented with three alternative procedures to correct for age heaping at 12 months. The first procedure involved an arbitrary redistribution of half of the deaths at 12 months back into infancy (Goldman, et al., 1980). The second procedure involved calculating the probabilities of dying between birth and exact age two [q(2)] from the reported number of deaths from 0 to 23 months of age and estimating IMRs with the aid of the West model life table systems of Coale and Demeny (1967). The third procedure was identical to the second, except that q(2) values were calculated after adjusting for age heaping at 24 months (by redistributing half of the deaths at 24 months to under age two).[1]

IMRs estimated from these three procedures, along with unadjusted IMRs are reported in Table 2. In almost all cases, the adjusted rates exceed the unadjusted rates. The only exception is the 1976-79 birth cohort where adjusted rates by procedures II and III are lower than the unadjusted rate by 1 to 3 percent. For the cohorts of 1961-65, 1966-70 and 1971-75, all three adjustment procedures yield adjusted rates which differ by only a few

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[1] The q(2) values on which the IMRs of the second and third adjustment procedures were based are presented in Table 3.

points from each other (4 points in 1971-75, 3 points in 1966-70 and 8 points in 1961-65). However, for the cohorts of 1946-55 and 1956-60, the alternative procedures yield adjusted rates which differ by more than a few points. For example, for the 1946-55 birth cohort, the adjusted rates by the alternative procedures differ by 15 points. Thus, it seems that we can have greater confidence in results of the adjustments for the four most recent birth cohorts and that the simple procedure of redistributing half the deaths at 12 months back into infancy is reasonable. Accordingly, throughout the remainder of this report, all analyses and all reported rates are based on data which have been adjusted by this procedure.

Note, however, that the estimates in Table 2 exclude from the analysis those deceased children for which information on age at death was missing. Over all for about 10 percent of the total deaths reported in the survey information on age at death was not available. This percent figure, however, slightly varied by birth cohorts. For the two most recent birth cohorts, of 1976-79 and 1971-75, information on age at death was missing respectively for 5% and 8% of the total deaths. For the earlier birth cohorts percent of the total deaths with missing age was relatively higher and varied between 10 and 12 percent. Since various rates presented in this paper are not corrected for this deficiency, the net effect is that they are understated to a certain extent.

However, estimates of the infant mortality rates for the whole country and the three major regions (Cairo and Alexandria, Lower Egypt, and Upper Egypt) were made with additional adjustments for the deaths with unknown ages. Thus, adjustments are made by making an assumption that the deaths of unknown ages have an age distribution identical to the age distribution of deaths with known ages. The deaths with the known ages were classified by sex, region, and birth cohort and within each category unknown ages

were distributed according to the distribution of deaths with known ages in that category. The rates for the country and the regions were arrived at by pooling the data.

Estimates of the IMR for four birth cohorts from 1961 to 1979 with the additional adjustment for the deaths with unknown ages are shown in Table 4. (The estimates for the cohorts prior to 1961 are not shown because as described later they suffer from the truncation bias.) This adjustment increases the IMR of 1976-79 by about 4%, of 1971-75 by 7%, of 1966-70 by 11%, and 1961-65 by 10%. These adjusted rates show a more regular decline in the IMR than unadjusted rates and rates adjusted only for the age heaping. Table 4 also compares the estimates of IMR from the survey with those made by the NAS panel.* For the birth cohorts of 1966-70, and 1961-65 adjusted estimates from the survey are quite close to the NAS estimates. However, for the two most recent birth cohorts, 1971-75 and 1976-79, all estimates whether adjusted or unadjusted are higher than the NAS estimates. This discrepancy between the two sets of rates is a cause of concern. We, however, find no obvious evidence to support that deaths of infants in the survey for the recent cohorts were overreported.

Truncation Bias

The pregnancy history data of the EFS, as is the case with all pregnancy history data, are susceptible to truncation effects. The EFS collected retrospective data from women who, at the time of the survey, were between the ages of 15 and 49. Thus, for the time period 0 to 5 years preceding the survey, the collected data are representative of births to women of all reproductive ages. However, for the time period 20 to 25 years preceding the survey, the collected data are representative of births only to women

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*The NAS report estimated infant mortality rate on the basis of reported vital events. The estimates for the most recent years are constructed by applying estimates of underregistration to the numbers of reported events.

up to age 30 (i.e., the birth data for earlier time periods are truncated). If the risk of infant mortality is correlated with mother's age at birth, the truncated data may yield biased estimates of infant mortality.

Truncation bias has the potential of being serious for time periods in which the observed distribution of births (by age of mother) differs substantially from the true distribution. The birth distributions observed in the EFS by age of mother and by time period are presented in Table 5 (Panel A). The potential for truncation bias occurs in the 1946-55, 1956-60 and 1961-65 birth cohorts. In those cohorts, births under age 20 constitute 64 (1599/2481), 35 (1316/3750) and 26 (1578/6060) percent, respectively, of all observed births. This contrasts sharply with the 1976-79 birth cohort where births under age 20 constitute only 16 (934/5884) percent of observed births. Since infant mortality rates are relatively high for women under age 20, the observed data may yield infant mortality estimates for the 1946-55, 1956-60 and 1961-65 which are positively biased.

We tested for bias in the mortality estimates for 1946-55, 1956-60 and 1961-65 by a standardization procedure. IMRs were computed for the 1966-70, 1971-75 and 1976-79 birth cohorts which were standardized on the observed (i.e., truncated) birth distributions of the 1946-55, 1956-60 and 1961-65 birth cohorts. The differences between the standardized and observed IMRs for the three recent birth cohorts are an index of the degree of bias in the observed IMRs for the 1946-55, 1956-60 and 1961-65 cohorts. When standardized on the 1946-55 observed birth distribution, the standardized rates exceed the observed rates by between +14% and +22%, suggesting a positive bias in the observed rates for the 1946-55 birth cohorts by approximately that amount (Table 5, Panel C). Similarly when standardized on the 1956-60 birth distribution, the standardized rates differ from the observed rate by between +7% and +9%, suggesting that the 1956-60 observed rates also

suffer significantly from truncation bias. However, when standardized on the 1961-65 birth distributions, the standardized rates differ from the rate by between +2% and 5%, suggesting that for this birth cohort truncation is not serious.

The Proportion of Infant Deaths in the Neonatal Period

The proportion of infant deaths that occur in the neonatal period (0 completed month of age) is sometimes used to asses the completeness of reporting of the neonatal deaths. The proportion of the neonatal death is known to vary inversely with the level of infant mortality. At levels of infant mortality in excess of 100 per 1000, it has been widely accepted that about one third of infant deaths occur in the neonatal period. This view is based on historical data from western publications (U.N. 1954) and on the rationale that infectious diseases, which cause infant deaths primarily in the post-neonatal period, are primarily responsible for high infant mortality rates. The applicability of such an age pattern of mortality within infancy among the developing populations is, however, questioned. Two recent studies that have analyzed Bangladesh data found that at levels of infant mortality of 128 and 150, 60 percent of infant deaths occurred in the neonatal period. At levels of infant mortality of 150 or more, such as reported in Table 6, data on the proportion of infant deaths in the neonatal period for developing populations are generally lacking.

Table 6 presents IMRs and the proportion of infant deaths which occur in the NN period as reported in the EFS. The proportion shows a systematic rise from .30 in 1946-55 to .42 in 1976-79. This rise is consistent with the finding that when infant mortality declines the proportion of the infant deaths in the neonatal period increases. Further, proportions are also reasonable when judging from the experience of western populations. On the basis of this analysis, all that can be said is that there is no apparent gross underreporting of neonatal deaths in the EFS.

III. Time Trend in Mortality Rates and Regional Differences

Levels and Trends

Table 7 presents neonatal, post-neonatal, infant and child mortality rates by sex for four birth cohorts from 1961 to 1979. With the exception of the neonatal mortality rate, which changed very little during this period, all rates display a trend of declining mortality.

Between 1961-65 and 1976-79, the infant mortality rate of both sexes combined declined by 11 percent (from 160 to 142), and the post-neonatal mortality rate declined by 20 percent (from 112 to 84). With respect to child mortality Table 6 presents rates for three quinquennial cohorts from 1961 and 1975. Between 1961-65 and 1971-75, the child mortality rate of both sexes combined declined by 30 percent (from 93 to 65). Thus over the period from 1961 to 1975, the percent decline in child mortality exceeds the percent decline in the PNN and NN mortality over the longer time period from 1961-65 to 1971-79. The pattern of successively large declines in mortality at ages further removed from the time of birth is consistent with the general view that improvements in socioeconomic conditions, which have occurred in Egypt, have had little impact on reducing NN mortality which is greatly associated with physical and biological factors.

The separate rates for males and females show time trend pattern which is similar to the pattern of both sexes combined. However, when rates by sex are compared an important difference is observed. With respect to infant mortality, the sex differential in the IMR is small and there is no consistent pattern. However, within infancy, the NN rate is consistently higher for males and the PNN rate is consistently higher for females. The finding of higher NN mortality for males than females is common to most populations and reflects greater susceptibility of male births than female births to mortality from genetic causes. Also, in most populations, mortality of males is

generally found to exceed that of females in the PNN interval. In the case of Egpyt estimates apparently indicate a reverse pattern. This reverse pattern of sex differences in mortality is generally observed in populations in which preference for male children exists and is considered to suggest the possibility of preferential care and attention to male offspring.

It should be remembered that the mortality rates in Table 7 exclude deaths with unknown ages. However, when an approximate allowance is made then the level of the rates changes, but time trend and sex differential patterns remain essentially the same.

Regional Estimates

Table 8 shows infant and child mortality rates for three major regions of Egypt. The three regions are combined governorates of Cairo and Alexandria; Upper Egypt (the Nile valley which is south of Cairo) and lower Egypt (the Nile Delta which is north of Cairo). In interpreting these rates it must be remembered that regional location was determined by place of residence at the time of the survey, but that the mortality rates pertain to time periods in the past when the respondents may have lived somewhere else. Also many of these rates are based on a small number of cases and, thus, would have large sampling errors. Hence, these rates should be considered only for discerning broad patterns.

With respect to the most recent cohort of 1976-79, the IMR was 117 for the region of Cairo and Alexandria, 122 for the region of Lower Egypt, and 184 for Upper Egypt. Thus, the IMR was substantially higher in Upper Egypt than in the other two regions. The Lower Egypt IMR slightly exceeds the IMR for Cairo and Alexandria which has the lowest IMR. This pattern of differences in the regional IMRs exists throughout the period of 1961-65 and 1971-79. All regions experienced declines in the IMR during these periods, but the proportionate decline was slight in the IMR of Cairo and Alexandria (3%) and Lower Egypt (2%) and was substantially greater in Upper Egpyt (22%). With

respect to rural-urban differences, a higher infant mortality in villages than in towns and cities is observed from these data. With one exception, the IMR in villages was always higher than the rate in towns and cities. These observations on time differentials in the regional infant mortality are broadly consistent with the observations from the estimates prepared by the National Academy of Sciences (1982), although the estimated IMRs in this paper differ from those prepared by the NAS panel.

With respect to child mortality (Table 9), the rate for the 1966-70 birth cohort was 49 for Cairo and Alexandria, 67 for Lower Egypt and 72 for Upper Egypt. Thus, as was the case with the IMR, the CMR was highest in Upper Egypt and lowest in Cairo and Alexandria. During this period child mortality declined in all three regions (and throughout this period the urban child mortality rate was lower than the rural rate).

IV. Bivariate Analysis: Mortality Differentials

The analysis of differentials is restricted to births which occurred in the ten year period preceding the survey, i.e., from 1970 through 1979. This restriction was applied to minimize the bias that arises from the truncation effect. Also the use of the most recent data minimizes the problem of memory and recall lapse that may be existing in the data.

Mortality rates for the neonatal, post-neonatal, infant, and childhood ages are presented for selected demographic and socioeconomic characteristics and are discussed below.

Demographic Factors

Demographic factors which are biological attributes at birth are considered most proximate correlates of mortality. Age of mother at time of birth, birth order, and birth interval are the demographic factors most commonly analyzed. The earlier studies seem to show that there is apparently a range for each of these factors in which risk of infant death is minimal (U.N., 1954; Suchindran and Adlakha, 1981; Sullivan, et al, 1983). With respect to age, infant mortality is higher when the mother is very young, and decreases to a minimum around age 25-30, then rises again first slowly and then more rapidly as the mother approaches menopause. For birth order, the lowest mortality rate usually occurs among second births, while the first order births and births order 6 and higher have higher mortality. In the case of interval preceding successive births, various studies indicate that a short birth interval preceding a birth is associated with higher mortality. Some studies also indicate that infants born after too long an interval suffer from higher infant mortality.

The relationship between demographic characteristics and mortality of infants is partly considered as a result of certain biological factors, e.g., varying frequencies of premature or low weight births, complications associated with pregnancies at different ages and birth orders (Shapiro, et al,

1969). However, other factors could also be partly responsible for these associations. For example, young mothers, having relatively little experience in childbearing, may be less capable of providing necessary care for their infants, which may result in a higher mortality of their infants. Similarly, birth interval may be viewed as a measure of the amount of pressure on the mother for the care of children. When the birth interval is short, there will be at least two children in a family with similar demands which may cause severe pressure on the mother responsible for the care, and, thus, result in a higher mortality of children.

The infant and childhood mortality rates by demographic characteristics are given in Table 10. With respect to the neonatal mortality rate, the mother's age at birth displays an expected U-shaped pattern. The neonatal mortality rate for births to women under 20 is 75. The rate decreases to 62 at ages 20-24, 61 at ages 25-29, and to 52, the lowest rate, at ages 30-34. Thereafter, a rise in the neonatal mortality rate is observed for mothers of ages 35-39 and 40-44 years old, the rates being 67 and 78, respectively. Birth order also displays a 'U' shaped pattern. The rate for first order births (66) and births for order 5-6 (71) and 7+ (79) are relatively high and relatively lower for intermediate birth orders (51 and 53 respectively for birth order 2 and 3-4). Length of the preceding birth interval shows a strong inverse relation with the neonatal mortality rate. The neonatal mortality rates decline rapidly with the increase in the length of interval. The rate for births with a birth interval of less than 2 years is 95 and decreases rapidly to 42 for births with 2-3 year birth intervals, to 32 for 3 to 5 year intervals and 24 for 4-5 year intervals. Large differences are also observed with regard to the survivorship of the previous birth. The NN rate for births when the previous birth had died (119) is about two and one half times the rate when the previous birth had survived (47).

In the case of PNN, mother's age shows a 'U' type pattern, though a minimum in this case is found for women 35-39. Birth interval and survivorship status of the previous birth show strong associations with the PNN rate. For example, the PNN rate for births with the interval less than 24 months (124) is about twice as high for other births (56). Similarly, the PNN rate for births when previous birth had died (247) was about twice the rate for births when the previous birth had survived.

Infant mortality differentials reflect the joint finding of the NN periods. All four demographic variables are found to be associated with infant mortality. Both mother's age and birth order show 'U' type association with the infant mortality rate. As in the case of NN and PNN mortality the infant mortality rate decreased when the length of the preceding birth interval increased or when the previous birth had survived.

Child mortality rates do not show any clear trend with age of mother, birth order or the survivorship of the previous birth. However, it is strongly associated with the length of the preceding interval. The childhood mortality rate decreased from 97.9 when the length of the preceding interval was <24 months to 30.4 when the length was over 60 months.

Socioeconomic Factors

In any society the incidence of infant and child mortality, under existing levels of social and economic development, including public health and medical facilities, may vary between different social and economic strata. These variations may be reflections of differentials in the sophistication of parents with relation to understanding and practicing modern methods of childcare and differentials in their access to modern health care facilities. In this section we present results on infant and child mortality by certain selected parental characteristics.

Mortality rates were computed for five socioeconomic characteristics:

mother's education; father's education; father's occupation; work status of mother since marriage; and place of residence (Table 11). Two types of biases relevant to this analysis should be noted. First, the characteristics data generally apply to the survey date while mortality rates are for the longer period from 1970 to 1979. It is possible that socioeconomic conditions have changed over time. Thus, observed relationships of these variables to mortality rates are subject to this time discrepency. Second, as reported earlier, for a significant number of deceased children information on age at death was not available. While estimates show lower mortality for those who are better educated, or are in higher status occupations, or live in urban areas, for those who are less educated, work in agriculture related occupations or live in rural areas, the observed differentials are perhaps conservative. This is because our analysis indicates that proportion of the unknown deaths was generally lower for the former categories than the latter categories (see Appendix).

For the purposes of discussion, the selected variables can broadly be divided into three categories:

1) Social class status (mother's education, father's education, father's occupation);
2) Work status (whether mother worked since marriage); and
3) Residence (rural or urban residence).

Many studies have shown that the social status is associated with mortality of children and thus may be an important factor in determining their level of mortality. For example, infant and child mortality differentials, based on individual data by social class, measured in terms of income, education or occupation, find that mortality decreases with an increase in social class (Sullivan, et al, 1983; Suchindran and Adlakha, 1981; Arriaga and Hobbs, 1980; Adlakha, 1970; Chase, 1964). Overall differentials in mortality rates by social class variables in Egypt are similar to

those found in other populations (Table 11). When mother's or father's education is used as a measure of status a pronounced inverse relationship is observed with each age interval mortality rate. For example, the IMR for mothers with no schooling is 158 and is about 89% greater than the IMR of 84 for mothers with 6 or more years of schooling. Similarly the NNR of mothers with no schooling is greater by 91%, the PNN is greater by 86% and CMR is greater by 108% than the corresponding rates for mothers with 6 or more years of schooling. Similar differentials in mortality rates are observed with respect to father's education.

With regard to father's occupation pronounced differentials in mortality rates are also observed. Overall rates are highest for the agriculture category, lowest for the white collar category, and the intermediate status categories of transitional and blue collar have rates in between the rates for the agriculture and white collar categories. The only exception to this pattern is the PNN interval in which the rate for the agriculture workers is slightly lower than the rate for the transitional workers.

With respect to mother's working status, women were classified into two categories, whether she ever worked after marriage or not. When births are classified into these two categories, the results show no differences in mortality rates.

With respect to rural-urban residence, the mortality rates show an expected pattern of higher mortality of infants and children in rural areas than urban areas. In each age interval the rural mortality rate is higher than the urban mortality rate. With the exception of the PNN interval, differences between the rural-urban rates are substantial. The rural neonatal mortality rate of 74 is 68 percent higher than the urban rate of 44. Similarly the rural infant mortality rate is 30% greater and child mortality rate is 52% greater than the corresponding urban rates. However, in the PNN interval, the difference in the mortality rate between rural and urban areas

is relatively small, the rural rate is only 9% greater. This is somewhat surprising since one would expect that the advantage of the urban residence as observed in the NN interval would also extend to this interval.

V. Multivariate Analysis: Net Effects

In this section we discuss the net effects of various demographic and socioeconomic factors on infant and childhood mortality. The approach followed here is that of Sullivan et al (1983). Results are presented separately for the neonatal, post-neonatal, infant and childhood age intervals. For each age interval, logistic regression model was used to investigate the effect of the selected factors on mortality.

The logistic model is specified as follows:

$$\ell n\left(\frac{q}{1-q}\right) = \beta_0+\beta_1 x_1+ \ . \ . \ . \ +\beta_r x_r+E$$

Where q is an age-specific mortality rate (neonatal, post neonatal, infant or childhood),

x_i denotes an independent variable,

β_i denotes a regression coefficient, and

E is the error term.

The independent variables in the model are those previously considered, namely, demographic factors: mother's age at birth, length of the preceding birth interval, survivorship of the previous birth and birth order, and socio-economic factors: mother's education, father's education, mother's work status, father's occupation, place of residence and religion.

The data for the main regression model is restricted to births in 10 years preceding the survey (January 1970 to February 1979). Since earlier analysis showed that the length of the preceding birth interval and survivorship of the previous birth are strongly associated with mortality rates, these variables are included in the analysis which requires restricting the data set to births of order two or higher.[2]

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[2] To determine if our findings concerning the net effects of particular factors on mortality are valid when first births are added to the universe

For each age interval considered, three logistic regression models were run. Model I included only demographic factors, Model II only socioeconomic factors, while Model III included both sets of factors. A comparison of the β coefficients for Model I and III can determine whether any significant relationships between demographic factors and death rates are explainable through their association with the socioeconomic variables. Similarly, the comparison of the coefficients for Model II and III can determine whether any significant relationships between socioeconomic variables and death rates are explainable through their correlation with the demographic variables.

Regression results are presented below for each of the four age intervals investigated. To provide an indication of the impact of an independent variable on a mortality probability, we have calculated two additional statistics for all variables significant in the model: the absolute response value and the relative risk (See Appendix B for definition and method of estimation).

Neonatal Mortality (NN)

Table 12 presents regression results for the neonatal period. Model I indicates all demographic variables (age, birth order, length of preceding birth interval, and survivorship of previous birth) have a significant effect on NN mortality. A comparison of Models I and III indicate that the significant effects of the demographic variables remain after controlling for the socioeconomic factors.

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we ran regression models dropping the variables length of the preceding birth interval and survivorship of the previous birth. The model was run with data exclusive as well as inclusive of first order births. The results were identical for neonatal and post neonatal mortality, and dropping the variables did not make any change. For infant and child mortality, the exclusion of first order births from the universe did not make any significant change in the results. However, when the two demographic variables were dropped the effect of birth order changed from non-significance to significance. Since the dropped variables are correlated with birth order, this result is not a surprising one.

The mother's age at birth, which has a significant net effect on the probability of NN death, is found to be non-linear. A significant negative linear coefficient together with a significant positive coefficient for the square term indicates that the risk of NN death decreases initially with age and then increases at older ages (Table 12). The calculation of absolute response values show that from the reference NN mortality rate of 48.1 per 1000, at mother's age of 18 at birth the death rate declines by 11.1 at age 30. The relative risk ratios indicate that when mother's age at birth changes from 18 to 30 the NN rate is only .72 times as great (Table 13).

The birth order is found to have significant positive relationship to NN mortality. When birth order changes from 2 to 5, the absolute increase in NN mortality was 13.7. For corresponding changes in birth order, the relative risk ratio was 1.28.

The preceding birth interval shows a significant negative relationship with NN mortality. When the birth interval changed from 12 to 24 months, the NN mortality on an average declined by 13.7, and from 12 to 36 months the decline was 23.1. In terms of the relative risk, with an increase in preceding birth interval from 12 to 36 months the NN rate is .52 times as great.

The survival of the previous birth implied a lower NN mortality. A change in the survival status of the previous birth from alive to dead shows an absolute increase in the NN rate by 46.7. The risk of NN death is 1.97 times greater when the previous birth had died than when the previous birth had survived.

Models II and III show that among the socioeconomic variable considered the place of residence of the mother and religion have significant effect on NN mortality. A comparision of Models II and III indicates that the significance of these two variables persists even after adjusting for demographic variables.

The NN mortality rate of urban mothers is significantly lower than that

of rural women. When mother's place of residence changes from urban to rural the NN mortality rate increased by 32.1. The relative risk ratio indicates that the NN death is 1.7 times greater when the mother lives in a rural area than if she lived in an urban area.

Mother's religion also showed significant influence on NN mortality rate. The NN rate is higher for Christian than Muslim mothers. The risk of death is 1.6 times greater for children of Christian religion than that of Muslim religion.

Post-Neonatal Mortality (PNN)

As in the case of NN mortality all demographic variables considered show significant effect on PNN mortality (Table 14). Comparison of Models I and III shows that the inclusion of the socioeconomic variables did not weaken their impact. Model II indicates that mother's education has a significant effect on PNN mortality. Unlike NN mortality the place of residence of mother and religion do not show any statistically significant effect on PNN mortality.

The mother's age at birth has a significant non-linear effect on the PNN mortality. The risk of PNN mortality decreases with age and then increases at older ages. The absolute PNN mortality rate decreased from a reference value of 159.1 at age 18 to 9.4 at age 30 and increased to 10.5 at age 40. When mother's age at birth changes from 18 to 30 the PNN rate is only 0.59 as great.

The PNN death rate is found to increase with birth order. When the birth order changed from 2 to 5, the PNN mortality rate increased by 39.1 (Table 15). The risk of PNN is 1.43 times greater when birth order changed from 2 to 5.

The length of preceding interval shows a negative effect on the PNN mortality. When the birth interval changed from 12 to 24 months the PNN decreased by 45.8. For such a change in birth interval, the relative risk indicates that PNN was only 0.71 times as great.

When the previous child dies in infancy, the probability of the ensuing birth dying in PNN period is about 1.39 times that of the birth in which the previous child survived. Changes in the survivorship of the previous birth from alive to dead increases the absolute PNN mortality rate by 61.8.

The PNN mortality decreased significantly with increase in mother's education. When mother's education changed from illiterate to 6 or more years of schooling, the PNN mortality decreased by 46.2. For such a change in mother's education, the risk of PNN death is only 0.71 times as great for mothers with 6 or more years of schooling than that of illiterate mothers.

Infant Mortality

Results of infancy (i.e., the NN and PNN periods combined) need not necessarily follow from the separate analysis of the NN and PNN periods. Since the standard type of analysis looks at infant death as a category we present here the results in that format (Tables 16 and 17).

Table 16 shows that the following factors have a significant net effect on infant mortality: mother's age at birth, birth order, length of preceding birth interval, survivorship of the previous birth, mother's education, place of residence and religion.

The relative risk ratio shows that when mother's age is 30, the infant mortality is only 0.65 times as great as that at age 18. The infant mortality rate increases with age and at birth order 5, the rate is 1.23 times as great as the rate at birth order 2. The infant mortality rate decreased significantly with the length of the preceding birth interval. An increase in the birth interval from 12 to 26 months implies approximately 27 percent reduction in the infant mortality rate. Also when the survival outcome of the previous infant changes from "alive" to "dead" the infant mortality increased by 54 percent.

Among the socioeconomic factors, mother's education, place of residence and religion are found to have significant effect on the infant mortality.

Expressed in terms of the relative risk ratio, with a change in mother's education category from "illiterate" to 6 or more years of schooling, the infant mortality is reduced by 26 percent. A change in the place of residence from urban to rural increased the rate by 12 percent. The infant mortality of Christians was about 22 percent higher than that of Muslims.

Childhood Mortality

The net effect of demographic and socioeconomic variables on child mortality rates differed from that of infant mortality rates (Table 18). In the case of child mortality, birth order and survivorship of previous birth did not show any significant net effect. Mother's age at birth had only marginal effect on child mortality (significant at 10% level). The length of previous birth interval was found to be statistically significant. The absolute response to a change in the length of the birth interval from 12 to 24 (or 36) months was -29.2 (or -51.3). Expressed in terms of the relative risk, an increase in birth from 12 to 24 (or 36) months implies a mortality rate of .73 (or .42) times as great (Table 19).

Father's education and place of residence show significant net effect on childhood mortality. Unlike infant mortality, religion and mother's education did not show any significant net effect on child mortality. The probability of child death reduced significantly with the increase in the number of years of schooling the father had received. The risk was 0.72 (or .42) times greater when the father has had 6-9 years (or 10 or more years) schooling than when the father has had less than 6 years of schooling. Births to urban women experienced significantly lower child mortality than those of rural women. The estimated regression coefficient shows that the risk of child mortality is 1.33 times greater when the mother is from rural area than if she is from an urban area (Table 19).

VI. Breastfeeding: Gross and Net Effects on Mortality

For the last two births of respondents the EFS collected information on whether the birth was breastfed and, if breastfed, the duration of breastfeeding. Several aspects of the data limit their suitability for an analysis of the relationship between breastfeeding and mortality. First, the information on breastfeeding is extremely limited. The data do not provide any information on 1) the frequency of breastfeeding and supplemental feeding and 2) 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.[4] Third, the universe consisting of the last two births of women constitutes a very selective population.[5]

The analysis which follows is restricted to births occurring between January 1970 and February 1979 for which data on breastfeeding is available.[6] There were 7973 such births of all orders of which 275 had died in infancy. The analysis involves computing mortality rates for breastfeeders and non-breastfeeders for the following age intervals: the early PNN periods (1-5 months), the late NN period (6-11 months), the entire PNN period (1-11 months) and the childhood age interval (12-59 months).[7]

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[4] The evidence is of two kinds: the data on the duration at which breastfeeding stopped exhibited a substantial degree of heaping at 6, 12 and 18 months. For 68 cases in the data, the duration of breastfeeding exceeded either age and they were excluded from the analysis child.

[5] The data set included in the present analysis consisted of 7973 children of all births between January 1970 and February 1979 for which breastfeeding data were available. The post neonatal mortality rate for this population is 34.5 which is well below the corresponding death rate of 84.2 observed for all the births during the same period.

[6] The life table analysis performed in the section included all births between January 1970 and the interview date.

[7] 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 are classified as breastfeeders or non-breastfeeders following two alternate procedures. In the first procedure for each age interval investigated, births are classified according to their breastfeeding status at the beginning of the age interval. Mortality rates for cases classified by breastfeeding status according to this procedure are presented in Table 20. For the age 1-5 months, 6-11 months and 1-11 months, mortality rates were much lower for breastfeeders than for non-breastfeeders. However, for the age interval 12-59 months, mortality rates were almost identical for both breastfeeders and non-breastfeeders. The table also indicates the mortality rates of never breastfed are higher than those who stopped breastfeeding during 1-5 months, but the rate is lower during 6-11 months and 12-59 months.

In the second classification procedure births are classified as breastfeeders for each month of age on the basis of their breastfeeding status at the close of the previous month. This procedure involves the calculation of monthly death probabilities by breastfeeding status and the calculation of mortality rates for broad age intervals from the monthly rates (i.e., the life table approach). The life table calculation for the interval 1-11 months is illustrated in Table 21.[8] The corresponding rates for the intervals studies are given in Table 22. For both the interval 1-5 months and 6-11 months, the breastfeeders have considerably lower mortality than the non-breastfeeders.

Net Effects

We investigated the differential mortality rate for breastfeeders and non-breastfeeders among gross rates further by estimating the net effect after controlling for a number of confounding factors. Logistic regression model weighted with data on births of order 2 and higher for which breastfeeding data were

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[8] Because of small sample size life table calculations were not extended beyond 12 months.

available. The model included all demographic and socioeconomic 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. The results are given in Table 23.

The coefficient of the breastfeeding variable is negative (indicating that breastfeeding is associated with lower mortality) and is highly significant for all the age intervals considered (PNN and childhood intervals). For the 1-5 month period, the mortality rate for non-breastfeeders is 8.39 times that of the breastfeeders. The corresponding relative risk ratio for the intervals 6-11, 1-11 and 12-59 months are respectively 5.78, 6.38 and 1.98 (Table 24). These results suggest that the effects of breastfeeding on mortality rates decrease as the age interval increases.

VI. Summary

This paper presents an analysis of the levels, time trends and determinants of infant and child mortality in Egypt using data from the 1980 Egyptian Fertility Survey (EFS). The data on mortality in the 1980 EFS was obtained as part of the birth history of ever married women. Much of the analysis is conducted in terms of four mortality rates for neonatal, post-neonatal, infant and childhood ages.

Various indirect tests were applied to evaluate the quality of the mortality data. Two points that have bearing on the various computed rates were highlighted. First evidence was found indicating misreporting of age at death. An adjustment to the data to approximately correct for this defect was made. Second, for about 10% of the total deaths reported in the survey, information on the age at death was not available. No correction or adjustment was made for this problem. As a result the estimated rates in this paper are most probably underestimates of the true levels.

The analysis of the time trend which was limited to the period of 1965-79 indicated a modest decline in the IMR (11%) during the period, and relatively greater decline (30%) in child mortality during a shorter time period from 1961-65 and 1971-75. Within infancy, the PNN rate declined by 20 percent while the NN rate remained virtually unchanged. Thus, the decline in child mortality was greater than that in infant mortality. This finding is consistent with frequent observations that with the socioeconomic improvement in a population over time, the mortality rates for age intervals far removed from the time of birth decline relatively faster.

A persistent pattern of mortality differentials by sex was found in the data. For all birth cohorts between 1961 and 1979, male NN mortality exceeded female NN mortality but male PNN mortality as well as childhood mortality was less than female PNN and child mortality. This pattern

suggests preferential care and treatment of male offspring.

Analysis of mortality differentials was restricted to data on births in the 10 year period from 1970 to 1979. Differentials were calculated for four demographic factors: mother's age at birth, birth order, survivorship of the previous birth and length of the preceding birth interval. All four factors showed systematic associations with neonatal mortality and post-neonatal mortality. However, with respect to child mortality only the birth interval showed strong association. Differentials were investigated for five socioeconomic factors: mother's and father's education, mother's work status, father's occupation and place of residence. All factors except mother's work status were associated with infant and child mortality.

Multivariate analysis with a logistic regression model was conducted to determine the net effect of the demographic and socioeconomic factors on mortality. Separate regression runs were made for the neonatal, post-neonatal, infant and childhood age interval.

For the neonatal, post-neonatal and infant mortality all the demographic factors considered, (i.e., mother's age at birth, birth order, survivorship of the previous birth and the length of the preceding birth interval), had a statistically significant effect on mortality. Among the demographic variables, only the length of the preceding birth interval had significant effect on the child mortality.

For NN, PNN and infant mortality, the mother's age at birth showed a 'U' shaped pattern of effect; the effect increased with birth order, decreased when the length of the preceding birth interval increased and when the previous birth had survived. The inverse relationship with the length of the preceding birth interval also presisted for the childhood mortality.

The relationship of socioeconomic variables and mortality varied by the type of mortality. For NN mortality, mother's place of residence

and religion had statistically significant effect. Rural mothers and Christians experienced higher mortality. For PNN mortality mother's education is the only variable showing statistical significance. The PNN mortality decreased significantly when mothers had six or more years of schooling. Mother's education, place of residence, and religion had significant effect on the infant mortality. The effect was similar to that of NN and PNN mortality.

The data provided information on breastfeeding duration for births which were last and next to the last birth of the respondents in the survey. The effect of breastfeeding was to significantly reduce the death rate for all the age intervals considered. However, it should be noted that the data on breastfeeding lacked detailed information on reasons for stopping breast-feeding and are provided by a very selective sample.

VIII. Program and Policy Implications

The findings reported in this paper have implications for health programs designed to reduce mortality and for future mortality research.

Implications for Health Programs

Screening programs which identify infants and children at high risk to mortality are an accepted part of public health services. 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 subgroup 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 neonatal and post neonatal mortality;
2. Birth order: the first birth and the birth of order 6 have higher mortality, especially during infancy;
3. Birth interval: births following a birth interval of less than 24 months have high rates of neonatal, post neonatal and childhood mortality;
4. Survivorship status of the previous birth: births following a birth that died have high neonatal and post neonatal mortality;
5. Breastfeeding: births which are never breastfed or which are weaned in early infancy have especially high mortality.

Implications for Policy

Our findings have implications for government policy in the areas of family planning and education. The results suggest that the national family planning program has a significant role in reducing infant and child mortality.

The high levels of neonatal mortality among births to women at the extreme ages of childbearing indicate that the family planning program can reduce mortality by delaying the first pregnancy of women who marry below age 20 and by providing the means for limiting fertility to women above the age of 35. There is some evidence that births of very high order and births to women over 35 are unwanted births, and such births are subject to high mortality risks. Similarly, the relatively high mortality in the neonatal, post neonatal and childhood periods of births which occur after a birth interval of less than 24 months is a strong case for birth spacing. In the Egyptian sample 17 percent of the births occurred to women under 20, whereas 10 percent of the births occurred to women over 35. Also, 18 percent of the births were of order 7 or more and 31 percent of births occurred after a spacing of less than 24 months. These findings have implications concerning the population to which the family planning program is targeted, the post partum component of that program, and the educational components of the national MCH and family planning programs.

Implications for Further Research

Our investigation has revealed several areas which could benefit from the additional study.

Infant and Childhood Mortality Levels

Because the Egypt Fertility Survey is retrospective in nature, there is some evidence that the level of mortality is underestimated especially in the past and in some special groups. Another estimate of infant mortality for the 1976-79 period (a rate of 118 per 1000) is greater than that reported in the survey (an adjusted rate of 142 per 1000). Also, there is some evidence that the death rate among women with a very low education may be due to the nonreporting of deaths. In addition, for about 10 percent of deaths the date of death was unknown. Thus, it is important to conduct further evaluative

study to validate the estimates obtained in the study.

Determinants of Mortality

The Egypt Fertility Survey did not include information on a number of proximate determinants of mortality such as birth weight, duration of gestation, etc. Also, our analysis did not include 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 analysis.

The Effect of Breastfeeding

Our analysis of the relationship between breastfeeding and mortality was hampered by the limited information on breastfeeding. The following types of data should be collected in future surveys which investigate this relationship:

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

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Table 1

Sex Ratios of Births and Infant Mortality Rates by Birth Cohort Based on Unadjusted Survey Data[a]

(The 1980 Egypt Fertility Survey)

Birth Cohort	Births			Infant Mortality Rates		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio
1976-79[b]	3073	2810	109.4	138.0	133.1	103.7
1971-75	4162	3931	105.9	145.8	136.9	106.6
1966-70	3730	3426	108.9	139.9	139.8	100.1
1961-65	3125	2935	106.5	146.9	147.9	99.3
1956-60	1925	1825	105.5	169.4	159.5	106.2
1946-55	1274	1207	105.6	207.2	179.0	115.8

Notes: a) Results are based on data which are not adjusted in any manner. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

c) This and all the text tables, unless otherwise specified, exclude deceased births for whom information on age at death was missing.

Table 2

Unadjusted and Adjusted Infant Mortality Rates by Sex and Birth Cohort[a]

(The 1980 Egypt Fertility Survey)

Birth Cohort	Unadjusted IMRs	IMRs Adjusted for Age Heaping at 12 Months				
		Procedure I	Procedure II		Procedure III	
			West	South	West	South
		BOTH SEXES				
1976-79[b]	135.6	141.9	131.7	125.2	133.8	126.9
1971-75	141.5	149.1	141.4	133.2	145.0	136.2
1966-70	139.9	150.1	146.9	137.7	153.0	142.5
1961-65	147.4	160.4	158.2	146.5	166.2	152.7
1956-60	164.5	184.0	182.6	165.2	193.8	173.9
1946-55	193.5	218.1	219.9	195.0	233.5	206.1
		MALES				
1976-79[b]	138.0	141.9	134.5	127.6	135.6	128.5
1971-75	145.8	152.3	142.5	134.3	145.5	136.8
1966-70	139.9	147.7	144.2	135.8	149.8	140.5
1961-65	146.9	159.7	158.4	147.5	166.7	154.1
1956-60	169.4	189.6	188.5	171.0	201.3	181.1
1946-55	207.2	233.1	230.9	205.7	240.8	213.9
		FEMALES				
1976-70[b]	133.1	142.0	128.6	122.5	131.8	125.1
1971-75	136.9	145.8	140.2	131.6	144.7	135.2
1966-70	139.8	152.7	149.9	139.2	156.4	144.2
1961-65	147.9	161.2	157.6	145.1	165.4	150.9
1956-60	159.5	178.1	176.1	158.9	185.7	150.9
1946-55	179.0	202.2	208.0	183.9	225.6	197.8

Notes: a) Rates are per 1000.

b) Unadjusted and adjusted (Procedure I) rates for 1976-79 exclude births occurring within one year of the interview date. Adjusted rates (Procedures II and III) for 1976-79 are based on q(2) values which were computed from data which excludes births occurring within two years of the interview date.

Table 3

Unadjusted and Adjusted Values of the Probability of Dying Between Birth and Age Two[a] [q(2)] by Sex and Birth Cohort

(The 1980 Egypt Fertility Survey)

Birth Cohort	Unadjusted q(2)[b]			Adjusted q(2)[c]		
	Both Sexes	Males	Females	Both Sexes	Males	Females
1976-79	164.4	164.5	164.3	167.1	165.9	168.5
1971-75	177.1	174.9	179.3	181.9	178.8	185.2
1966-70	184.2	177.2	191.8	192.0	184.5	200.2
1961-65	198.5	195.5	201.7	208.6	205.8	211.6
1956-60	229.1	232.7	225.2	242.9	248.3	237.3
1946-55	274.9	284.1	265.1	291.4	295.9	286.7

Notes: a) Rates are per 1000.

b) Used to estimate IMRs of Table 2 (Procedure II).

c) Used to estimate IMRs of Table 2 (Procedure III).

d) Excludes births occurring within two years of the interview date.

Table 4

Estimates of Infant Mortality Rate from the Survey Data and the NAS Report by Birth Cohort

Survey Estimates

Birth Cohort or Period	Unadjusted	Adjusted		NAS Rates
		For Age Heaping at 12 Months	For Age Heaping and for Deaths with Unknown Ages	
1976-79	136	142	148	118[a]
1971-75	142	149	160	134[b]
1966-70	140	150	166	160[b]
1961-65	147	160	176	160[b]

Notes: a) Rate is for 1975-76.

b) Unweighted average of rates by single year.

Source: NAS (1982). The Estimatation of Recent Trends in Fertility and Mortality in Egypt. Report No. 9, National Academy Press, Washington, D.C., 1982.

Table 5

Births and IMRs by Mother's Age at Birth and Birth Cohort[a]

(The 1980 Egypt Fertility Survey)

Mother's Age at Birth	Birth Cohort					
	1946-55	1956-60	1961-65	1966-70	1971-75	1976-79[b]
			Panel A: Births			
<20	1599	1316	1578	1423	1443	934
20-24	874	1624	2121	2263	2383	1789
25-29	8	799	1645	1896	2093	1560
30-34	0	11	712	1188	1358	955
35-39	0	0	4	382	667	487
40-44	0	0	0	2	149	143
45-49	0	0	0	0	1	16
All Ages	2481	3750	6060	7156	8094	5884
			Panel B: IMRs			
<20	228.3	215.0	189.5	180.4	184.3	197.0
20-24	201.4	171.8	155.6	156.4	147.7	130.2
25-29	0.0	157.7	144.7	136.6	141.9	134.0
30-34	-	181.8	146.1	126.3	124.4	129.8
35-39	-	-	250.0	141.4	143.9	117.0
40-44	-	-	-	0.0	181.2	174.8
45-49	-	-	-	-	0.0	187.5
All Ages	218.1	184.0	160.4	150.1	149.1	141.9
			Panel C: Standardized IMRs			
Standardized on the 1946-55 Birth Dist.	na	199.6	177.4	171.8	171.3	173.3
% Deviation of STD. IMR from OBS. IMR	na	+8%	+11%	+14%	+15%	+22%
Standardized on the 1956-60 Birth Dist.	na	na	na	160.5	159.2	154.[illegible]
% Deviation of STD. IMR from OBS. IMR	na	na	na	+7%	+7%	+9%
Standardized on the 1961-65 Birth Dist.	na	na	na	153.7	152.9	148.6
% Deviation of STD. IMR from OBS. IMR	na	na	na	+2%	+3%	+5%

Notes: a) Results are based on data which are adjusted for heaping at 12 months in the reporting of age at death. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

Table 6

The Distribution of Infant Deaths Between the Neonatal and Post-Neonatal Periods[a]

(The 1980 Egypt Fertility Survey)

Birth Cohort	Neonatal Mortality Rate	Post-Neonatal Mortality Rate	Infant Mortality Rate	Proportion of Deaths in the NN Period
1976-80[b]	61.9	80.0	141.9	.44
1971-75	63.1	86.0	149.1	.42
1966-70	61.9	88.2	150.1	.41
1961-65	59.6	100.5	160.4	.37
1956-60	69.6	114.4	184.0	.38
1946-55	65.3	152.8	218.1	.30

Notes: a) Results are based on data which are adjusted for heaping at 12 months in the reporting of age at death. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

Table 7

Infant and Child Mortality Rates by Sex and Birth Cohort[a]

(The 1980 Egypt Fertility Survey)

Birth Cohort	Mortality Rates				Persons Exposed	
	Neonatal Mortality	Post-Neonatal	Infant Mortality	Child Mortality	Infant Mortality	Child Mortality
			BOTH SEXES			
1976-79[b]	61.9	80.0	141.9	-	5884	-
1971-75	63.1	86.0	149.1	65.0	8004	5632
1966-70	61.9	88.2	150.1	74.8	7156	6083
1961-65	59.9	100.5	160.4	93.0	6060	5088
			MALES			
1976-79[b]	69.3	72.6	141.9	-	3073	-
1971-75	70.4	81.9	152.3	58.0	4162	2873
1966-70	67.6	80.2	147.7	64.5	3730	3179
1961-65	70.7	89.0	159.7	85.3	3125	2626
			FEMALES			
1976-79[b]	53.7	88.3	142.0	-	2810	-
1971-75	55.5	90.3	145.8	71.4	3931	2759
1966-70	55.8	96.9	152.7	86.1	3426	2903
1961-65	48.4	112.8	161.2	101.1	2935	2462

Notes: a) Results are based on data which are adjusted for heaping at 12 months in the reporting of age at death. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

Table 8

Infant Mortality Rates by Region and Birth Cohort

(The 1980 Egypt Fertility Survey)

Region	Birth Cohort			
	76-79	71-75	66-70	61-65
Rate				
Cairo and Alexandria	117.2	117.8	119.9	122.6
Lower Egypt	121.8	120.6	124.5	123.8
Cities and Towns	105.3	117.5	129.3	115.5
Villages	126.6	121.5	123.1	126.6
Upper Egypt	183.5	204.6	204.4	234.6
Cities and Towns	167.0	148.9	159.3	223.7
Villages	188.3	218.7	217.1	237.7
Persons Exposed				
Cairo and Alexandria	1117	1536	1534	1370
Lower Egypt	2702	3763	3245	2674
Cities and Towns	608	817	719	684
Villages	2094	2946	2526	1990
Upper Egypt	2005	2795	2377	2016
Cities and Towns	449	564	521	447
Villages	1556	2231	1856	1569

Notes: a) Rates are based on data which are adjusted for heaping at 12 months in the reporting of age at death. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

Table 9

Childhood Mortality Rates by Region and Birth Cohort

(The 1980 Egypt Fertility Survey)

Region	Birth Cohort		
	71-75	66-70	61-65
Rates			
Cairo and Alexandria	49.4	48.9	74.8
Lower Egypt	66.8	80.6	85.4
Cities and Towns	56.7	47.9	67.8
Villages	69.5	89.8	91.5
Upper Egypt	72.1	84.6	118.6
Cities and Towns	53.4	41.1	83.6
Villages	77.4	97.7	128.8
Persons Exposed			
Cairo and Alexandria	1134	1340	1202
Lower Egypt	2710	2841	2343
Cities and Towns	582	626	605
Villages	2128	2215	1738
Upper Egypt	1788	1891	1543
Cities and Towns	393	438	347
Villages	1395	1453	1196

Note: a) Rates are based on data which are adjusted for heaping at 12 months in the reporting of age at death. Rates are per 1000.

Table 10

Infant and Childhood Mortality Rates by Demographic Characteristics for Births Between 1970 and 1979

(The 1980 Egypt Fertility Survey)

Characteristic	Mortality Rates per 1000 Persons Exposed[a]				Persons Exposed[a]	
	Neonatal Mortality	Post Neonatal	Infant Mortality	Childhood Mortality	NN,PNN & Infant Mortality	Childhood Mortality
Mother's Age at Birth						
<20	75.1	111.9	187.0	77.9	2637	1198
20-24	61.9	83.4	145.2	67.8	4607	2007
25-29	61.3	77.0	138.3	51.8	4028	1794
30-34	52.5	74.4	126.9	68.5	2553	1182
35-39	67.2	70.3	137.5	73.3	1295	587
40-44	78.2	98.6	176.9	46.0	294	87
45-49	176.5**	0.0*	176.5*	-	17	0
Birth Order						
1	66.4	77.5	143.9	53.8	2968	1300
2	51.3	87.7	139.0	56.7	2633	1147
3-4	52.6	79.8	132.4	78.7	4109	1855
5-6	70.9	84.8	155.8	63.8	2876	1285
7+	79.1	93.5	172.6	68.8	2845	1264
Length of the Preceding Birth Interval[b]						
<24 months	95.4	123.9	219.2	97.9	4739	1920
24-35 months	42.4	70.2	112.6	66.1	3891	1756
36-59 months	32.0	47.8	79.8	43.1	1841	928
60+	23.8	32.9	56.8	30.4	1762	889
Survivorship of the Previous Birth[b,c]						
Survived	47.4	74.3	121.7	68.4	10172	4652
Died	119.2	128.0	247.1	70.0	1821	700
TOTAL	63.3	84.2	147.5	65.7	15431	6851

a) The analysis of neonatal, post-neonatal and infant mortality excludes births that occurred within 1 year of the date of interview. The analysis of child mortality, excludes births that occurred within 5 years of the date of interview.

b) Excludes 3198 births which are either first order births or births of plurality more than one.

c) Excludes 240 births for which the information on the age at death of the previous birth was missing.

*) Number of births is less than 50.

Table 11

Infant and Childhood Mortality Rates by Socioeconomic Characteristics for Births Between 1970 and 1979

(The 1980 Egypt Fertility Survey)

Characteristic	Mortality Rates per 1000 Persons Exposed[a]				Persons Exposed[a]	
	Neonatal Mortality	Post Neonatal	Infant Mortality	Childhood Mortality	NN,PNN & Infant Mortality	Childhood Mortality
Mother's Education						
None	68.5	89.1	157.6	68.8	9942	4449
1-5	60.3	84.9	145.1	69.2	4065	1793
6+	35.8	47.8	83.6	32.8	1424	609
Father's Education						
0-5	68.1	87.2	155.3	71.9	12159	5453
6-9	49.8	83.4	133.2	52.3	1727	745
10+	40.7	61.0	101.7	29.6	1524	641
Mother's Work Status						
Worked	63.9	79.2	143.1	66.4	2991	1355
Never Worked	63.2	85.4	148.6	65.5	12440	5496
Father's Occupation						
Agriculture	75.1	86.9	162.0	73.3	6488	2906
Transitional	59.0	91.1	150.1	56.6	2864	1308
Blue Collar	56.4	81.8	138.2	67.8	4241	1843
White Collar	45.1	69.8	114.9	44.6	1819	784
Place of Residence						
Urban	44.3	79.5	123.8	49.6	5711	2602
Rural	74.5	86.9	161.4	75.5	9720	4249
TOTAL	63.3	84.2	147.5	65.7	15431	6851

a) The analysis of neonatal, post-neonatal and infant mortality excludes births that occurred within 1 year of the date of interview. The analysis of child mortality, excludes births that occurred within 5 years of the date of interview.

Table 12

Net Effects on Neonatal Mortality Probabilities of Demographic and Socioeconomic Factors

(The 1980 Egypt Fertility Survey)

Variable	Regression Results by Model					
	Model I Demographic Variables		Model II Socioeconomic Variables		Model III All Variables	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	-.432	.688	-2.867**	.106	-.600	.708
Mother's Age at Birth						
Age	-.127*	.050			-.114*	.051
Age Squared	.002*	.001			.002*	.001
Birth Order	.197**	.022			.089**	.023
Length of Preceding Birth Interval	-.028**	.003			-.028**	.003
Survivorship of Previous Birth						
Survived	-.378**	.045			-.364**	.045
Died	.378**	.045			.364**	.045
Mother's Education						
None			.186	.173	.127	.174
0-5			.033	.089	-.008	.090
6+			-.219	.148	-.119	.149
Father's Education						
0-5			.108	.203	.071	.209
6-9			-.093	.115	-.005	.117
10+			-.015	.167	.024	.173
Mother's Work Status						
Worked			.005	.050	.006	.050
Never Worked			-.005	.050	-.006	.050
Father's Occupation						
Agriculture			-.020	.203	-.045	.210
Transitional			.062	.084	.071	.086
Blue Collar			-.045	.091	-.059	.093
White Collar			.003	.161	.033	.167
Place of Residence						
Urban			-.038**	.054	-.273**	.053
Rural			.038**	.054	.273**	.053
Religion						
Muslim			-.282**	.072	-.258**	.073
Christian			.282**	.072	.258**	.073
Number of Observations	11961		11961		11961	
Model of Chi-Square	260.86**		80.01**		311.16**	
Degrees of Freedom	5		10		15	
D Statistic[a]	.021		.007		.025	

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 13

Neonatal Mortality: Absolute Mortality Differential and Relative Risk Ratios for Selected Factors

(The 1980 Egypt Fertility Survey)

Variable	Absolute Mortality Differential	Relative Risk Ratio
Reference Neonatal Mortality Rate: 48.1a		
Mother's Age at Birth		
from 18 to 20	-3.7	.92
25	-9.4	.81
30	-11.1	.72
35	-9.4	.81
40	-3.7	.92
Birth Order		
from 2 to 3	+4.2	1.09
5	+13.7	1.28
7	+24.7	1.51
Length of the Preceding Birth Interval		
from 12 to 24	-13.3	.72
36	-23.1	.52
Survivorship of the Previous Birth		
from Alive to Dead	+46.7	1.97
Place of Residence		
from Urban to Rural	+32.1	1.67
Religion		
from Muslim to Christian	+30.0	1.62

Notes: a) For the calculation of the reference mortality rate, all variables in Model III (Table 12) were set at their mean values except the following:

Variable	Reference Value
Mother's Age at Birth	18 Years
Birth Order 2	
Length of the Preceding Birth Interval	12 Months
Survivorship of the Previous Birth	Alive
Place of Residence	Urban
Religion Muslim	

Table 14

Net Effects on Post-Neonatal Mortality of Demographic and Socioeconomic Factors

(The 1980 Egypt Fertility Survey)

Variable	Regression Results by Model					
	Model I Demographic Variables		Model II Socioeconomic Variables		Model III All Variables	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	1.214*	.586	-2.511**	.095	1.061	.604
Mother's Age at Birth						
Age	-.191**	.044			-.184**	.044
Age Squared	.003**	.001			.003**	.001
Birth Order	.097**	.020			.089**	.021
Length of Preceding Birth Interval	-.032**	.003			-.033**	.003
Survivorship of Previous Birth						
Survived	-.204**	.042			-.202**	.042
Died	.204**	.042			.202**	.042
Mother's Education						
None			.184	.139	.133	.138
1-5			.174*	.071	.130+	.072
6+			-.358***	.117	-.263*	.118
Father's Education						
0-5			.088	.153	.063	.157
6-9			.079	.086	.085	.086
10+			-.167	.127	-.148	.131
Mother's Work Status						
Worked			.010	.043	.034	.044
Never Worked			-.010	.043	-.034	.044
Father's Occupation						
Agriculture			-.010	.154	-.037	.159
Transitional			-.084	.068	-.088	.060
Blue Collar			-.035	.071	-.029	.073
White Collar			.129	.119	.154	.123
Place of Residence						
Urban			.012	.043	.048	.043
Rural			-.012	.043	-.048	.043
Religion						
Muslim			-.019	.073	-.020	.074
Christian			.019	.073	.020	.074
Number of Observations	11263		11263		11263	
Model Chi-Square	307.00**		19.67*		316.69**	
Degrees of Freedom	5		10		15	
D Statistic[a]	.027		.002		.027	

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 15

Post-Neonatal Mortality: Absolute Mortality Differential and Relative Risk Ratios for Selected Factors

(The 1980 Egypt Fertility Survey)

Variable	Absolute Mortality Differential	Relative Risk Ratio
Reference Post-Neonatal Mortality Rate: 159.1a		
Mother's Age at Birth		
from 18 to 20	-19.7	.86
25	-51.1	.68
30	-64.8	.59
35	-65.8	.59
40	-54.2	.66
Birth Order		
from 2 to 3	+12.3	1.08
5	+39.1	1.25
7	+68.9	1.43
Length of Preceding Birth Interval		
from 12 to 24	-45.7	.71
36	-79.7	.50
Survivorship of the Previous Birth		
from Alive to Dead	+61.8	1.39
Mother's Education		
None to 1-5 Years	-0.3	1.00
6+	-46.2	.71

Notes: a) For the calculation of the reference mortality rate, all variables in Model III (Table 14) were set at their mean values except the following:

Variable	Reference Value
Mother's Age at Birth	18 Years
Birth Order 2	
Length of the Preceding Birth Interval	12 Months
Survivorship of the Previous Birth	Alive
Place of Residence	Urban
Mother's Education	Illiterate

Table 16

Net Effects on Infant Mortality Probabilities of Demographic and Socioeconomic Factors

(The 1980 Egypt Fertility Survey)

Variable	Regression Results by Model					
	Model I Demographic Variables		Model II Socioeconomic Variables		Model III All Variables	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	1.465**	.472	-1.923**	.073	1.304**	.486
Mother's Age at Birth						
Age	-.178**	.035			-.167**	.035
Age Squared	.003**	.001			.003**	.001
Birth Order	.105**	.016			.092**	.016
Length of Preceding Birth Interval	-.031**	.002			-.031**	.002
Survivorship of Previous Birth						
Survived	-.296**	.033			-.289**	.033
Died	.296**	.033			.289**	.033
Mother's Education						
None			.193+	.110	.137	.112
1-5			.125*	.057	.084	.058
6+			-.318**	.094	-.221*	.096
Father's Education						
0-5			.100	.126	.066	.130
6-9			.020	.071	.023	.073
10+			-.120	.104	-.089	.108
Mother's Work Status						
Worked			.008	.034	.023	.035
Never Worked			-.008	.034	-.023	.035
Father's Occupation						
Agriculture			-.018	.127	-.042	.132
Transitional			-.031	.054	-.028	.056
Blue Collar			-.043	.058	-.046	.060
White Collar			.092	.099	.116	.103
Place of Residence						
Urban			-.111**	.034	-.070*	.035
Rural			.111**	.034	.070*	.035
Religion						
Muslim			-.139**	.053	-.125*	.055
Christian			.139**	.053	.125*	.055
Number of Observations	11961		11961		11961	
Model Chi-Square	540.58**		59.63**		563.42**	
Degrees of Freedom	5		10		15	
D Statistic[a]	.043		.005		.045	

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 17

Infant Mortality: Absolute Mortality Differential and Relative Risk Ratios for Selected Factors

(The 1980 Egypt Fertility Survey)

Variable	Absolute Mortality Differential	Relative Risk Ratio
Reference Infant Mortality Rate: 199.8a		
Mother's Age at Birth		
from 18 to 20	-21.0	.90
25	-54.9	.73
30	-69.3	.65
35	-68.2	.66
40	-51.5	.74
Birth Order		
from 2 to 3	+15.1	1.08
5	+47.8	1.24
7	+83.7	1.42
Length of the Preceding Birth Interval		
from 12 to 24	-53.2	.73
36	-94.2	.53
Survivorship of the Previous Birth		
from Alive to Dead	+108.0	1.54
Place of Residence		
from Urban to Rural	+23.2	1.12
Mother's Education		
from none to 1-5 Years	-8.3	.96
6+	-51.1	.74
Religion		
from Muslim to Christian	+43.5	1.22

Notes: a) For the calculation of the reference mortality rate, all variables in Model III (Table 16) were set at their mean values except the following:

Variable	Reference Value
Mother's Age at Birth	18 Years
Birth Order 2	
Length of the Preceding Birth Interval	12 Months
Survivorship of the Previous Birth	Alive
Place of Residence	Urban
Mother's Education	Illiterate
Religion	Muslim

Table 18

Net Effects on Childhood Mortality Probabilities of Demographic and Socioeconomic Factors

(The 1980 Egypt Fertility Survey)

Variable	Regression Results by Model					
	Model I Demographic Variables		Model II Socioeconomic Variables		Model III All Variables	
	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error	Beta Coeff.	Std. Error
Intercept	.118	1.013	-2.950**	.165	-.251	1.040
Mother's Age at Birth						
Age	-.161*	.076			-.148+	.076
Age Squared	.003*	.001			.003+	.001
Birth Order	.034	.032			.011	.033
Length of Preceding Birth Interval	-.028**	.004			-.028**	.004
Survivorship of Previous Birth						
Survived	-.093	.082			-.096	.082
Died	.093	.082			.096	.082
Mother's Education						
None			-.028	.222	-.034	.224
1-5			.073	.115	.054	.117
6+			-.045	.190	-.020	.191
Father's Education						
0-5			.425	.286	.428	.288
6-9			.074	.158	.073	.159
10+			-.499*	.238	-.501*	.240
Mother's Work Status						
Worked			.013	.069	.024	.069
Never Worked			-.013	.069	-.024	.069
Father's Occupation						
Agriculture			-.169	.254	-.166	.256
Transitional			-.019	.110	-.026	.112
Blue Collar			-.141	.119	-.127	.119
White Collar			.329+	.195	.319	.197
Place of Residence						
Urban			-.186**	.072	-.167*	.072
Rural			.186**	.072	.167	.072
Religion						
Muslim			.031	.122	.019	.123
Christian			-.031	.122	-.019	.123
Number of Observations	5336		5336		5336	
Model Chi-Square	61.97**		21.66*		80.25	
Degrees of Freedom	5		10		15	
D Statistic[a]	.011		.004		.015	

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 19

Child Mortality: Absolute Mortality Differentials and Relative Risk Ratios for Selected Factors

(The 1980 Egypt Fertility Survey)

Variable	Absolute Mortality Differential	Relative Risk Ratio
Reference Child Mortality Rate: 111.7a		
Mother's Age at Birth		
from 18 to 20	-8.7	.92
25	-20.3	.82
30	-20.1	.82
35	-8.0	.92
40	-20.2	1.18
Length of Preceding Birth Interval		
from 12 to 24	-29.2	.74
36	-51.3	.54
Father's Education		
from primary to 6-9 Years	-30.7	.72
10+	-64.4	.42
Place of Residence		
from Urban to Rural	+37.6	1.33

Notes: a) For the calculation of the reference mortality rate, all variables in Model III (Table 18) were set at their mean values except the following:

Variable	Reference Value
Mother's Age at Birth	18 Years
Length of the Preceding Birth Interval	12 Months
Father's Education	Primary
Place of Residence	Urban

Table 20

Mortality Rates by Age Intervals and by Breastfeeding Status at the Beginning of the Age Interval[a]

(The 1980 Egypt Fertility Survey)

Age Interval (Months)	Status at the Outset of the Age Interval	Number of Births	Number of Deaths	Mortality Rates (per 1000)
1-5	Breastfeeders	7531	87	11.6
	Non-Breastfeeders	442	30	67.9
	Never Breasfed	415	29	69.9
	Stopped Breastfeeding	27	1	39.0
6-11	Breastfeeders	6948	101	14.5
	Non-Breastfeeders	908	57	62.8
	Never Breastfed	386	22	59.0
	Stopped Breastfeeding	522	35	69.0
1-11	Breastfeeders	7531	218	28.9
	Non-Breastfeeders	442	57	129.0
	Never Breastfed	415	51	122.9
	Stopped Breastfeeding	27	6	222.2
12-59[b]	Breastfeeders	2058	64	31.1
	Non-Breastfeeders	470	15	31.9
	Never Breastfed	127	1	7.9
	Stopped Breastfeeding	343	14	110.8

Notes: a) The data set for this analysis consisted of all births between January, 1970 and February, 1979 (regardless of birth order) for which breastfeeding data were available (i.e., the last two live births of respondents).

b) For the calculation of child mortality rates by breastfeeding status, the data set was restricted to births born five years before the interview date.

Table 21

Life Table Mortality Rates by Breastfeeding Status[a]

(The 1980 Egype Fertility Survey)

Month of Life	Persons Beginning the Month	Events During the Month				Cumulative Mortality Rate Beginning with Month One
		Deaths	Stopped Breast-feeding	Withdrawn from Observation[b]	Monthly Mortality Rate	
			Breastfeeders			
1	9193	24	111	213	.0027	.0027
2	8845	23	125	208	.0027	.0054
3	8489	19	169	167	.0023	.0077
4	8134	22	104	170	.0028	.0105
5	7838	12	70	158	.0016	.0120
6	7598	35	172	123	.0047	.0167
7	7268	17	93	115	.0024	.0190
8	7043	15	123	138	.0022	.0212
9	6767	8	135	80	.0012	.0224
10	6544	8	75	112	.0012	.0236
11	6349	13	66	94	.0021	.0256
			Non-Breastfeeders			
1	544	9	-	3	.0176	.0176
2	613	3	-	8	.0049	.0224
3	727	10	-	16	.0139	.0360
4	870	14	-	16	.0162	.0316
5	944	12	-	9	.0128	.0638
6	993	19	-	14	.0193	.0818
7	1132	15	-	23	.0134	.0941
8	1187	9	-	13	.0076	.1010
9	1288	9	-	10	.0070	.1073
10	1404	7	-	15	.0050	.1118
11	1457	17	-	23	.0018	.1223

Notes: a) The data set for this analysis consisted of all births between January 1970 and the interview date (regardless of birth order) for which breastfeeding data were available (i.e., the last two live births of respondents).

b) Births under one year of age and alive at the interview data are classified as withdrawn from observation at their age in months as of the interview date.

Table 22

Life Table Mortality Rates for Selected Post-Neonatal Age Intervals by Breastfeeding Status[a]

(The 1980 Egypt Fertility Survey)

Age Interval (Months)	Mortality Rates per 1000 Births[b]	
	Breastfeeders	Non-Breastfeeders
1-11	25.6	122.3
1-5	16.7	81.8
6-11	8.9	40.5

Notes: a) The data set for this analysis consisted of all births between January 1970 and the interview date (regardless of birth order) for which breastfeeding data were available (i.e., the last live births of respondents).

b) Rates calculated from the monthly mortality probabilities of Table 21.

Table 23

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 24

Absolute Mortality Differentials and Relative Risk Ratios
Associated with a Change from Breastfeeding to Non-Breastfeeding

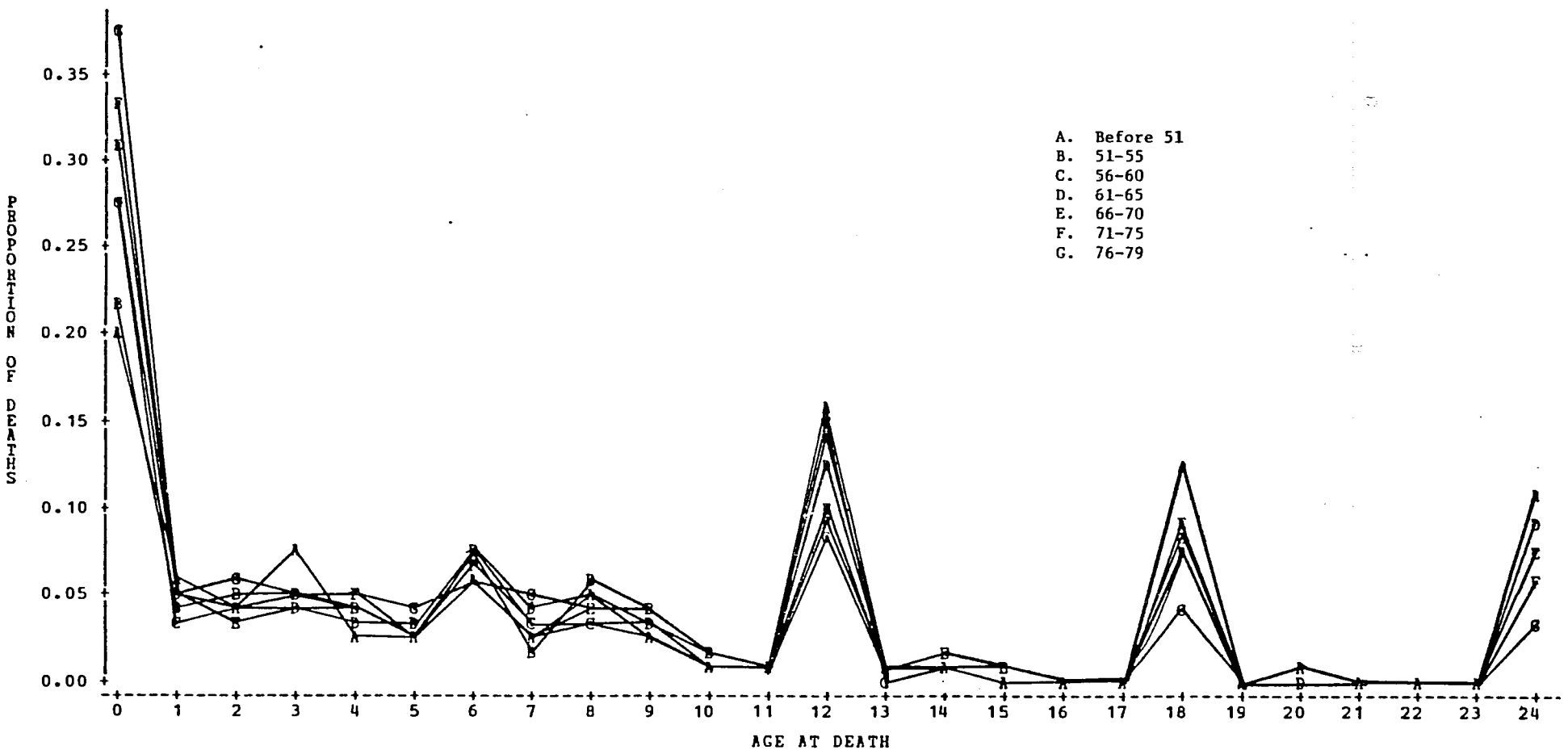
(The 1980 Egypt Fertility Survey)

Variable	Absolute Mortality Differential	Relative Risk Ratio
1-5 Month Age Interval, Reference Mortality Rate: 3.3a		
From Breastfeeder to Non-Breastfeeder	+27.7	8.39
6-11 Month Age Interval, Reference Mortality Rate: 6.4[a]		
From Breastfeeder to Non-Breastfeeder	+30.6	5.78
1-11 Month Age Interval, Reference Mortality Rate: 10.3[a]		
From Breastfeeder to Non-Breastfeeder	+55.4	6.38
12-59 Month Age Interval, Reference Mortality Rate: 17.7[a]		
From Breastfeeder to Non-Breastfeeder	+17.4	1.98

Notes: a) For the calculation of reference mortality rates for a specific age interval, all variables in Table 23 were set at their mean values except the breastfeeding variable which was set at breastfeeding.

Figure 1

PROPORTION OF DEATHS UNDER 25 MONTHS BY AGE AT DEATH AND PERIOD



8

Appendix B

Absolute Response and Relative Risk

The logistic regression model is used in this study to estimate the absolute response value and the relative risk. The absolute response value measures the absolute difference between the mortality rate for one value of an independent variable as opposed to some other value, while holding all other variables constant (e.g., the absolute differential of being born in a rural area as opposed to an urban area). The relative risk is the ratio of the mortality rates associated with two alternative values of an independent variable, while holding other variables constant. In other words, relative risks expresses the risk of death in a specified category compared with a baseline category.

Absolute response values and relative risk rations were calculated as follows: first, equation (1) was transformed into the form:

$$q = \frac{e^{\Sigma \beta_i X_i}}{1 + e^{\Sigma \beta_i X_i}}$$

Where all variables are as defined in equation (1) and e is the base of the natural logarithm system.

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 computed after changing the value of one independepnt variable. The absolute response value is the difference between the two q values, while the relative risk ratio is the ratio of the two q values.

Appendix A

As reported in the text for about 10 percent of the total deaths information on age at death was missing. Table A.1 shows the proportion of unknown deaths in different categories of characteristics used in the analysis of differentials. Tables A.2 and A.3 provide estimates of infant mortality rates by birth cohorts for the country and the major regions after making allowance for the unknown age deaths. In this respect it was assumed that the age distribution of the unknown ages deaths was similar to the age distribution of the deaths with known ages in the sample.

Table A.1

Percent of Unknown Deaths and Inflation Factor by Various Characteristics, 1970-1979

(The 1980 Egypt Fertility Survey)

Characteristics/ Category	Percent of Unknown Deaths
Age of Mother	
Under 20	6.3
20-24	7.7
25-29	9.1
30-34	9.6
35-39	7.9
40-44	6.1
45-49	0.0
Birth Order	
1	7.4
2	7.7
3-4	10.0
5-6	12.7
7+	8.1
Length of Preceding Birth Interval	
<24	8.6
24-35	12.2
36-9	9.6
60+	5.2
Survivorship of the Previous Birth	
Survived	9.7
Died	4.3
Inapplicable	7.4
Unknown	30.0
Mother's Education	
None	9.4
1-5	10.2
6+	3.6
Father's Education	
0-5	9.8
6-9	8.4
10+	3.7
Mother's Work Status	
Worked	10.0
Never worked	6.6

Table A.1 (con.)

Percent of Unknown Deaths and Inflation Factor
by Various Characteristics, 1970-1979

(The 1980 Egypt Fertility Survey)

Characteristics/ Category	Percent of Unknown Deaths
Father's Occupation	
Agriculture	10.6
Transitional	8.4
Blue collar	7.8
White collar	8.0
Religion	
Muslim	9.6
Christian	6.1

Table A.2

Infant and Child Mortality Rates by Sex and Birth Cohort[a]

(The 1980 Egypt Fertility Survey)

Birth Cohort	Mortality Rates				Persons Exposed	
	Neonatal Mortality	Post-Neonatal	Infant Mortality	Child Mortality	Infant Mortality	Child Mortality
			BOTH SEXES			
1976-79[b]	64.7	83.7	148.4	-	5935	-
1971-75	67.5	92.3	159.7	-	8238	-
1966-70	68.4	97.8	166.3	84.5	7379	6152
1961-65	65.7	110.0	175.7	103.0	6256	5157
			MALES			
1976-79[b]	72.3	75.6	147.9	-	3097	-
1971-75	75.8	88.8	164.6	-	4246	-
1966-70	74.4	88.2	162.6	72.3	3832	3209
1961-65	77.8	97.1	174.9	94.3	3225	2661
			FEMALES			
1976-79[b]	56.4	92.7	149.0	-	2838	-
1971-75	58.6	95.9	154.6	-	3992	3375
1966-70	62.0	108.3	170.3	97.9	3547	2943
1961-65	52.8	123.7	176.5	112.2	3031	2496

Notes: a) Results are based on data which are adjusted for unknown ages of death and for heaping at 12 months in the reporting of age at death. Rates are per 1000.

b) Excludes births occurring within one year of the interview date.

Table A.3

Adjusted Infant Mortality Rates by Region and Birth Cohort

(The 1980 Egypt Fertility Survey)

Region	Birth Cohort			
	76-79	71-75	66-70	61-65
Rate				
Cairo and Alexandria	119.4	126.5	130.1	131.2
Lower Egypt	127.5	129.4	137.2	133.9
Urban	109.6	122.7	139.5	120.3
Rural	132.7	130.8	136.5	138.5
Upper Egypt	193.3	218.8	228.0	258.5
Urban	175.8	173.2	184.8	258.3
Rural	198.4	230.5	240.0	258.6
Number of Births				
Cairo and Alexandria	1181	1557	1560	1395
Lower Egypt	2721	3810	3332	2734
Urban	611	823	731	690
Rural	2110	2997	2601	2044
Upper Egypt	2033	2861	2487	2127
Urban	455	583	541	480
Rural	1578	2278	1946	1647

Notes: a) Rates are ajusted for heaping at 12 months in the reporting of age at death as well as for the deaths with unknown ages.

Appendix on Methodology

Two problems typically occur in studies on breast-feeding. First, respondents have a preference for certain units (digits), which is manifest in a tendency to report their duration of breast-feeding in multiples of six-months (e.g., 6, 12, 18, etc.). Existing techniques of demographers for smoothing data which is artificially heaped on particular ages or digits are not appropriate for reducing the heaping in breast-feeding duration data when breast-feeding is to be the dependent variable in a functional relationship.

The statistical estimation technique we use to correct for the digit preference problem also eliminates the second problem, the fact that the reported duration of breast-feeding is truncated, either by the birth of another child (in the case of births before the last birth) or by the date of interview (in the case of the last birth). In the case of the former, the birth of the last child truncates the previous child's breast-feeding not due to actual cessation of breast-feeding because the methods of data collection and coding used by WFS censure the breast-feeding behavior of the many mothers in low-income countries who continue breast-feeding during the first or even the second trimester of pregnancy. Statistically, the truncation problem means that the actual duration of breast-feeding is not observed for a significant proportion of children in the sample.

In the technical paper on Jordan (which this summarizes) and in a previous paper on Sri Lanka (see References), we explain why the two data problems of digit preference and truncation by interview or pregnancy make it inappropriate to use the usual statistical estimation technique of ordinary least squares regression. It is necessary to reformulate the variable being investigated, duration of breast-feeding, as an either/or breast-feeding continuation decision variable; that is, at each age of the child in months, determine whether he/she is breast-fed (=Yes) or not (=No). Children whose reported duration is (usually incorrectly) given in multiples of six are randomly assigned to the month number on either side (i.e., if twelve is reported either eleven or thirteen is randomly designated). The statistical analysis examines the factors ("explanatory variables") that influence whether the woman continues breast-feeding the child beyond the chosen cut-off date or not. The estimation technique is called the probit procedure.

Various cut-off dates are used to check the stability of the results, and, in particular, whether the factors influencing breast-feeding continuation decision differ among women who tend to be relatively longer or shorter duration breast-feeders. The duration groups are identified by breaking the sample into two groups. We used 0 and 9 months (=short duration breast-feeders) and 10 months plus (=long duration), so that our empirical work amounts to testing what factors influence women who are short-breast-feeders to continue from 0 - 4 to 5-9 months, and what factors influence the long-duration

breast-feeders to continue from 10 to 14 to at least 15 months. Factors influencing the continuation decisions of short-duration and long-duration breast-feeders may well differ. For example, the major factors influencing the decision to extend a relatively short period of breast-feeding will tend to be psychological or biological in nature, while those important in determining the extent to which women who have already breast-fed their child a substantial number of months continue to breast-feed will more often tend to be social and economic. While the choice of the nine month break is arbitrary, of the several break points tried it seemed to give the most reasonable results.