



AN EVALUATION OF THE METHODOLOGY
FOR ANALYZING THE PATTERNS AND DETERMINANTS
OF BREASTFEEDING AND MORTALITY
IN THE NEAR EAST

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EXECUTIVE SUMMARY

The purpose of the evaluation was to review and provide technical guidance to the AID/UNC contract for the analysis of the patterns and determinants of breastfeeding and mortality in the Near East. Two prototype analyses of data from Jordan on infant mortality and breastfeeding were the basis for the investigators' detailed discussions on site with the UNC contractor at Chapel Hill.

In general, the evaluators feel that substantial progress has been made on both parts of the project. Appropriate techniques are being applied competently. There are a number of areas, however, where it is felt that improvement could be made. The team offers general and specific technical suggestions, and it urges in particular the increased coordination of the two projects to ensure greater comparability of results. The evaluators strongly recommend that the final report include a comparison of results from both parts of the project because this will add considerably to the document's value for policymakers. To facilitate this task, efforts must be made to ensure comparability in analysis to the greatest degree possible. Additional attention also must be given to the presentation of results in a manner that can be interpreted easily by potential users.

I. INTRODUCTION

John Knodel (University of Michigan) and Jane Menken (Princeton University) were asked to serve as a review panel to evaluate the methodology proposed for use in a project entitled "The Patterns and Determinants of Breastfeeding and Mortality in the Near East." The project is being carried out at The University of North Carolina at Chapel Hill (UNC). It is funded by the AID Bureau for the Near East. The evaluation team visited UNC on April 8-9, 1981, and was present at a debriefing on April 10, 1981 at the AID Near East Bureau in Washington, D.C.

II. OBSERVATIONS AND FINDINGS

Introduction

The first set of studies of the patterns and determinants of mortality and breastfeeding in the Near East consists of an analysis of data from the World Fertility Survey (WFS) in Jordan, the only country in the study for which data are available. The study team divided the work into two separate projects, one on mortality and one on breastfeeding, which are being carried out by non-overlapping groups of investigators from The University of North Carolina. (Jeremiah Sullivan, Arjun Adlakha, and C. M. Suchindran have undertaken the mortality investigation; Barry Popkin, John Atkin, Richard Bilsborrow, and David Guilkey are analyzing breastfeeding.) The investigators' approaches are similar in a number of important ways, and especially in their methodological sophistication, but they are also quite different. For this reason, it is especially useful to carry out at this time a detailed evaluation of the project. The work on Jordan can be viewed as a pilot study for the entire project and the comparability of results can be ensured between the two parts and among all countries in the Near East which are to be included in the remaining work.

In the first section of this chapter, the evaluators address the patterns and determinants of breastfeeding; in the second section, they assess the analysis of data on infant mortality. General comments on the analyses and recommendations for the presentation of future results are offered in Chapter III. The evaluators have focused on areas that can be improved, but they stress that they are positively impressed by the execution of the project to date.

Patterns and Determinants of Breastfeeding

The data on breastfeeding in all World Fertility Surveys are seriously flawed by sampling biases and measurement and recall errors, yet they are the best available source of such information. It is, therefore, especially important that in the analysis of these data the information be used to the fullest extent possible even though allowance is made for the quality of the individual records. The breastfeeding project employs advanced statistical methods in a multivariate analysis which takes into account problems that were not addressed in earlier work. However, the analyses and the presentation of results can be improved in several ways.

A. Basic Descriptive Statistics

Only two sets of descriptive statistics are presented: breastfeeding life tables of children of urban and rural women and a distribution of the reported duration of breastfeeding (to measure digit- or duration-heaping). Data on breastfeeding duration are available only for last and next-to-last children. To reduce the bias introduced by the omission of children for whom data were not collected, statistics were calculated from information on children born within the four years prior to the survey. Still, in Jordan, 29 percent of children born within this period were excluded from the calculations.

Any child whose mother subsequently had at least two children in four years or less is likely to have been breastfed for a relatively short time. Therefore, the sample for which breastfeeding data are available is biased against short intervals. The life tables calculated from these data overestimate the duration of breastfeeding by some unknown amount.

Another method for measuring the duration of breastfeeding for all children born within a time period can be adapted from the method proposed by Page and Lesthaeghe. The Page and Lesthaeghe method assumes that a child who has at least one younger sibling is no longer being breastfed, and it uses only "current-status" information that reveals whether or not a child born x months before the survey is still being breastfed.

Using the current status method, the mean duration of breastfeeding can be calculated for all children and at least for sizable subgroups of the population (e.g., children of women categorized by education, by father's education or occupation, maternal age at birth, etc.). The means provide useful descriptive information on overall breastfeeding practice and differentials within the population and are especially important for comparison with infant mortality rates in these same subgroups. The evaluators therefore strongly recommend that current-status estimates of the mean duration of breastfeeding be made for categories that are comparable to the categories used in the mortality analysis.

B. Sample Selection Bias and Trend Analysis

Because data on breastfeeding were collected only for the last closed- and open-birth interval (i.e., for the last and next-to-last child), the longer ago a child was born, the more likely it is that no information on breastfeeding will be available. No data are available for nearly 30 percent of the children born within the four years preceding the survey, even when the sample is restricted to that group. The investigators have concluded, reluctantly, that no analysis of trends in breastfeeding can be carried out for Jordan. The evaluators concur with this opinion.

The sample selection bias may affect all subsequent analyses, although, like the investigators, the evaluators suspect that the bias is small in the multivariate analysis because of the controls for the characteristics of parents. However, it would be wise to check this assumption. Several checks are possible. For example, the sample could be split into births that occurred less than two years, and between two years and four years, before the survey, and separate analyses could be made. There should be almost no children in the first group for whom breastfeeding data are omitted. If the results are comparable, then the sampling bias is minimal. The sample might also be split into children of mothers who had fewer than three, or three or more, children in that period. Again, if the results of separate multivariate analyses are similar, the sampling bias is not a serious problem. If it becomes obvious that the results are affected by the selective omission of data, the sample could be restricted to births that occurred within the three years preceding the survey. It should be stressed here that it is unlikely that other countries will have as severe a sample problem unless they also have a fertility rate that is as high as the rate in Jordan. The sample for the multivariate analysis should exclude children who died within the first two months of life because the date of death and the date of breastfeeding termination for children who died shortly after birth are subject to considerable error, and no adequate correction or adjustment procedure has been found.

C. Choice of Dependent Variable

The problems of misreporting the duration of breastfeeding and the heaping on half-year intervals beginning at 12 months have been solved by using a set of dichotomous dependent variables that specify whether or not breastfeeding started or lasted less than or more than x months ($x = 3, 4.5, 6, 9, 12, \text{ and } 15$ months). Separate analyses are carried out for each of the variables. It is far better to use this method than to treat the data as if they were reported accurately.

D. Choice and Specification of Covariates

Breastfeeding is assumed to be affected by residence, maternal and paternal education, maternal age, number and sex composition of children in family, religion, sex of infant, maternal work force participation and its location, and pill use. Education is measured in years.

The assumption of a linear trend with education may be inappropriate. In many countries, it seems likely that some kind of threshold effect or step-function is operating. The evaluators recommend that the analysis be repeated using categories for education (and for other variables) that are comparable to the categories in the mortality paper.

It should be noted that one should be particularly cautious about making inferences from results for the last three factors. Pill use is measured only when it is determined that the pill was ever used in the birth interval. In fact, pill use may begin after breastfeeding ends. There is no way to determine whether, for example, pill use leads to early termination of lactation, or vice versa. Labor force participation is measured only at the time of the survey and not at birth or when a child reaches a specified age. In addition, it is clear that labor force characteristics are measured differently in the various WFS countries. Consequently, the data and the results may not be comparable even within a single region.

E. Statistical Estimation Procedures

The heaping on of certain digits when they are cutoff points for the definition of a dichotomous dependent variable is handled in this way: If a response falls on the cutoff point (e.g., six months), it is randomly assigned to the less-than-or-greater-than-six-months category. This is a standard statistical procedure for handling ties in data where it is equally likely that the duration should have been above or below the cutoff point but was reported erroneously. It is not certain that this assumption is appropriate for the breastfeeding data for several reasons. For example, the number erroneously reported at six months may not come equally from duration at five and seven months. However, no other procedure is available for this situation, except dropping all the heaped responses and losing a fair amount of information. The investigators tried this procedure and found little difference in the results.

The analysis uses a weighted probit program developed by the investigators. This is a sophisticated and appropriate procedure for this situation. However, it is not certain how the weights affect the t-statistics used for testing the significance of the effects of various factors. The paper reports as significant observed t-values, with $p < .13$. Some discussion of the bias in the t-values and the choice of the p-value just given is essential. A justification of the claim that weighted probit is better than unweighted is called for, especially since unweighted observations are used in the mortality investigation.

Since probit results are not interpreted easily, even by technically sophisticated demographers, a greater effort must be made to communicate the results in clear, understandable language. The presentation should include a description of the chi-squared and t-tests used and of the impact of changes in covariates. Tables 5 and 7, which present some measures of the effects of the covariates, should be expanded and explained more fully in the text.

The investigation of the determinants of early and later termination of breastfeeding is especially interesting and it should provide information of particular policy relevance.

F. Presentation of Results

As has been mentioned, the evaluators believe that estimates of duration of breastfeeding according to various characteristics are useful and informative. The probit discussion needs considerable amplification. As a minimum, a description of how the effects of changes in a single variable are calculated should be included. It would also be helpful to provide a table of estimates of the predicted mean duration of breastfeeding for subgroups of the population defined along several characteristics.

Analysis of Infant Mortality

In general, the evaluators found the prototype analysis of infant mortality based on the Jordan Fertility Survey to be well done. The investigators are clearly abreast of the important methodological issues, as well as the appropriate techniques for dealing with those issues, and they have a genuine feeling for the problems that are associated with the kinds of data gathered in surveys such as the World Fertility Survey. Considerable attention has been given to the problems of omission of deaths, misstatement of age at death, and truncation bias. In large part, these problems are dealt with in a reasonable and appropriate manner. Moreover, the investigators are well informed about the most appropriate approaches for analyzing the data, both in terms of obtaining estimates of mortality and in applying multivariate techniques to the data. A birth file which is derived from the standard recode tape and which is the basis for the investigators' analysis was apparently created successfully; few, if any, problems were encountered.

A. Value of the Prototype Analysis

The team believes that several aspects of the prototype analysis are particularly valuable.

1. Attention to neonatal and post-neonatal mortality and the overall level of infant mortality. The analysis clearly demonstrates that mortality early and late in the first year is not necessarily associated with the same variables and that there is, therefore, considerable value in treating the two components of infant mortality separately.
2. Adjustment of infant mortality for the misstatement of age at birth (some deaths which actually occurred prior to the first birthday are reported as occurring at age one year as a result). The need for this adjustment was convincingly demonstrated, and the procedure which is used appears to be reasonable.

3. Restriction of the analysis to periods when problems of death omission are less serious.
4. General sensitivity to problems of data quality throughout the paper and caution when presenting results. For example, results showing differences and trends in male and female mortality are always accompanied by appropriate warnings about a likely sex-selective recall bias.
5. Sensitivity to and interest in differences in indirect and direct estimates of mortality. Some comparison has already been done based on the pregnancy history, but it is intended that more will be done when the data from the household questionnaire become available. This dimension of the research project should be of considerable methodological value to researchers other than those who are interested in the substantive findings for the Middle East. However, to do this project properly, more time and funds than are allocated at this time will probably be needed.
6. The combined presentation of univariate demographic and socioeconomic differentials and a multivariate analysis of the same demographic and socioeconomic differences as they affect infant mortality. Use of a logistic regression approach to the multivariate analysis is an appropriate methodology for achieving the intended purpose. Not entering sex as a covariate in the multivariate analysis is judged to be an appropriate way to avoid the problem associated with sex-selective recall bias.

B. Considerations and Recommendations for Improvement

The evaluators believe that the analysis is on the right track, but they still believe improvements can be made. A number of considerations and recommendations for improving the analysis are offered below.

1. Given the importance of separately examining neonatal and postnatal components of infant mortality, attention needs to be given to the potential effect of age misstatement on the classification of deaths into these two categories. In particular, there is reason to believe that some deaths which occurred in the first month of life were reported as occurring when the child was one month old. It seems likely that some women would report children who died toward the end of the first month of life as being age one

month at death. An attempt should be made to estimate the extent to which this occurs and to consider ways to avoid this problem. For example, cutting points other than one month might be used to distinguish early from later infant deaths. One obvious choice would be a two-month cutoff point, since it seems unlikely that many neonatal deaths would be reported as occurring at age two months or older. Another alternative might be to assign some proportion of the deaths reported as exactly one month to the under-one-month category. The method would be similar to the method used to treat deaths reported at exactly one year of age. Some attention might also be given to the extent to which omission of deaths, as distinct from age misstatement, contributes to the relatively low levels of neonatal mortality observed. For example, even if half the deaths reported as occurring at one month of age were assigned to the neonatal category, the proportion of infant deaths that occur by one month of age appears to be lower than the proportion that would be expected in most populations experiencing comparable levels of infant mortality.

2. It would be useful to compare mortality rates obtained through the current analysis with mortality rates available from other sources, both in Jordan and in the other countries that will be analyzed. The evaluators expect that, in many cases, the estimates of infant mortality obtained through this project will be superior and far more plausible than some of those reported elsewhere. For example, the infant mortality rate of 22 per 1,000 presented in Table 1 of the project proposal and attributed to the World Bank is clearly implausible, given the findings of the current analysis.
3. It would be useful to extend the analysis to include child mortality and infant mortality. Quite possibly, the correlates of child mortality may prove to be considerably different from those of infant mortality, and in much in the same way that interesting differences were revealed when neonatal and post-neonatal mortality was examined. Moreover, the inclusion of child mortality might be useful in determining which family of model life tables is most appropriate for use in Middle Eastern populations. More attention should be given to this problem to improve the application of indirect mortality estimates to Middle Eastern data. It is also necessary to consider whether age differences in male and female infant

and child mortality are large enough to justify the application of different families of model life tables according to the sex of the child.

4. It may be possible to modify the multivariate analysis to improve the interpretation of results. In particular, it is recommended that an attempt be made to assess the total effect, as well as the direct effect, of the socioeconomic background variables. For example, the impact of educational status and occupation should be assessed in a model that omits some of the more immediate determinants of infant mortality, such as survival status of the previous birth and the interval since the last birth. When such an assessment is made, it should be applied not only to second- and higher-order births, as is done in the present multivariate analysis, but also to the full data set, including first births.
5. The results of the multivariate analysis should be presented in a format that is readily comprehensible to readers unfamiliar with the techniques that are used. For example, the logistic regression coefficients could be converted into factors that are more readily interpretable.

III. CONCLUSIONS AND GENERAL RECOMMENDATIONS

In general, the evaluators believe that both components of the study are being carried out well. The methodologies that are being used are appropriate and, indeed, they are advanced in terms of the current state of the art. The value of the results can be enhanced by implementing the authors' suggestions. It is felt that most of these recommendations are relatively easy to execute. Several, however, will probably require additional time and funds to ensure that they are carried out properly. The authors wish to reiterate that their criticisms and suggestions should not obscure the fact that their overall impression of the work is very positive.

Coordination

As the authors indicated in the introduction to this report, there appears to be little coordination at this time between the breastfeeding and infant mortality components of the project. The evaluation team believes that the value of both projects would be considerably enhanced if greater interchange and coordination were undertaken. Several specific examples where coordination is needed and would be useful are described below.

- a. It should be determined that either weighted or un-weighted samples will be used for the multivariate analysis. One possible outcome of an agreement on this point is that the breastfeeding project will continue to use the weighted sample and the infant mortality project the non-weighted sample. This determination should be made only after the two groups have discussed and jointly agreed on the merits and appropriateness of using or not using weights for each project. The evaluators are not criticizing the different decisions made by the two groups of investigators, for those decisions simply reflect the considerable disagreement among all researchers over whether or not weights should be used in multivariate analyses.
- b. Comparable SES variables should be developed. The evaluators feel that it is important that the projects yield results that can be readily compared. At this time, the definitions of the socioeconomic variables vary in the two studies. For example,

education is treated as a continuous variable in the breastfeeding study but as a categorical variable in the infant mortality study. Both groups are working from a common data set; therefore, there should be no difficulty in coordinating the use of a single method to specify the socioeconomic and demographic variables. It would probably be useful for the two groups to meet to discuss this issue.

- c. Problems with data that are common to both studies should be shared among the groups. Since a number of variables in the studies overlap, this exchange should be mutually beneficial.

Comparability of Socioeconomic Variables

Additional attention should be given in both studies to the question of the comparability of socioeconomic variables across countries. For example, there are indications from previous analyses of WFS data that variables relating to women's work experience do not mean the same thing in different countries. The investigators can do little to change this situation; nevertheless, they need to recognize that cross-country differences may reflect different definitions of variables rather than actual differences in relationships. The members of the project are aware of the current studies on the problems of increasing comparability across countries with WFS data. The evaluators thus anticipate satisfactory treatment of this problem.

Regional Differentiation

It would be extremely advantageous to introduce into the analyses of both breastfeeding and infant mortality a variable representing a region of the country. This kind of variable has been shown to be important in a variety of studies that have been based on WFS data. Moreover, many potential users of the results undoubtedly have an interest in the regional differentials of a country.

Presentation of Results

The investigators of both components of the project need to give additional attention to the problem of how best to present results so that they can be understood by non-experts. For example, a description of univariate relationships with independent variables for breastfeeding behavior would be useful if the presentation were comparable to the presentation in the infant mortality prototype paper. Tables and graphs should

contain sufficient detail to stand on their own. Other ways of summarizing key results should be explored.

Comparison of Results

The authors believe that the utility of the results for policymakers would be substantially enhanced if an effort were made to combine the results of the studies of the two components in a single final report. This task would be facilitated if the recommendations to increase the comparability of approaches and to specify the independent variables were implemented. In particular, such a comparison would put the breastfeeding results in a broader perspective, thus enhancing the possibility that they could be used more realistically for policy decisions. For example, it may well turn out that precisely those groups that breastfeed the least are also experiencing lower infant mortality. With this kind of comparison, the policymaker would be better able to understand how independent variables may affect breastfeeding adversely but have a favorable impact on infant mortality. The evaluators particularly encourage the comparison of results because the policy relevance of the breastfeeding study alone is limited, as the investigators themselves acknowledge, by the limited amount of information available in the WFS data set. The analysis raises a number of interesting questions that cannot be investigated further with the existing data. However, the findings will be illuminated if breastfeeding data are compared with infant mortality data.

Appendix

LIST OF CONTACTS

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