PN-AAY-689

BREAST-FEEDING PATTERNS AND DETERMINANTS IN YEMEN

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September 7, 1984

BREAST-FEEDING AND INFANT MORTALITY FACT SHEET: YEMEN
(WORLD FERTILITY SURVEY, 1978)

	BREAST-FEEDING			MORTALITY RATE/1000		
	Percent of Sample[1]	Percent Ever Breast-Fed	Mean Duration in Months[2]	Neonatal	Postneonatal	Infant
TOTAL SAMPLE	100	84.8	12.7	55.0	115.4	170.4
1. AREA OF RESIDENCE						
Urban	9	85.0		47.5	80.7	128.2
Urban Migrant	2		9.5			
Always Urban	5		10.3			
Rural	93	83.0	13.1	56.2	120.7	176.8
2. REGION OF RESIDENCE						
North	35	83.7	12.7			214.8
South	39	84.5	12.0			138.5
West	20	86.7	12.5			193.0
East	6	86.2	15.5			150.3
3. SEX OF CHILD						
Male	53	85.6	12.5	62.8	127.0	190.8
Female	47	83.9	12.3	46.9	117.4	164.3
4. WORK STATUS OF MOTHER[4]						
Does not work/ never worked	53	85.3	11.4	50.2	115.2	165.4
Works at home/worked	36	85.9	14.6	60.7	115.6	176.2
Works away/worked	11	81.6	13.0			
5. EDUCATION OF MOTHER[5]						
Zero/illiterate	99.0	84.8	12.8	55.0	116.7	171.8
1 to 3/literate			—	55.1	55.3	110.5
4 to 6/literate	1.0	87.0	5.0			
7 to 9/literate			—			
10 and over/literate			—			
6. FATHER'S OCCUPATION						
Modern	4	83.6	10.5	29.5	74.6	104.2
Transitional	22	86.5	11.6	52.5	120.4	172.9
Mixed	33	83.0	11.5	57.9	101.5	159.5
Traditional	41	85.2	14.3	57.2	126.9	184.0

[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 1970-1978.
[4]For mortality rate, work status is either never worked or worked.
[5]For mortality rate, mothers are classified illiterate or literate.
—No observations in this grouping.

SOURCES: Akin, J.S., Bilsborrow, R., Guilkey, and Popkin, B.M. (1984). "Breast-feeding Patterns and Determinants in Yemen."

Suchindran, C.M. and Adlakha, A.L. (1984). "Levels, Trends and Differentials of Infant and Child Mortality in Yemen."

BREAST-FEEDING PATTERNS AND DETERMINANTS IN YEMEN

by

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1. Introduction

Recent research has documented the benefits of breast-feeding for the health of the infant, as an inexpensive and appropriate source of nutrients, and for the stimulation of a strong emotional relationships between mother and child. Breast-feeding suppresses ovulation and is therefore a major source of protection against pregnancy in most low-income nations. This protection results from not only the direct hormonal effect but also taboos against sexual intercourse during breast-feeding in some cultures. Despite these major benefits associated with breast-feeding, little in-depth research has been conducted on the patterns of breast-feeding in low-income countries or on the factors which influence these patterns.

In a recent paper, we developed and applied a methodology to the analysis of breast-feeding, based on data for Sri Lanka from the World Fertility Survey (WFS) (Akin, et al., 1981a). In a second paper we extended that approach to Jordan to show that the factors that affect the decisions of women to continue breast-feeding differ for women who breast-feed for different lengths of time (Akin, et al., 1981b). Testing for differences in the factors that affect the decision to terminate breast-feeding after a fairly short duration as opposed to a longer duration is important because it may allow us to specify different policy implications for women who tend to breast-feed their children different durations, since

children at different ages face significantly different health problems related to cessation of breast-feeding.

The purpose of this paper is to present the results for the patterns and determinants of the extent and duration of breast-feeding in Yemen. Because the statistical analysis of breast-feeding data is complex, we use a variety of methods that are either descriptive or multivariate. The statistical methods that we use are described in detail in the technical appendix attached to this paper.

2. Sample Selection

The source of data is the national sample of women surveyed by the government of Yemen in 1979 as part of the World Fertility Survey program. The WFS questionnaire focuses on fertility and collects most basic and recent information on breast-feeding, but only for the last two births. Specifically, the woman is asked whether she breast-fed each of her last two children, and, if so, how long (in months). Observations refer to children (n = 2262) born in the four-year period preceding the date of interview, i.e., in 1975-79. The reason we constrain ourselves to a four-year period is that it is desirable to examine those breast-feeding decisions that occurred as recently as possible so that the variables measured at the time of interview (e.g., women's labor force behavior and marital status) refer to a time as close as possible to the actual breast-feeding decision. Moreover, the farther back respondents are asked to recall, the less accurate tends to be the information. Most important, including both the last and the next-to-last born (but only when they occurred within this time period) ensures that the data are reasonably representative of all children born in the study period.

3. Patterns of Breast-Feeding in Yemen

As we and others have noted elsewhere, the usual techniques for calculating the mean duration of breast-feeding suffer serious selectivity biases, and were therefore not used. Problems in using WFS and other data for measuring mean duration arise from the decision of whether to include or exclude (the relatively short) durations of breast-feeding for children who die during the interval under consideration. Children may cease to be breast-fed not only because of the mother's decision but also because of the child's death. The technique which can take into account not only the child's breast-feeding but also its survival status is the multiple decrement life table method, which is described in the technical appendix to this paper.

Before examining the findings for Yemen, we observe that 38.4% of the last- and next-to-last-born children in the four years preceding the Yemen WFS Survey were still being breast-fed at the time of interview. We also note that 11.6% of the births (262 children) occurring in the four years died during the interval. As noted in the appendix, the life table procedure alleviates both truncation problems.

Table 1 shows the percentages of (surviving) children breast-fed at various ages in Yemen. In rural areas 90.4% of the children were ever breast-fed, while in urban areas the percentage was 89.4. These percentages decline with the age of the child, to 82 and 65.8% respectively at the age of three months, 73.3 and 49.4% at six months, 48.2 and 25.9% at one year, and 8.1 and 5.2% on the second birthday. There are striking rural-urban differences beginning after the second month, with breast-feeding of urban children being 11.7 % lower starting at two months, over

16 percentage points lower at three months, and falling abruptly to around 20% lower from 6 months to 21 months. In rural areas nearly half of the children were breast-fed at least one year while the proportion in urban areas was only about one-fourth.

Table 1 about here

Figure 1 graphically illustrates the wide differences in breast-feeding between urban and rural areas in Yemen as well as the rapid decline of the proportion being breast-fed in the urban areas during infancy.

Figure 1 about here

To pave the way for the multivariate statistical analysis, it is useful to first indicate some of the basic differentials in breast-feeding. Table 2 indicates these, based on the current status technique (an alternative type of life table, which is also described in the technical appendix). This technique utilizes data on the current breast-feeding status of all surviving children (born in the four years preceding the Yemen WFS) to compute the mean duration of breast-feeding for various classifications of children. Overall the average child in Yemen was breast-fed 12.7 months at the time of the survey. Significant differences in breast-feeding customs of women appear to exist not only between urban and rural areas and different regions (the East is higher than the rest of the country) in Yemen, but also according to the education and occupation of the husband and the woman's work status (see Figures 2-4). Judging from this table, the effect of husband's education would appear to be the strongest factor, i.e., higher husband's education is associated with

considerably lower breast-feeding. However, the "effect" observed for each of the variables in such two-way tables does not take into account any of the other variables and therefore cannot be accepted. For example, if women living in urban areas tend to be married to more educated husbands, then for most urban women both the urban-rural and husband's education differentials observed in Table 2 will exist. But we cannot know which variable is more important unless we include both in the statistical analysis at the same time. This applies to all the other variables as well. What is needed is multivariate analysis, wherein the effect of each variable is observed, controlling for all the other available factors that may also influence breast-feeding.

While the husband's education differentials appear strong, several other comments on Table 2 seem appropriate here. It is interesting that urban migrants appear to have breast-feeding customs closer to those of their urban neighbors than to those of their former rural neighbors. It may be that most of the migrants have lived in the cities for a long time period and have altered their customs in this respect, or it may be that the socioeconomic constraints do not allow them to breast-feed in their new urban location. It should also be noted that breast milk substitutes are more readily available in the urban location. The other comment refers to the woman's work status, where, curiously, women working at home do not breast-feed less than women who do not work at all (indeed they breast-feed more). This clearly indicates that working at home is usually fully compatible with breast-feeding. Data for women working away similarly suggests work-away is also compatible with breast-feeding. As can be seen in Table A-3, close to half (47%) of the Yemeni mothers in this sample

worked in market jobs. Of these, 11% worked away from home.

Figures 2-4 provide some evidence about location, education, and occupation on the percentage of children breast-fed at least six months. In Figure 1, we again see the urban-rural differential in breast-feeding. However, breast-feeding does not appear to differ much by region. The Eastern region is slightly higher than the other three.

Stratification by father's education presents an interesting pattern in Figure 3. We see that families headed by a poorly educated father have the highest percentage of children breast-fed at least six months. In the middle range of education we see the lowest percentage with the percentage rising for our group with the highest level of education. This suggests a possible non-linear effect for education when it is used as a determinant of breast-feeding.

Finally, Figure 4 shows some correlation between father's occupation and breast-feeding. Traditional is associated with the highest percentage while modern occupations are associated with the lowest percentage.

Figures 2, 3 & 4 and Table 2 about here

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4. Factors Influencing Breast-Feeding: Methodology and Selection of Variables

To analyze the factors affecting the extent and duration of breast-feeding in Yemen, we develop a model of the determinants of such behavior. We will attempt to determine the factors that influence both (1) whether the child is ever breast-fed, and (2), if so, whether it is breast-fed at various ages. Other important measures of breast-feeding behavior--the frequency of feeding, whether the infant is fed separately or with others,

the extent of use of breast milk relative to other foods at various ages (other milk, formula, solid food), and the age of weaning--cannot be addressed with WFS data because the necessary questions were not included in the questionnaire.

a. Methodology. Two problems typically occur in studies on breast-feeding. First, respondents have a greater or lesser preference for certain time 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.). This is evident in all countries that we have studied including Yemen (suggested by the lumpiness in Table A-1 for 12, 18 and 24 months). Existing techniques of demographers for smoothing data 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 a second problem, the fact that the duration of breast-feeding is truncated by the birth of another child (in the case of a closed birth interval) or by the date of interview (in the case of the last birth). 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 previous papers on Sri Lanka and Jordan we explained why the two problems of digit preference and truncation make it inappropriate to use the usual statistical estimation technique of ordinary least squares regression (see the technical appendix). 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 (in months) of the child, determine whether the child is still breast-fed (1 = Yes) or not (0 = No). Children whose reported duration is (usually incorrectly) given in multiples of six are randomly assigned to the month number on either side (e.g., if twelve is reported, then either eleven or thirteen is randomly designated). The statistical analysis examines the factors ("explanatory variables") that influence whether or not the woman continues breast-feeding the child beyond the chosen cut-off date. The estimation technique is called the probit procedure.

Various cut-off dates are used to check the stability of the results. The results in Table A-3 suggest that the results are very sensitive to the choice of cut-off. Hence, we put very little emphasis on these results. Instead, we will focus our discussion on the results in Table A-5 where duration groups are used. The duration groups are identified by breaking the sample into two parts. We used 0 to 9 months ("short duration breast-feeders") and 10 months plus ("long duration breast-feeders"). Our empirical work thus 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 10-14 to beyond 15 months. As noted in section 1, factors influencing the continuation decisions of short-duration and long-duration breast-feeders may well differ. One expects that the major factors influencing the decision to extend a relatively short period of breast-feeding will tend to be more 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 somewhat arbitrary, of the several break points tried it seemed to give the most reasonable results. Previous research also leads us to expect that different factors will affect also the ever-never choice which the mother faces during the first few weeks of life. Biological, sociopsychological, and contacts with health professionals may be the most important for the ever-never decision.

b. Selection of Variables. In an earlier study we reviewed the various individual, household and community factors expected to affect breast-feeding behavior (Akin, et al, 1981b; Popkin, et al, 1983). Based on that review and the data available from the WFS Yemen tape, we selected a set of characteristics of the mother, the child, and the household which could have effects on breast-feeding in Yemen. Table A-2 lists and defines these variables, as well as providing brief justifications for each. Whenever possible, the variables are designed to relate to the specific birth intervals of the mother during the last four years before the survey. For example, pill usage refers to whether the mother used the pill at all during the particular interval. The work now and work away variables are combined to produce the mother works at home variable which is discussed below. Table A-3 presents the means and standard deviations for the variables used in the multivariate analysis. As can be seen the mean education for women in years of schooling is .05 years and only 1% of the women used an oral contraceptive pill. Also the sample was predominantly rural.

The family composition variables measure the number of children alive in each age-sex group. This information is not quite the same as the parity of the child, the measure most often used by demographers in such

analyses. However, age-sex composition variables more directly relate to the child care situation than does parity, and hence are likely to be more closely related to breast-feeding.

Breast-feeding may be influenced (negatively) both by the biological effects of contraceptive pills and by the decision to use contraceptives as a substitute for the contraceptive effects of breast-feeding (see Popkin et al., 1983 for a review of these issues). Thus the use of any contraceptive method may be inversely related to breast-feeding. This negative effect would be expected to be even more pronounced for the pill, given its assumed added negative (biological) effects on lactation.* Similarly we tested the inclusion of the variable, desires another child, to determine whether breast-feeding cessation was associated with a desire to have a shorter birth interval.

There are several other important specification issues. One is whether the sample should be further divided into urban and rural samples. We examined this possibility by combining the "Always Urban Resident" and "Migrant to Urban Area" variables into one Urban variable. We then interacted this Urban variable with all other independent variables in the model (by adding interaction terms with Urban multiplied by each of the other included variables). This approach allowed us to determine if a large number of coefficients were statistically different for the urban and rural samples. We found they were not and combined urban and rural mothers into one sample. Yemen is a predominantly rural country (89% of the sample

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*We could not test this relationship since few women utilized any family planning method other than the pill. Only 1% of the sample women used the pill.

lived in rural areas) and this would be expected in a country which does not have a large, dominating urban sector.

The next specification issue is whether and how to incorporate husband and wife occupation variables. Significant effects of occupation on the duration of breast-feeding may be expected for a number of reasons. Certain types of occupations of the mother may be more compatible with breast-feeding than others, and the occupational category of the husband may reflect the socioeconomic status and income level of the family. These additional occupational variables for the mother added no explanatory power to the model. Therefore they were subsequently dropped and will not be discussed further in the empirical results section of this paper. The father's occupation variables were occasionally significant so they were included in the model. It should be noted that the traditional occupation category was the omitted category. Therefore, a significant coefficient for one of the other dummy variables indicates a significant difference from fathers in a traditional occupation. The women's location of work variables did produce significant effects and were left in the final model specification.

Finally, several other key variables are excluded. There was no religion variable for the Yemen WFS and too few women who "lived alone" to allow us to consider this factor.

5. Empirical Results for the Determinants of Breast-Feeding

The discussion here summarizes the main empirical results showing the effects of changes in the various explanatory variables on the probability that children shift from the "No" into the "Yes" breast-feeding category (i.e., to being ever breast-fed, for the ever/never decision, and to being

breast-fed past the cut-off for the duration decision). The detailed results are presented in Tables A-4 to A-7 in the Appendix and summarized below in Table 3. In interpreting the results for variables 3-8, 10 and 11 (dichotomous or categorical variables), the results shown are for children in households characterized by the variable identified in comparison with other "control" households. For example, the results for variable number 5, "urban migrant" show the "effects" of being a child of a mother who is an urban migrant vs. non-urban (i.e., rural) resident. For example, the — in the short duration column means the urban infant is significantly less likely to be breast-fed a much shorter duration. Details may be gleaned from the variable definitions in Table A-2.

The statistical results are weakest for the ever/never decision, which is not surprising given that over 90% of the children are ever breast-fed (see left column in Table 3). Level of education (of the woman or her husband) does not have the expected negative impact on the decision to (ever) breast-feed when statistically controlling for the other factors, and only two variables, work away and number of brothers 7-12, are significantly related to the ever-never decision (Table A-3). The important policy variable is, of course, the location of women's work, women who work away from home being less likely to ever breast-feed, even controlling for the education levels of both parents, the woman's age, urban-rural status, household composition, and so on. This effect compares the breast-feeding behavior of women who work away from home to those who work at home and found that there is a 6% greater likelihood that women whose work is away from home will never breast-feed.

The results in the two right columns of Table 3 allow us to compare

the factors influencing continuation decisions of women who breast-feed relatively short and relatively long durations. First, we see that again mother's education and father's education do not have the expected strong negative effects. There is so little variation in the education levels of women that it would require much more refined measures of education to determine if there is any educational effect. In fact, for some samples (e.g., the breast-feeding decision at 15 months for women who breast-feed 12 months), all women in the sample had zero years of education. The education of the father did not have a significant effect when we controlled for his occupation. The mother's work away from home variable also has none of the expected negative effects, however women who work at home (which represents the majority of working women) are significantly more likely to breast-feed for longer durations in both the short and long-duration samples than non-working women.* On the other hand, the effects of being a migrant to an urban area is statistically significant and negative for the short duration sample. In fact, for the short duration sample, these are the strongest negative statistical results observed. The other negative effect on breast-feeding duration is the negative association between transitional and mixed occupations of the fathers and short-duration breast-feeding. These represent about 50% of the cases in this sample. The strong positive relationship between mother's age and the continuation decision of both the short-duration and long-duration breast-feeders may indicate a tendency for older cohorts of women to breast-feed

*In Table A-7 the reader can see that the main effect is the increased likelihood of longer breast-feeding for women who work at home compared to women who do engage in market work. Once the woman works, the relative effects on the duration of working away from home compared to working at home (row B5) is statistically insignificant.

longer, which one would expect if there is a secular decline in breast-feeding in process in Yemen. Given that there is evidence in some countries that women are aware of the contraceptive effects of breast-feeding, the fact that the desire for another child has a positive effect on the probability of breast-feeding for the short breast-feeders is somewhat surprising. Finally none of the household composition variables were found to be important.

Table 3 about here

It is important to note that the largest negative effect is the effect of being an urban migrant (see Table A-7). Among the short duration ever breast-feeders, being an urban migrant was associated with a .22 reduction in the likelihood of being breast-fed five or more months. Fathers who worked in transitional or mixed (usually sales, semi-skilled) occupations were associated with large reductions in breast-feeding relative to fathers in traditional occupations. Women who worked at home were much more likely to continue to breast-feed (20% for the short duration and 18% for the long duration sample).

6. Policy Implications

The fact that potentially important variables are not available in the WFS data must be borne in mind in recognizing the substantive limitations of the analyses reported here, and thereby in deriving policy inferences from them. Greater knowledge of factors which influence extending breast-feeding from a very short to a moderate duration are particularly important because infants fed foods other than breast-milk before 4-6 months of age usually have a higher risk of morbidity, growth retardation and even death

in developing countries. However, there are also known immunological, nutritional, and other benefits of even partial breast-feeding beyond nine months, as well as family planning protection and economic benefits (since purchased milk is much more expensive).

Our brief discussion here focuses on four possible substantive policy areas:

a. Labor force policies. In Yemen, where 47% of the women declare themselves as working, women's work per se has a significant effect on breast-feeding behavior. The mean duration of breast-feeding is much lower for women who do not work, however the multivariate analysis has clarified these relationships and found that women who work away from the home are less likely to ever breast-feed. Among women who breast-feed, women working at home will be more likely to breast-feed a longer duration of time. Therefore, it is important to examine the nature of work away from home as well as the type of women who work away from home (e.g., What is their socioeconomic status?). A large number of legislative and child care options are possible.

There were some negative associations between the occupation of the fathers and their wives' breast-feeding behavior. It is very difficult to discern possible policies with regard to fathers' occupation, particularly in a country with such a large proportion of the adult male population engaged in work in other Near East countries. Also, there were very few fathers in each disaggregated occupational category (e.g., sales) and too little other occupation-related data on the fathers to provide policy interpretations for these results.

b. Education Policies. Essentially women in this Yemeni sample had

zero years of formal education. This limited any insights possible concerning education of women. The education of the fathers, on the other hand, was associated with reduced duration of breast-feeding in the descriptive analysis but was insignificant when the occupation of the father was considered.

c. Family Planning Policies. In the other Near East countries, women who use pills and other types of contraceptives were less likely to breast-feed their children. In Yemen only 1% of the women used pills and few favored other family planning approaches. There was no evidence found that pill use was associated with variations in breast-feeding behavior in Yemen.

d. Urban residence and migration policies. We did not find major urban-rural differences in Yemen in the multivariate analysis. However, one important result was that for short-duration breast-feeders, urban migrants are significantly less likely to extend breast-feeding from a one-to-four month period to five or more months. Infants are especially vulnerable to health risks at ages under 6 months, so it is important to develop and direct policies at arresting the decline in breast-feeding in urban areas, particularly among urban migrants. Data on the length of residence in the urban areas, unfortunately, is unavailable. In the current status analysis of Table 2 we also found that urban migrants breast-feed for a shorter duration than rural residents. We find a large reduction in breast-feeding with age in urban Yemen. It should be pointed out that urban residence was a significant factor associated with lower infant mortality in Yemen (see Adlakha and Suchindran, 1984). In fact, the relative risk of both infant and child mortality in urban Yemen was

relatively lower than in rural Yemen when compared to Egypt, Tunisia and Jordan. Given the amount of evidence favoring the positive morbidity and mortality reduction effects of breast-feeding, it is our assumption that other factors related to urban residence, such as better sanitation and improved health services more than cancel the effects of lower levels of breast-feeding for urban migrants. We, however, would carry the logic one step further and suggest that it is certainly plausible that mortality and morbidity levels would be even lower in the urban areas if the extent and duration of breast-feeding practices were to increase. Finally, the fact that only 2% of the sample consisted of urban migrants means little impact on infant nutrition in Yemen will result from focusing on the segment of the urban population.

7. Summary

The above results are based on a nationally representative sample of 2,262 infants born between 1975 and 1979. They indicate that over 90% of Yemeni infants are breast-fed at birth but that there are significant declines in breast-feeding in the first 6 months of infancy, particularly in urban areas. These results appear to show a slightly longer duration of breast-feeding than has been found in the Yemen National Nutrition Survey (Yemen General Grain Corporation, 1980). In that survey the median duration of breast-feeding was 12.7 months in rural areas and 5.6 months in urban areas (as compared with about 10 months in urban areas in these WFS results). The proportions being breast-fed at 6 and 12 months were slightly lower in the WFS results reported in this paper (about 3-6% lower). As did the national survey, this study found that father's literacy was associated with reduced breast-feeding. There were also

results similar to those of a smaller study conducted in Udain (Greiner, 1980) emphasizing women's work status. Greiner found that in rural areas part-time, full-time, away and farming employment were each associated with increased duration of breast-feeding. In our descriptive analysis, similar results were found (see Table 2). In the multivariate results, however, it was determined that once factors were controlled working at home was strongly associated with increased duration of breast-feeding.

FOOTNOTES

*The authors are associated with the Department of Economics (Akin, Guilkey), Biostatistics (Bilsborrow), and Nutrition (Popkin), and all are Fellows of the Carolina Population Center. This research is funded by the Near East Bureau of the Agency for International Development. Art Braunstein, Carol Adelman and Barbara Turner of that Bureau's Population, Health and Nutrition Division are thanked for their encouragement, as are Margaret Mauney, Emelita de Leon and Larry Taylor of the University of North Carolina for their assistance. Finally, we thank WFS and the Department of Statistics, Central Planning Organization, Government of Yemen, for permission to analyze the data.

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FIGURE 1.

LIFETABLE PATTERNS OF BREASTFEEDING, YEMEN

(WFS DATA, 1974-79)

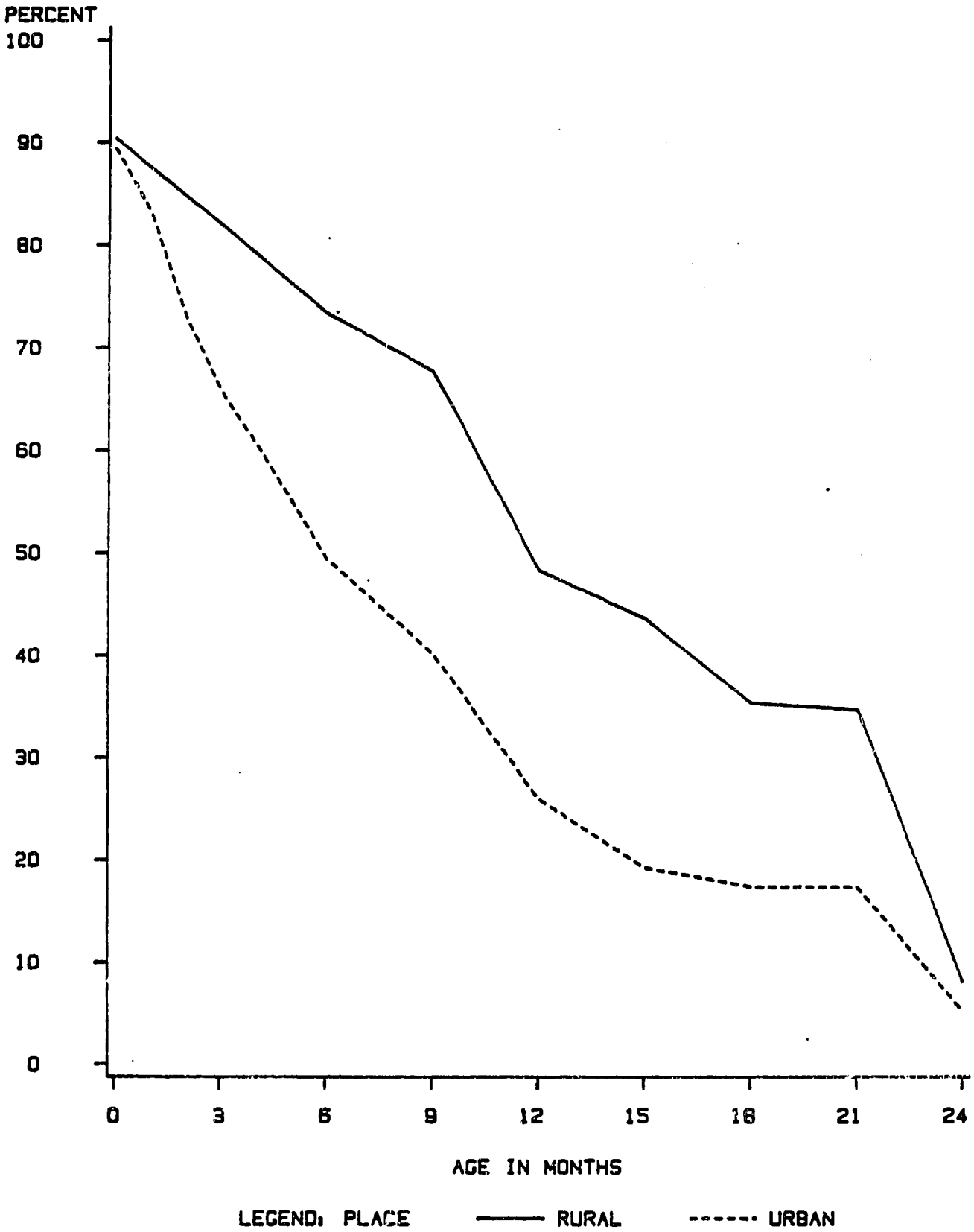

FIGURE 2

YEMEN: PERCENTAGES OF CHILDREN BREAST-FED AT LEAST 6 MONTHS ACCORDING TO MOTHER'S PLACE OF RESIDENCE

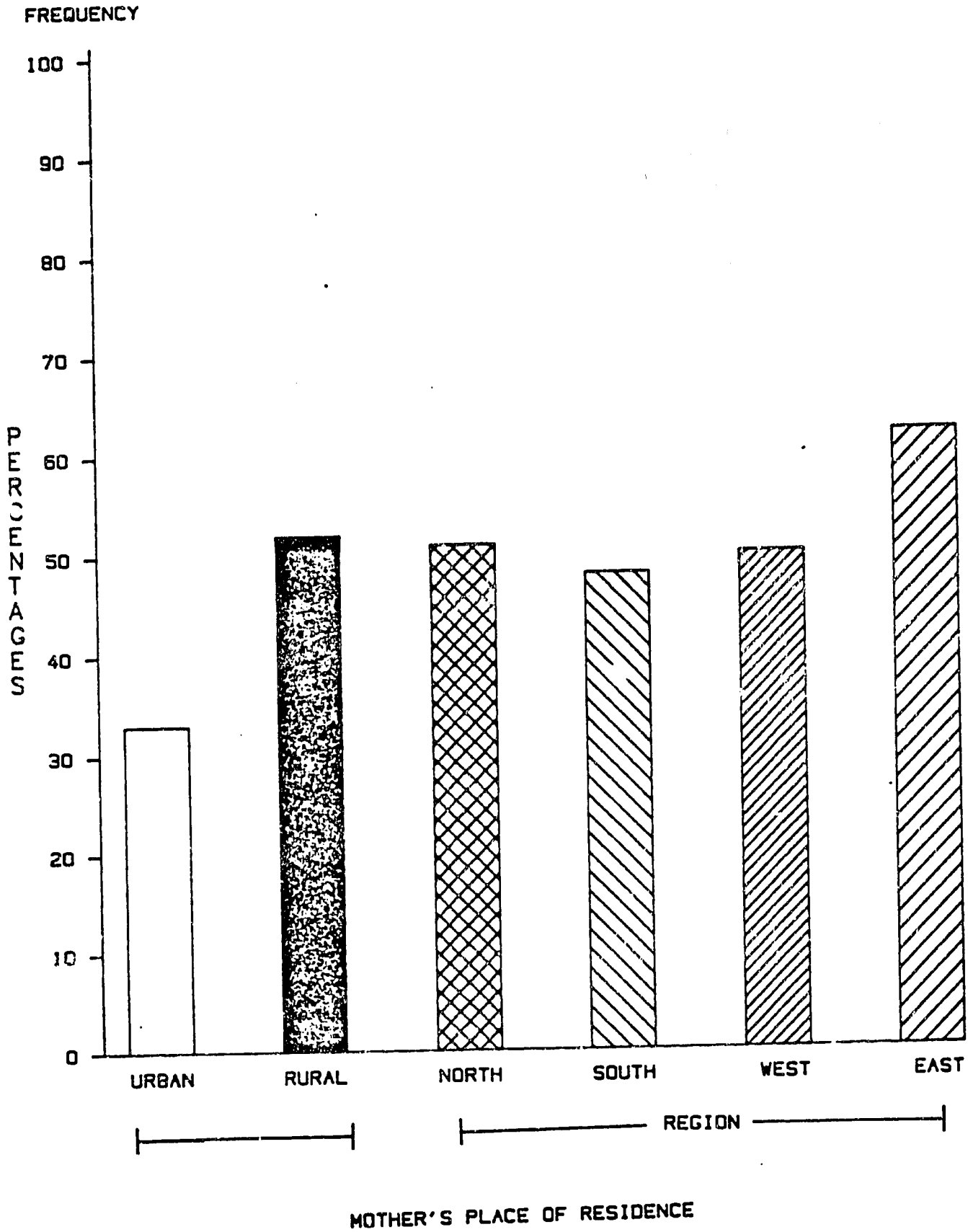

FIGURE 3

YEMEN: PERCENTAGES OF CHILDREN BREAST-FED AT LEAST 6 MONTHS ACCORDING TO FATHER'S EDUCATIONAL LEVEL

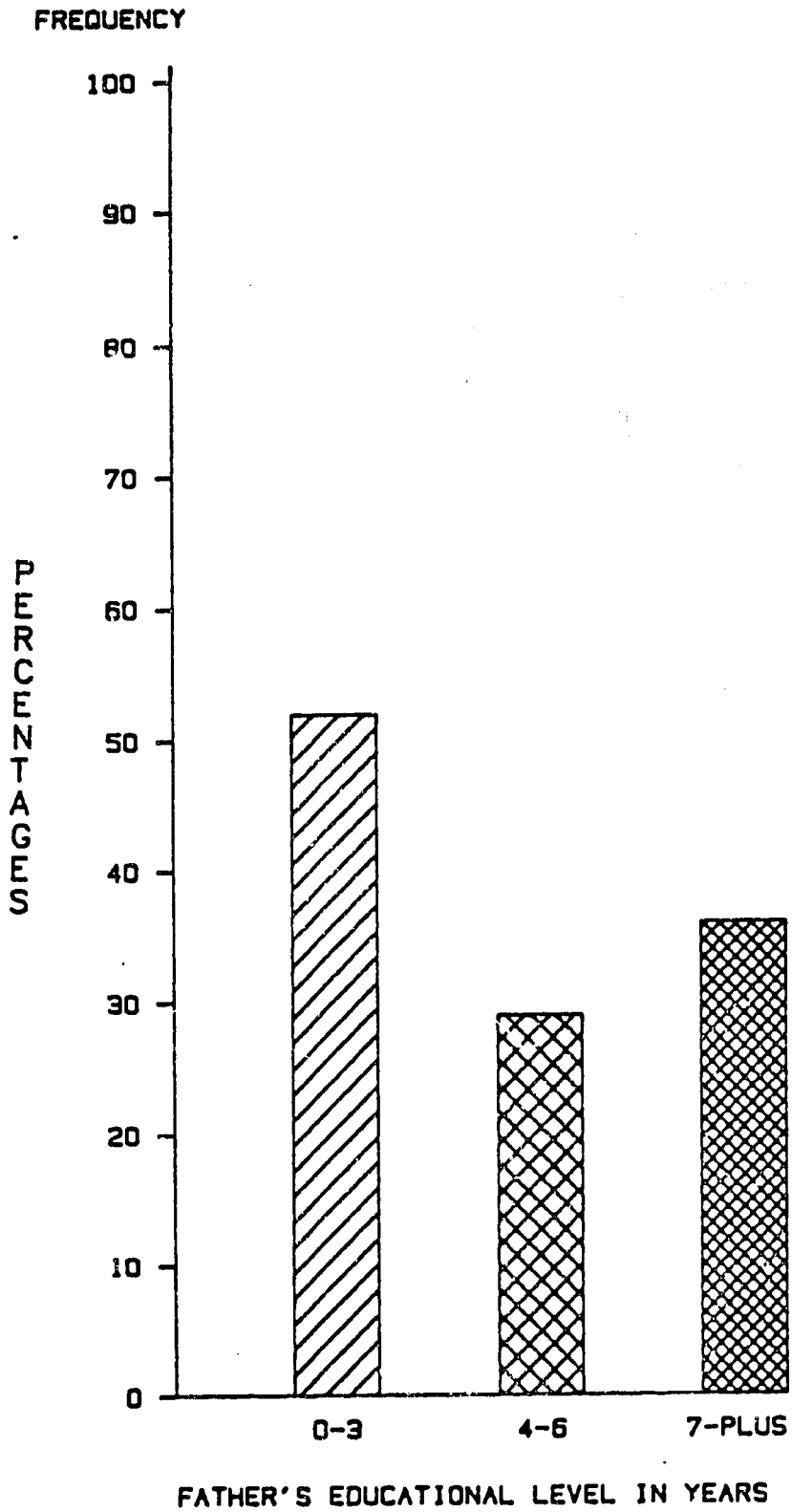

FIGURE 4

YEMEN: PERCENTAGES OF CHILDREN BREAST-FED AT LEAST 6 MONTHS ACCORDING TO FATHER'S OCCUPATION

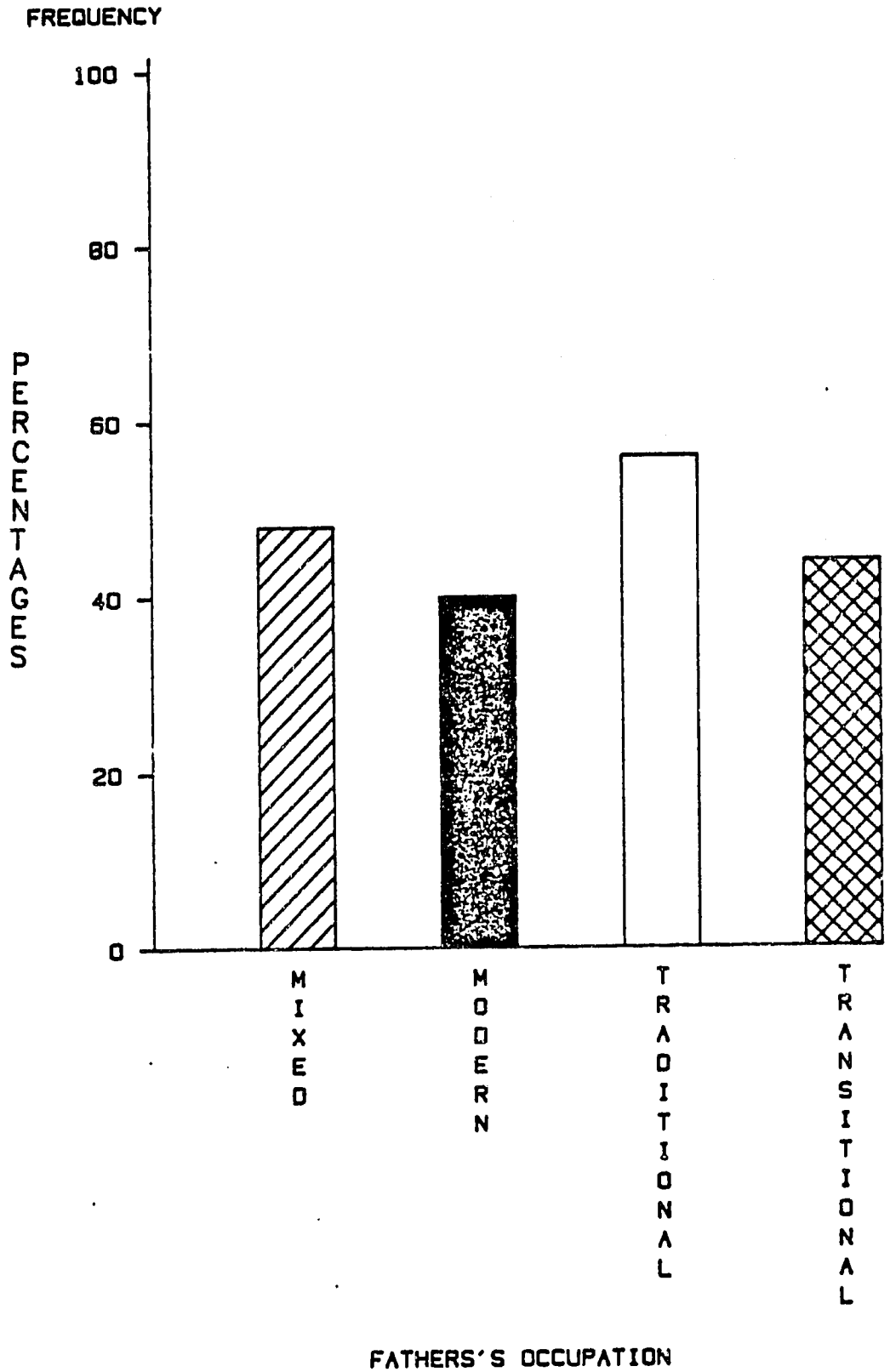

Table 1. Yemen: Percentages of Children Breast-fed at Various Ages: Urban, Rural and Total[1]

Age of Child in Months	Urban	Rural	Total
0[a]	89.4	90.4	90.3
1	83.3	87.5	87.1
2	73.0	84.7	83.7
3	65.8	82.0	80.2
4	60.6	79.1	77.1
5	55.1	76.2	74.0
6	49.4	73.3	70.7
9	40.1	67.6	64.7
12	25.9	48.2	45.8
15	19.2	43.5	41.0
18	17.3	35.3	33.6
21	17.3	34.6	32.7
24	5.2	8.1	7.8
30	5.2	7.5	7.3
36	5.2	7.5	7.3
42	5.2	7.5	7.3
Number of Children	258	2004	2262

[1] Based on life table analysis.

[a] Children breast-fed 1-30 days (i.e., ever breast-fed).

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Table 2. Yemen: Differentials in Mean Duration of Breast-Feeding for Children[1]

Classification of Mother	Mean Duration in months	
1. Urban-Rural		
a. Always an urban resident	10.3	
b. Urban migrant	9.5	
c. Rural	13.1	
d. Total	12.7	
2. Education (yrs. of schooling)	Mother	Father
a. Zero	12.8	13.0
b. 1 to 3	—[a]	8.8[c]
c. 4 to 6	5.0[b]	8.8
d. 7 to 9	—[a]	4.2
e. Greater than 9	—[a]	6.2
3. Work Status		
a. Does not work	11.4	
b. Works at home	14.6	
c. Works away	13.0	
4. Region of residence		
a. North	12.7	
b. South	12.0	
c. West	12.5	
d. East	15.5	
5. Husband's Occupation		
a. Modern	10.5	
b. Traditional	11.6	
c. Mixed blue collar	11.5	
d. Agricultural	14.3	

[1] Based on the current status technique (see text).
[a] No observations for women with this education level.
[b] Based on 17 observations.
[c] The number of observations for fathers with 1-3, 4-6, 7-9, >9 years of schooling are 54, 91, 43, 61 respectively.

Table 3. Yemen: Summary of Empirical Results on Breast-Feeding Decisions[1]

Variable whose effect is being investigated[2]	Effect on Ever-never Decision	Effect on the Decision to Continue or Not of: Effect on Short-duration breast-feeders	Effect on Long duration breast-feeders
1. Mother's education	0	0	a
2. Father's education	0	0	0
3. Work now	0	++	++
4. Work away	-	0	0
5. Urban migrant	0	--	0
6. Always urban resident	0	0	0
7. Desires another child	0	++	0
8. Use of pill	0	0	0
9. Mother's age	0	++	++
10. Male child	0	0	0
11. Father's occupation is:			
Modern	0	0	0
Transitional	0	--	0
Mixed	0	-	0

0 Indicates no effect
+ Indicates positive effect with students' t-statistic significant at .10 level
++ Indicates positive effect with students' t-statistic significant at .05 level
- Indicates negative effect with students' t-statistic significant at .10 level
-- Indicates negative effect with students' t-statistic significant at .05 level

[1] Source: Tables A-4, A-5, A-6 and A-7.

[2] Variable refers to the mother except as indicated. Variables omitted (see list in Table 3) had no significant effects, except a few family composition variables, which are discussed in the text.

[a] Inadequate variance. Variable had to be dropped due to multicollinearity.

Table A-1. Observed Breast-Feeding Frequencies for Children Born in the Four Years Preceding the World Fertility Survey, Yemen

No. of Months Completed	Combined Sample: Absolute Frequency	Combined Sample: Relative Frequency
0	344	15.2
1	208	9.2
2	184	8.1
3	160	7.1
4	133	5.9
5	100	4.4
6	111	4.9
7	72	3.2
8	65	2.9
9	61	2.7
10	24	1.1
11	24	1.1
12	241	10.7
13	35	1.5
14	33	1.4
15	48	2.1
16	38	1.7
17	24	1.1
18	71	3.1
19	13	0.6
20	18	0.8
21	13	0.6
22	6	0.3
23	15	0.7
24	168	7.4
25	4	0.2
26	5	0.2
27	2	0.1
28	7	0.3
29	5	0.2
30	3	0.1
31	4	0.2
32	1	0.1
33	1	0.1
34	3	0.1
35	3	0.1
36 or more	15	0.7

NOTE: Based on combining data for last open-interval and last closed-interval births that occurred within the four-year period.

Table A-2. Yemen: WFS Variables Selected for the Analysis of Breast-Feeding Determinants

Variable[1]	Definition and Brief Rationale
Education	In years completed. Reflects value of time, and household socioeconomic status.
Age of mother	In years. Older women have smaller volume of milk. Also, older women are more traditional in orientation.
Work Now	(1 = mother works in market; 0 = does not work). Mother works in a wage, farming, or other market-oriented occupation; in combination with work away, allows interpretation of impact of maternal working status on breast-feeding.
Work Away	(1 = mother works away from home; 0 = does not work away). Work away is more likely to be incompatible with breast-feeding.
Pill Use	(1 = use of contraceptive pill in interval; 0 = not used). Pill use has been associated with decreased breast-milk production.
Desires Another Child	(1 = an additional child is desired; 0 = no additional child desired). Measures whether women want more children. Relates to effectiveness of use of contraceptive methods.
Occupation of Mother/Father:	
Modern	(1 = modern; 0 = other). Mother/father occupation is professional or clerical.
Transitional	(1 = transitional; 0 = other). Mother/father classifies occupation as household services (also for mother as sales).
Traditional Agricultural	(1 = traditional agricultural; 0 = other). Mother/father classifies occupation as farmer or agricultural laborer.
Mixed Blue-Collar	(1 = mixed blue collar; 0 = other). Mother/father classifies occupation as skilled or unskilled (for father also sales).

1

Table A-2 continued

Variable[1]	Definition and Brief Rationale
Always Urban Resident	(1 = born and currently residing in urban areas; 0 = born in rural area or urban migrant). Measures influences of modern urban living conditions (media exposure, available breast milk substitutes, less social support for children, more exposure to modern health professionals, work situations for women less compatible with breast-feeding).
Migrant to Urban Area	(1 = born in rural area but now an urban resident; 0 = always urban resident, or always rural resident). Measures shorter-term influence of urban living for which less modernization effects are expected (and conversely a more traditional orientation is expected). Alternatively, measures migrant selectivity.
Male	(1 = male; 0 = female). Measures any sex bias against female children in breast-feeding.
Husband's Education	In years completed. A proxy for household socioeconomic status, husband's value of time.
No. of Other Children Aged 0-3	Number of siblings ages 0-47 months. Additional pre-schoolers can increase the value of mother's time at home and increase her likelihood of breast-feeding. On the other hand they also require attention and compete with the infant for the mother's time.
No. of Other Children Aged 4-6	Number of siblings aged 47 to 83 months. They are less time intensive than younger children but are less likely to act as mother-substitutes than older children. In many cultures, they are left alone while older family members work.
No. of Siblings Aged 7-12	Number of siblings (or brothers and sisters) aged 84 to 155 months. Potential mother substitutes for infant feeding (bottle, etc.) in many cultures.
No. of Siblings Ages $\geq$ 13	Number of siblings older (or brothers and sisters) than 156 months. Potential mother substitutes for either infant care or market production.

[1] All variables refer to mother except as indicated.

Table A-3. Yemen: Means and Standard Deviations for Explanatory Variables[1]

Variable	Mean	Standard Deviation
Mother's education level (yrs.)	0.05	0.66
Father's education level (yrs.)	0.59	2.32
Mother: works now	0.47	0.50
Mother: works away	0.11	0.31
Mother's age at birth of last child (yrs.)	26.74	6.97
Male (proportion male)	0.53	0.50
Always urban resident (proportion always urban resident)	0.05	0.21
Urban Migrant (Proportion urban migrant)	0.02	0.13
No. of children by age/sex		
0-3	0.72	0.70
4-6	0.56	0.69
7-12 male	0.40	0.73
7-12 female	0.37	0.69
13+ male	0.24	0.69
13+ female	0.22	0.63
Father's occupation		
Modern	0.04	0.21
Transitional	0.22	0.42
Mixed Blue Collar	0.33	0.47
Agricultural/Traditional	0.41	0.49
Desires Another Child	0.72	0.45
Pill Use	0.01	0.10

[1] Represents the proportion of cases unless otherwise noted. Based on the overall ever-never breast-feed sample.

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Table A-4. Determinants of Probability that Children in Yemen Were Breast-Fed at Specified Ages

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
1. Constant	0.794 (3.725)**	0.333 (1.186)	0.062 (0.211)	-0.205 (-0.788)	0.018 (0.069)	-0.190 (-0.724)	-1.068 (-3.729)**
2. Always Urban Resident	-0.140 (-0.937)	-0.206 (-1.204)	-0.162 (-0.914)	-0.320 (-1.866)*	-0.334 (-1.851)*	-0.382 (-2.010)**	-0.308 (-1.392)
3. Urban Migrant	0.246 (1.033)	-0.749 (-3.598)**	-0.803 (-3.538)**	-0.809 (-3.459)**	-0.779 (-2.915)**	-0.799 (-2.711)**	-0.491 (-1.527)
4. Mother's Education	0.014 (0.296)	-0.049 (-0.653)	-0.018 (-0.222)	0.006 (0.070)	0.060 (0.681)	0.074 (0.839)	a
5. Father's Education	-0.022 (-1.383)	-0.020 (-1.008)	-0.044 (-2.165)**	-0.047 (-2.302)**	-0.075 (-3.368)**	-0.072 (-2.941)**	-0.075 (-2.477)**
6. Works Now	0.0143 (0.172)	0.410 (3.766)**	0.582 (4.983)**	0.478 (4.695)**	0.442 (4.280)**	0.407 (4.018)**	0.568 (5.219)**
7. Works Away	-0.232 (-1.900)*	0.114 (0.571)	0.038 (0.185)	0.009 (0.054)	-0.108 (-0.645)	0.010 (0.066)	-0.188 (-1.118)

Table A-4 (cont'd)

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
8. Father's Occupation Modern	-0.104 (0.549)	-0.239 (-1.085)	-0.178 (-0.755)	-0.209 (-0.961)	-0.204 (-0.891)	-0.282 (-1.193)	-0.248 (-0.903)
9. Father's Occupation Transitional	0.137 (1.337)	-0.254 (-2.026)**	-0.362 (-2.753)*	-0.344 (-2.913)**	-0.420 (-3.469)**	-0.334 (-2.772)**	-0.228 (-1.756)*
10. Father's Occupation Mixed	-0.065 (-0.746)	-0.150 (-1.303)	-0.228 (-1.895)*	-0.184 (-1.716)*	-0.273 (-2.483)**	-0.216 (-2.008)**	-0.120 (-1.035)
11. Mother's Age at Birth of Last Child	0.008 (1.103)	0.032 (3.088)**	0.033 (3.112)**	0.031 (3.256)**	0.020 (2.135)**	0.016 (1.703)*	0.028 (2.785)**
12. Desires Another Child	-0.018 (-0.211)	0.182 (1.756)*	0.247 (2.301)**	0.172 (1.740)*	0.197 (1.962)**	0.092 (0.920)	0.150 (1.39[illegible])
13. Male	0.115 (1.575)	-0.179 (-1.958)*	-0.054 (-0.567)	0.027 (0.310)	-0.056 (-0.629)	-0.072 (-0.813)	0.017 (0.178)
14. Number of Children Aged 0-3	-0.018 (-0.346)	-0.034 (-0.501)	-0.023 (-0.324)	-0.003 (-0.041)	-0.076 (-1.168)	-0.105 (-1.621)	-0.081 (-1.157)

Table A-4 (cont'd)

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
15. Number of Children Aged 4-6	0.094 (1.548)	0.010 (0.132)	0.000 (0.00[illegible])	0.008 (0.114)	0.001 (0.001)	0.043 (0.621)	0.040 (0.539)
16. Number of Sisters Aged 7-12	0.012 (0.196)	-0.087 (-1.146)	-0.001 (-0.017)	0.005 (0.069)	-0.049 (-0.668)	-0.080 (-1.117)	-0.025 (-0.318)
17. Number of Brothers Aged 7-12	-0.146 (-2.703)**	-0.008 (-0.105)	-0.054 (-0.718)	-0.008 (-0.110)	0.014 (0.198)	-0.005 (-0.067)	0.012 [0.170]
18. Number of Sisters Aged 13+	-0.066 (-0.992)	-0.123 (-1.328)	-0.123 (-1.170)	-0.062 (-0.658)	0.027 (0.271)	0.054 (0.562)	-0.042 (-0.418)
19. Number of Brothers Aged 13+	0.017 (0.262)	-0.002 (-0.021)	0.133 (1.133)	0.011 (0.123)	0.075 (0.822)	0.103 (1.191)	0.038 (0.426)
20. Pill Use	-0.307 (-0.981)	0.022 (0.060)	-0.370 (-1.001)	-0.393 (-1.046)	-0.390 (-0.948)	-0.029 (-0.067)	-0.667 (-1.147)
Number of Observations	1783	1306	1151	1113	967	894	770
X^2	23.42	89.99	131.44	131.52	129.72	110.90	100.43

[a]Dropped due to multicolinearity problem
*Significant at 0.10 level
**Significant at 0.05 level

Table A-5. Effects of Simulated Changes in Selected Explanatory Variables on the Probability of Breast-Feeding Children--Yemen

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
A. Predicted Probabilities: All Variables at Means	0.846	0.878	0.864	0.767	0.690	0.564	0.435
B. Simulated Marginal Change							
1. Residence Changes from Rural to Urban Migrant	-0.051	-0.210*	-0.242*	-0.294*	-0.299*	-0.305*	-0.180*
2. Mother's Education Increases 1 S.D.	0.002	-0.005	-0.002	0.001	0.011	0.015	a
3. Father's Education Increases 1 S.D.	-0.013	-0.009	-0.022*	-0.033*	-0.064*	-0.064*	-0.061*
4. Mother Not Working to Working at Home	0.003	0.082*	0.124*	0.143*	0.152*	0.159*	0.222*
5. Mother Works at Home To Work Away	-0.060*	0.016	0.005	0.002	-0.034	0.004	-0.075

Table A-5 (cont'd)

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
6. Father's Occupation From Not Modern To Modern	0.023*	-0.054	-0.042	-0.068	-0.075	-0.112	-0.095
7. Father's Occupation Changes from Not Transitional to Transitional	0.031	-0.056*	-0.088*	-0.111*	-0.155*	-0.132*	-0.089*
8. Father's Occupation Changes from Not Mixed to Mixed	-0.016	-0.031	-0.052*	-0.057*	-0.098*	-0.085*	-0.047
9. Mother's Age Increases 1 S.D.	0.014	0.039*	0.044*	0.060*	0.047*	0.043*	0.077*
10. Desires Another Child	-0.004	0.039*	0.057*	0.054*	0.071*	0.036	0.059
11. Child's Sex Changes from Female to Male	0.027	-0.036*	-0.012	0.008	-0.020	-0.028	0.007

Table A-5 (cont'd)

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
12. No. of Children 0-3 Increases 1 S.D.	-0.003	-0.005	-0.004	-0.006	-0.019	-0.030	-0.023
13. No. of Children 4-6 Increases 1 S.D.	0.015*	0.001	-0.001	0.002	0.002	0.012	0.011
14. No. of Sisters 7-12 Increases 1 S.D.	0.002	-0.013	-0.002	0.001	-0.012	-0.022	-0.007
15. No. of Brothers 7-12 Increases 1 S.D.	-0.027*	-0.001	-0.008	-0.002	0.003	-0.001	0.004
16. No. of Sisters 13+ Increases 1 S.D.	-0.010	-0.016	-0.016	-0.011	0.005	0.012	-0.009
17. No. of Brothers 13+ Increases 1 S.D.	0.003	-0.003	0.017	0.002	0.017	0.027	0.010

Table A-5 (cont'd)

	Number of Months						
	Ever Breast-Fed	3 Months	4.5 Months	6 Months	9 Months	12 Months	15 Months
18. Pill Changes from Non Use to Use	-0.084	0.004	-0.097	-0.135	-0.148	-0.011	-0.233

Source: Derived from the probit results presented in Table A-4.

S.D. = standard deviation

*The absolute value of the t statistics for the coefficient of this variable in the probit results was greater than 1.5 (significant at about the .13 level).

[a]Dropped due to multicollinearity.

Table A-6. Differences in the Probability of Continuing of Breast-Feeding at Different Durations, Yemen

		4.5-Month Cutoff (1-9 Month Duration)	15-Month Cutoff (Greater than 9-Month Duration)
1.	Constant	-0.506 (-1.350)	-0.655 (-1.865)*
2.	Always Urban Resident	0.091 (0.408)	-0.210 (-0.716)
3.	Urban Migrant	-0.564 (-2.119)**	0.091 0.180
4.	Mother's Education	-0.082 (-0.648)	a
5.	Father's Education	-0.021 (-0.904)	-0.008 (-0.161)
6.	Works Now	0.567 (3.836)**	0.487 (3.653)**
7.	Works Away	0.064 (0.251)	-0.230 (-1.183)
8.	Father's Occupation Modern	-0.194 (-0.691)	-0.179 (-0.482)
9.	Father's Occupation Transitional	-0.349 (-2.084)**	-0.063 (-0.394)
10.	Father's Occupation Mixed	-0.251 (-1.631)	0.031 (0.223)
11.	Mother's Age at Birth of Last Child	0.030 (2.174)**	0.029 (2.340)**
12.	Desires More Children	0.307 (2.278)**	0.042 (0.309)

[a]Dropped due to multicollinearity.

Table A-6 (cont'd)

	4.5-Month Cutoff (1-9 Month Duration)	15-Month Cutoff (Greater than 9-Month Duration)
13. Male	-0.071 (-0.601)	0.011 (0.092)
14. No. of Children Aged 0-3	0.019 (0.211)	-0.019 (-0.225)
15. No. of Children Aged 4-6	-0.042 (-0.431)	0.056 (0.595)
16. No. of Sisters Aged 7-12	0.120 (1.075)	0.067 (0.688)
17. No. of Brothers Aged 7-12	-0.147 (-1.567)	-0.001 (-0.009)
18. No. of Sisters Aged 13+	-0.240 (-1.625)	-0.132 (-1.181)
19. No. of Brothers Aged 13+	0.167 (1.026)	-0.030 (-0.288)
20. Pill Used	-0.415 (-0.921)	-0.670 (-0.878)
Number of Observations	525	510
X^2	70.07	28.06

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Table A-7. Effects of Simulated Changes in Selected Explanatory Variables on Breast-Feeding When Structural Shift is Present--Yemen

	4.5-Month Cutoff (1-9 Month Duration)	15-Month Cutoff (Greater than 9-Month Duration)
A. Predicted Probabilities All Variables at Means	0.652	0.645
B. Simulated Marginal Change		
1. Residence Changes From Rural to Urban Migrant	-0.220*	-0.033
2. Mother's Education Increases 1 S.D.	-0.016	a
3. Father's Education Increases 1 S.D.	-0.021	-0.004
4. Mother Not Working To Working at Home	0.201	0.179
5. Mother's Place of Work Changes from Home to Away	0.019	-0.080
6. Father's Occupation From Not Modern to Modern	-0.074	-0.068
7. Father's Occupation From Not Transitional to Transitional	-0.132*	-0.024
8. Father's Occupation From Not Mixed to Mixed	-0.094*	0.012
9. Mother's Age Increases 1 S.D.	-0.070*	0.072*
10. Desires Additional Children	0.116*	0.016
11. Child's Sex Changes from Female to Male	-0.026	0.004
12. No. of Children 0-3 Increases 1 S.D.	0.005	-0.005

Table A-7 continued

	4.5-Month Cutoff (1-9 Month Duration)	15-Month Cutoff (Greater than 9-Month Duration)
13. No. of Children 4-6 Increases 1 S.D.	-0.010	0.014
14. No. of Sisters 7-12 Increases 1 S.D.	0.029	0.017
15. No. of Brothers 7-12 Increases 1 S.D.	-0.039*	-0.002
16. No. of Sisters 13+ Increases 1 S.D.	-0.047*	-0.032
17. No. of Brothers 13+ Increases 1 S.D.	0.032	-0.008
18. Pill Changes from Nonuse to Use	-0.161	-0.262

Source: Derived from table A-6.

* The absolute value of the t statistic for the coefficient of the variable in the probit results was greater than 1.5 (significant at about the .13 level).

S.D. = Standard Deviation.

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Technical Appendix

There are three major statistical techniques used in this paper: the life table, the current status method, and the probit maximum likelihood procedure. We will discuss each estimation method and present rationales for their use.

Life Tables

Life tables have been used by demographers to study mortality for many decades. A life table provides a life history of a group or cohort of people, showing the extent to which it is diminished gradually by deaths. Three assumptions are implicit in its construction: (1) the cohort is closed to migration, so no changes occur except losses from death; (2) mortality conditions are constant over time; and (3) losses (e.g., deaths) are evenly distributed over the time period under consideration (usually a year). Two special terms used in life tables are also worth defining here: l_x is the number of survivors at exact age x (i.e., reaching their xth birthday); and ${}_nq_x$ is the conditional probability of dying during the interval from age x to age x + n.

Life tables are usually constructed from data on the population aged x in a year (i.e., at the midpoint of the year) and deaths during the year by age. These data are used to compute the (conditional) q_x and l_x values, with people exiting because of death only. Because exit is due to one cause only (death), they are called single decrement life tables. In the analysis of breast-feeding, however, there are two possible ways children exit or suffer "mortality" from the population of breast-fed children--by either (1) ceasing to be breast-fed or (2) dying. Therefore the

appropriate technique is a multiple decrement technique. (For an early and standard reference, see Sheps, 1965).

In applying this technique to breast-feeding, children who die are excluded from the denominator because they die prior to the computing of the probabilities of "surviving" (being breast-fed). Thus the life table parameters for breast-feeding are probabilities of breast-feeding surviving children.

Let us return to the three assumptions required in the construction of life tables. Assumption 2 is not strictly correct in most contemporary societies, where both mortality (especially infant) and breast-feeding are probably declining. These declines are almost universally ignored, and are of negligible importance for the short (four-year) period we use here. Assumption (3) about losses being evenly distributed over the time interval (month) requires our assuming that when the reported number of months breast-fed and the reported age at death of a child are the same, an average of one-half month should be assigned for breast-feeding (included in both the numerator and denominator). Finally, the most important assumption, that the cohort be closed (to migration, normally), has in a sense already been addressed. Deaths of children are treated as equivalent to out-migrations, and the dead children are excluded prior to computing the (conditional) probabilities of breast-feeding.

Current Status Method

The reported durations of breast-feeding obtained from retrospective questions to women in surveys are known to be characterized by very serious age heaping. The current status method overcomes this problem. All that

is required for the current status method is that women report reasonably accurately the dates of their children's births and whether or not the child is currently being breast-fed.

The proportion of children being breast-fed at various durations, y, is then computed. First the likelihood of each age child currently being breast-fed is calculated:

$$\hat{\ell}_y = \frac{\text{Number of women currently breast-feeding a child born } y \text{ months before interview}}{\text{Number of women with a birth } y \text{ months before the interview}}.$$

In practice, this statistic is usually calculated assuming all closed interval children are no longer being breast-fed, so that such children only appear in the denominator of $\hat{\ell}_y$. In addition, in our computations we exclude children that die within the first month after birth. The measure of mean duration is then calculated by summing the $\hat{\ell}_y$'s (see Smith, 1980, 1981).

In our application of the current status method, severe fluctuations from month-to-month led us to group the data in three-month intervals. The resultant current status figures are also not strictly comparable to the life table because current status figures are developed only for children <u>ever</u> breast-fed.

Statistical Issues for the Multivariate Analysis

The purpose of this section is to discuss briefly several statistical problems that must be resolved in an analysis of the determinants of breast-feeding. The analysis of the binary choice decision variable, to breast-feed or not to breast-feed, can be handled within a standard discrete dependent variable framework. The method we have chosen is the probit technique, a procedure widely applied in diverse disciplines (for a

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textbook explanation, see Pindyck and Rubinfeld [1976], chap. 8). The computer program that we use to carry out the probit estimation method also allows us to use the sample weights provided in the WFS data. These weights were renormalized for each regression subsample. Thus, our estimated coefficients take into account potential sampling problems and assure us of a nationally representative sample.

The analysis of the factors that influence the duration of breast-feeding is a difficult problem. It would be statistically simple if we could investigate the determinants of the duration by employing a continuous dependent variable in a linear regression model; we shall now explain why such a simple model is not adequate.

The standard linear regression model is written as,

$$Y_t^* = X_t\beta + \mu_t \tag{1}$$

where Y_t^* is the observed number of months the child is breast-fed, X_t is a 1 by k vector of factors that influence the duration decision, β is a k by 1 vector of regression coefficients to be estimated, and μ_t is a random unobserved disturbance term. Under standard conditions in such a model, we assume the μ_t to be an independent, identially distributed random variable, with a mean of zero and a constant variance of ρ^2. If these assumptions hold and the μ_t and X_t are independent of each other, the ordinary least square method provides the best linear unbiased estimator for β.

Unfortunately, the data, for two reasons, do not behave in such an ideal manner. First, Y_t^* can be truncated by either pregnancy or the birth of another child (in the case of the closed-interval child) or by the date of interview (in the case of the last birth or open-interval child). This means that if we are dealing with a closed-interval child, we actually

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observe the correct variable Y_t^*, the duration of breast-feeding, only when the mother stops breast-feeding before or exactly at the birth of another child.

A similar type of truncation occurs for open-interval children. In this case, we only observe Y_t^* when the mother stops breast-feeding the child before or exactly at the date of the interview. If at the time of the interview the child is still being breast-fed, we cannot know how much longer the child will continue to be breast-fed.

The effect of this truncation problem is that ordinary least squares estimation cannot be used to analyze the determinants of breast-feeding because (for a substantial portion of the data) the dependent variable is not observed. Moreover, even if the variable were observed over its entire range, the digit preference problem that is common among retrospective survey data would preclude the use of ordinary least squares as a viable estimation technique. The data used in our analysis reveals a strong tendency for respondents to round towards half-year digits (particularly at 12, 18, and 24 months). Statistically this digit preference problem means that X_t and μ_t are likely to be correlated. To see this, suppose the X_t characteristics of a woman were such that she would be expected to breast-feed for 11 months. But the respondent would instead tend to respond that she breast-fed the child 12 months. Thus, the error term μ_t would tend to be positive when X_t assumed the configuration that should lead to a prediction of eleven. By similar argument, if the X_t configuration were such that we would expect a response of 13 months, the corresponding μ_t would tend to be negative since 12 would often be reported instead. If we ignored the correlation between X_t and μ_t and used the ordinary least

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squares regression method, the resulting estimates of β would be biased and inconsistent. The results of any analysis of the determinants of breast-feeding on the basis of such estimates would be highly suspect.

Our solution to these two statistical problems involves reformulating the continuous variable, duration of breast-feeding, as a discrete variable. For example, define the discrete variable Y_t as follows:

$$Y_t = \begin{cases} 0 \text{ if } Y_t^* < 9 \text{ months} \\ 1 \text{ if } Y_t^* > 9 \text{ months} \end{cases}$$

If Y_t^* were exactly equal to 9 months, then Y_t would be randomly assigned a value of 0 or 1 with equal probability. It is easy to see how this categorization solves the truncation problem since it is no longer necessary to observe Y_t^* through its entire range. Rather it is only necessary that the mother have the opportunity to breast-feed the child through the particular cut-off date chosen. The cut-off point chosen in defining the discrete variable is more or less arbitrary. However, it is clear that the higher the age cut-off chosen, the more observations will be lost due to truncation by date of interview (i.e., fewer children will be at least as old as the cut-off). Digit preference points can be used as the cut-off as long as there is no <u>systematic</u> rounding - either upward or downward - around the cut-off point by respondents. A small problem with this approach is that we assign children that fall on a digit preference point to the 0 or 1 category with equal probability when, in fact, attrition necessarily occurs as duration increases: fewer children are breast-fed at 10 than at 8 months. Because of this slight attrition problem we consider a fairly large number of cut-offs, some that are digit preference points and some that are not. The 2-, 6-, and 12-month cut-offs

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are chosen because they are typically considered important for health or population policy reasons. The 4, 5, 9, and 15 month cut-offs are chosen because they are not digit preference points; few observations have to be arbitrarily assigned to the 0 or 1 category. Once a cut-off is chosen, and the discrete variable Y_t defined, the probit technique is appropriate as the method of estimation.

The final statistical issue to be discussed is the stability of the coefficients of equation (1). As pointed out earlier, if there is a stable relationship between the determinants of breast-feeding and the duration of breast-feeding, then regardless of the cut-off chosen, we should obtain estimates of the coefficients that are invariant to the choice of cut-off. This may not be the case. For example, a variable may be of little importance in distinguishing short and medium duration breast-feeders, but quite important in identifying medium and long duration breast-feeders. The effects of certain variables may even be opposite in direction in the two cases. Thus, if all women with short and long duration of breast-feeding are grouped together, the effect of some variables may be obscured in the statistical results.

If we could use continuous data, this complication of different structures for different durations could be handled with a non-proportional hazards model. Unfortunately, the existence of the digit preference problem discussed above precludes the use of this model because it requires a continuous dependent variable. Thus, we use a discrete analogue to the hazards method using various shift points, based on what we consider to be reasonable time intervals, and divide each population into two subpopulations. Then we estimate separate equations for each

subpopulation.

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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.