INTERNATIONAL REVIEW

Trends in Infant Feeding in Developing Countries

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In recent years, interest in breast-feeding and infant-supplementation practices in the developing world has been growing. Numerous community, regional, and national studies have described the patterns of breast-feeding and, to a lesser extent, of supplementation in a wide range of low-income countries. Nevertheless, adequate documentation of national trends in breast-feeding is available for only a small number of developing countries, and trends in supplementation remain to be described.

The apparent decline in breast-feeding in the developing world has been the subject of numerous articles describing the impact of this trend on infant morbidity and mortality, fertility levels, and family finances. Frequently, the examples used to illustrate the decrease in breast-feeding are methodologically flawed; they use nonrepresentative or noncomparable samples, for example, or make implicit assumptions about past breast-feeding practices. In spite of such shortcomings, the consistent reports of important declines appear to indicate that some basic changes are taking place in breast-feeding practices in certain areas of the developing world. The fact that these changes seem to be following the general pattern of breast-feeding decline that occurred at earlier times in developed countries adds to their plausibility.

Although a general awareness of changes in lactation in the developing world now prevails, the documentation of this trend is far from complete. Even for those countries in which trends have been appropriately measured, the amount and pattern of change may vary widely from country to country. In most of the countries with information on breast-feeding trends, recent declines have occurred, although the decreases range from sharp to moderate. In some countries, most of the change has been in the duration of breast-feeding; in others, it has been in the proportion of children who have ever been breast-fed.

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Changes in nursing are not always common to all segments of society within a given country, however. Often such declines have occurred within higher socioeconomic groups. Also, the small number of countries adequately studied is in no way representative of the entire developing world. Appropriate information from a much wider range of developing countries may become available within the next few years because increasing interest in the subject has led many developing countries to consider the collection of nationally representative data on breast-feeding practices.

These are the principal conclusions derived from a review of studies of breast-feeding levels and trends in low-income countries. Because so little reliable information is available on supplementation, this paper concentrates on breast-feeding trends. The report also is limited to a review of trends based on national-level studies of infant-feeding practices. The first section of this paper examines data sources, conclusions, and limitations for the most important of these studies. For those countries with adequate data, trends in breast-feeding at the national level and for selected subgroups are described in the second section. This second section also reviews cross-sectional differences in breast-feeding practices for a larger number of countries. The third section examines available information on supplementation patterns in the developing world. The Appendix contains a more detailed discussion of methodologic issues and recommendations for an appropriate methodology for the measurement of breast-feeding trends in the developing world.

SOURCES AND LIMITATIONS OF DATA

The measurement of change over time in the infant-feeding practices of a particular population requires information that fulfills certain requirements. First of all, the information should cover a period of time, either through two or more surveys

from different points in time, or through a single study in which retrospective infant-feeding histories are collected. Data on feeding practices from a single point in time may be interesting, but they are not sufficient to measure the amount of change over time (this issue is discussed in detail in the Appendix). Other requirements for the measurement of change include consistent definitions of terms, samples truly representative of the study population, and samples of sufficient size to measure accurately infant-feeding practices.

Many studies that have attempted to describe trends in breast-feeding in developing countries have failed to satisfy one or more of these requirements. For example, a well-known and frequently cited study[4] of breast-feeding describes declines of alarming proportions in Chile, Mexico, the Philippines, Singapore, and the United States. In an evaluation of sources cited in the study, Millman[25] has demonstrated that whereas the Singaporean studies do a creditable job of documenting a decline in nursing, the source cited for the Chilean decline contains no mention of breast-feeding trends, the Mexican decline is based on data from a single village, and the Filipino trend is derived from two nonrepresentative and noncomparable samples. In another study[14] of breast-feeding patterns in developing countries, the problem of insufficient data on trends for developing countries is circumvented differently. In that report, examples cited to illustrate the decline in breast-feeding in the developing world are based on two studies—one of trends in a developed country, Japan, the other of changes in breast-feeding practices among Indian women after their emigration to Great Britain. Some studies[16,23] have attempted to infer the amount of change in breast-feeding practices by assuming universal practice in the past. Because no evidence of actual breast-feeding levels in the past is presented, however, these studies do not actually demonstrate that a decline has occurred; they can only indicate that a change may have taken place. It is worth noting that examples abound of traditional societies in which breast-feeding was practiced for short durations.[35]

A few articles[10,32,35] have appeared in recent years that contain more realistic assessments of the reliability of available information on breast-feeding trends in the developing world. In general, these articles agree that the available information is not adequate to document trends in breast-feeding in most developing countries.

A review of the literature has determined some countries with national data on breast-feeding that satisfy the requirements specified above. These countries are Taiwan, Thailand, Malaysia, Korea, Singapore, Mexico, and Panama. An overview of the data available for each country and of the limitations to which these data are subject is presented below. More detailed discussion of possible sources of error in estimating measures of breast-feeding practices, such as recall error, truncated responses, the limitations of last or next-to-last birth analysis and the like can be found in the Appendix.

Data Sources

As noted above, adequate information on breast-feeding trends is available for a limited number of developing countries. In most cases, the data on breast-feeding experiences were obtained from studies involving interviews with probability samples of women that were nationally representative. Information on trends came either from a single survey that collected information on the entire breast-feeding histories of the sample women or from two or more cross-sectional surveys. The period of observation is not the same for all countries, and in some cases may not be sufficient to detect significant changes in breast-feeding. In several instances, some (and in one case, all) of the information on breast-feeding came from surveys conducted under the auspices of the World Fertility Survey.

Various sources of error affect the quality of data from these studies. Because they all involve the retrospective collection of information, the results are subject, to a greater or lesser extent, to the impact of recall error. This is particularly true for estimates of breast-feeding duration. Most of the studies allowed respondents to define breast-feeding for themselves, rather than providing a definition for them. Few of the studies distinguish between full (exclusive) and partial (supplemented with other foods) breast-feeding, although respondents' replies probably embraced both types of nursing. The impact of these factors on the quality of data collected are considered in more detail below.

Advantages and Limitations of Different Survey Methods

The advantages and drawbacks of the two principal approaches to data collection for the study of breast-feeding trends, breast-feeding histories, and current breast-feeding practice data from different points in time are examined in this section. In all of the countries with adequate information on nursing trends, one or the other method was used to collect data. Whereas both methods have disadvantages for the study of national trends, one clear advantage they share is that in almost every country, the studies are based on nationally representative probability samples. The use of probability

samples makes it possible to measure the sampling error of estimates from these studies. The fact that they are nationally representative means that the results represent the breast-feeding experiences of the entire population. Nonnational studies are often restricted to specific subgroups, such as urban or lower-income women, or women attending clinics. A disadvantage of the restricted studies is that they may systematically exclude women whose breast-feeding practices differ from those of the sample population. In addition, the study population of the restricted studies may not be well defined, making it difficult to ensure comparability with future studies of the same subgroup.

Breast-Feeding Histories. In Malaysia and Korea, trends in breast-feeding were measured through a single survey, in which nursing information was collected for all children of the mothers in the sample. The use of breast-feeding histories to measure trends has several advantages. First, because information is obtained on all live births of mothers in the sample, a single survey of this type can provide data on breast-feeding experiences during a period of 30 or more years. Second, comparability problems are not an issue with this type of study. Because all the information is collected through one survey, this technique avoids the differences in definitions and procedures that can plague trend studies that are based on a series of surveys.

On the other hand, some important disadvantages are associated with this type of study. Collecting breast-feeding histories requires that respondents recall and report correctly experiences that may have taken place many years in the past. The impact of recall error on the quality of breast-feeding data from developing countries can be substantial, even for periods in the recent past, as described in the Appendix. Presumably, the effect on the reporting of events even farther back in time is even more important.

A second disadvantage concerns how representative the selected sample is. In these surveys, only women of reproductive age (15 to 44 or 49 years) were interviewed. Whereas these samples will reasonably represent recent breast-feeding experiences, this is less true for intervals in the past. Information for older women is not obtained because they will be beyond the reproductive age—and so ineligible for interview—by the time of the survey. For periods long before the survey, therefore, nursing practices will be based on the experiences of younger women, rather than of all women who gave birth during the period studied. If there are important differences in breast-feeding behavior by age of women, the fact that women of all ages are not represented may bias the measurement of trends.

Information from Several Points in Time. In the majority of cases, information on breast-feeding trends in developing countries was obtained from two or more cross-sectional surveys. Measuring breast-feeding behavior at different points in time avoids the two serious drawbacks of the breast-feeding history approach. Erroneous recall of nursing practices exists, but because the reference period is limited to the recent past, the problem is less severe than with longitudinal studies. Second, each study includes a sample of women of reproductive age at the time of interview. Thus, for the period between the surveys, the results are representative of the nursing behavior of all women.

The disadvantages of this approach are mainly attributable to differences between the various surveys, which may reduce comparability of the results. Whereas minor differences in survey techniques may be ignored, the documentation of trends may be compromised by serious differences in the choice of study population, sample design, index children, and definitions of breast-feeding practices. For example, the study[22] of breast-feeding trends in Thailand was complicated by the presence of several of these factors. In three of the four studies used, significant areas of the country were excluded from the study population. Comparisons of the results were affected to the extent that the nursing practices of the excluded population differed from those in the population sampled. Differences between surveys also existed in the selection of women for the sample, and in the determination of breast-feeding duration.

Various techniques for analyzing the issues raised above, such as the current breast-feeding status method or the use of life tables, are described in the Appendix, along with a recommended methodology for the study of breast-feeding levels and trends.

TRENDS IN BREAST-FEEDING

Information is presented in this section on changes in breast-feeding practices over time in the seven developing countries with adequate information on national trends. Trends within population subgroups are discussed for those countries with the requisite data. The results of cross-sectional studies of breast-feeding, available for a larger number of developing countries, are provided at the end of the section.

A variety of measures are used to evaluate trends in breast-feeding in the seven countries included in this review. Trends in the proportion of children who had ever been breast-fed were provided in most of the country studies reviewed. On the other hand, calculation of the length of breast-feeding varied

from country to country. In some, the average duration of breast-feeding was based on those infants who had ever been breast-fed, whereas in other countries it was based on all children, whether they had ever been breast-fed or not. Results presented in this report use one or more of these measures to document breast-feeding trends.

The pattern of change over time varied markedly from one country to another. In some nations, most of the change was in the average duration of nursing, with little change occurring in the proportion of children who had ever been breast-fed (Thailand). In others, the opposite pattern appeared (Mexico). In still others, there was an important change in both measures (Malaysia).

Changes in the pattern of breast-feeding could be described in more detail using information on the proportion breast-fed for different periods of time, such as 4, 6, or 12 months. A decline in the mean duration of breast-feeding may indicate an increase in the early cessation of nursing, a decline in prolonged breast-feeding, or something in between. Because the mean duration is a summary measure, it is impossible to decide which of these patterns is the correct one without information on the proportion breast-fed for different periods of time. Only two of the countries examined, Korea and Malaysia, have reliable information on changes in the proportion breast-fed for different durations. For the two countries, the pattern of change described by this measure differs substantially.

Trends by Country

Taiwan. Information on breast-feeding experience in Taiwan is available for three separate points in time, together covering the period from 1967 to 1968 to 1979 to 1980.[25] The data were collected in four surveys of knowledge, attitude, and practice of contraception (KAP surveys), carried out by the Taiwan Provincial Institute of Family Planning. Nationally representative probability samples were used in each of the surveys. The 1967 to 1968 data were obtained from two separate KAP surveys, known as KAP-2 and KAP-3. When data from the two surveys were combined, breast-feeding data were obtained for 1,887 last and next-to-last children. Information on breast-feeding from the 1973 (KAP-4) and 1980 (KAP-5) surveys pertains to the most recent child. The 1973 study provided data on 3,685 children, whereas the 1980 survey obtained information on 2,255 children.

These surveys focused on the measurement of variables related to reproduction and family planning, but all surveys included specific questions on the current status and duration of breast-feeding. No attempt was made to provide respondents with a specific definition of breast-feeding. Each survey included a variety of background and attitudinal variables that were useful in the explanation of breast-feeding practices for the three time periods. The conclusion of several reliability studies cited by Millman[25] was that the data collected in each of the surveys were generally considered to be of high quality, including the reported birth dates of respondents' childen.

Although information on both the current breast-feeding status and the duration of breast-feeding was obtained for the selected children, the current status data were judged to provide more reliable measures of breast-feeding duration. Average duration measures reported refer to the experience of children born within 36 months of each survey. Measures of the proportion of children who had ever been breast-fed are based on births within 12 months of each survey.

The available data indicate that breast-feeding practices have declined sharply and continuously during the period 1967 to 1980 in Taiwan (Table 1). Among all children, the average length of nursing decreased by more than 9 months during the period of study, from 13.6 months in 1967 to 1968 to 4.4 months in 1979 to 1980, a two thirds decline. Separate consideration of the two components of this measure, the proportional of children who had ever been breast-fed and the expected duration of nursing for those ever breast-fed, shows that changes in both aspects of breast-feeding contributed to the overall decline. The percentage of children who were nursed at all, even for short periods of time, declined from 93% to about 50% during the 14-year period. At the same time, the expected duration of breast-feeding for children who had ever been breast-fed dropped from 14.6 months to 8.8 months. Regardless of the measure used, the decline in breast-feeding in Taiwan was also consistent over time; the 1973 rates were invariably located between the 1967 to 1968 and the 1979 to 1980 figures.

The strength and scope of the change in nursing practices are demonstrated by an examination of trends within population subgroups, including places of residence, standard of living, mother's education, and mother's work experience. During the period of study, consistent and strong declines in all measures of breast-feeding practice were registered for every subgroup considered.

Certain categories did experience larger relative declines than others did, however. For example, average duration of nursing for infants from large cities declined by 78%, whereas for rural infants the figure decreased 64%. Although the decline was slightly greater for urban infants, the rural trend demonstrates that decreases in breast-feeding are

TABLE 1. Taiwan: Average Duration of Breast-Feeding (in Months) at Three Points in Time*

	1967–1968	1973	1979–1980
Total	13.56 (1,887)	9.59 (3,685)	4.41 (2,255)
Type of area			
Large city	11.17 (382)	6.64 (1,001)	2.47 (595)
Small city	12.25 (148)	7.11 (476)	3.46 (407)
Urban township	12.98 (559)	10.58 (892)	5.46 (512)
Rural township	15.39 (798)	11.86 (1,300)	5.61 (741)
Socioeconomic status†			
Higher	12.04 (956)	8.47 (1,954)	3.79 (1,613)
Lower	15.27 (928)	10.79 (1,635)	6.19 (627)
Mother's education			
None	15.35 (722)	12.14 (838)	7.32 (170)
Primary	13.61 (972)	10.06 (2,217)	5.25 (1,281)
More	7.00 (193)	4.82 (612)	2.93 (803)
Mother's work			
Housewife	12.26 (962)	9.74 (2,428)	4.91 (1,368)
Works at home	15.38 (619)	10.79 (771)	5.09 (400)
Works away from home	13.89 (304)	6.37 (470)	2.28 (487)

* Data from Millman.[25] Duration of breast-feeding calculated from current status (breast-fed or not at survey) by age of surviving births 0–36 months before each survey. Number in population shown in parentheses.
† For 1967–1968, this is an interviewer's assessment; for 1973 and 1979–1980, self-reported adequacy of income. Categories are not comparable across surveys.

not necessarily limited to urban areas of the developing world. Larger relative declines were also noted for infants from families with higher standards of living, for the infants of mothers with some education, and of mothers who work away from home. Nonetheless, the smallest relative decline for any subgroup was 52% (mothers with no education), underlining the importance of the changee in breast-feeding practices in Taiwan.

Given the pattern of declines in nursing among population subgroups, the overall measures would have declined even without any changes in the composition of the population. Changes in the distribution of the population during the study period tended to reinforce the downward trend, however. The population became more urban, more educated, and wealthier. In general, shifts in the composition of the population were toward subgroups in which breast-feeding was less commonly practiced or practiced for shorter periods of time.

Thailand. Trends in breast-feeding practices in Thailand have been well documented in a study of Knodel and Debavalya.[22] The data for their analysis were obtained from a series of four studies conducted between 1969 and 1979 by the Institute of Population Studies, Chulalongkorn University. All of the surveys were based on nationally representative probability samples. The field work for each was carried out in April and May of the year in which the survey took place.

The two rounds of the National Longitudinal Study for Social, Economic and Demographic Change (LS1 and LS2, Table 2), were completed in a series of four surveys during the years 1969 to 1973. The first rounds covered a sample of rural households in 1969 and of urban households in 1970. In the second round, the rural sample was reinterviewed in 1972, and the urban survey was repeated in the following year. The Survey of Fertility in Thailand (SOFT), a part of the World Fertility Survey, took place in 1975. Finally, the

TABLE 2. Thailand: Mean Duration of Breast-Feeding and Percentage of Infants Ever Breast-Fed from Selected Surveys, 1969–1979*

Survey	Mean Duration of Breast-Feeding (mo)†	% of Lastborn Children Ever Breast-Fed
Rural		
LS1 1969	22.4	NA
LS1 1972	22.0	NA
SOFT 1975	20.9	93.6
NS 1979	17.5	90.4‡
Urban		
LS1 1970	12.9	NA
LS2 1973	9.9	NA
SOFT 1975	9.7	74.2
NS 1979	8.4	75.6‡

* Data adapted from Knodel and Debavalya,[22] Table 2 and Table 4. Abbreviations used are: LS1 and LS2, the two rounds of the National Longitudinal Study for Social, Economic and Demographic Change; SOFT, The Survey of Fertility in Thailand; NS, National Survey of Family Planning Practices, Fertility and Mortality; NA, not available.
† Among nonpregnant women. Based on proportions still breast-feeding by age of child in months.
‡ Standardized for age of mother using age distribution of respondents to the equivalent question in the equivalent residence category in the SOFT sample.

National Survey of Family Planning Practices, Fertility and Mortality (NS) was conducted in 1979.

All of these studies were general-purpose demographic surveys that concentrated on measuring fertility and contraceptive use. Whereas breast-feeding was not a major focus of any of the studies, all four did include similar questions on the subject. In all four studies, the age and current breast-feeding status of the most recent child were obtained, as was the duration of breast-feeding for this child. The last two surveys also included questions on duration of breast-feeding for the next-to-last child.

As in Taiwan, data on current breast-feeding status were found to provide the most reliable measure of nursing. Average figures on duration refer to all children born within 36 months of each survey. No adjustment was made for children who died before the interview; this avoided upward bias in duration estimates and coding inconsistencies across surveys.

Breast-feeding practices appear to have declined during the recent past in Thailand, but not to the extent found in Taiwan (Table 2). Among nonpregnant women, the average duration of nursing decreased in both rural and urban areas, dropping from 22.4 months (1969) to 17.3 months (1979) in rural areas, and from 12.9 months (1970) to 8.4 months (1979) in urban Thailand. The proportion of children ever breast-fed did not change much in urban areas, although information on last births shows a decline in the proportion breast-fed in rural areas between 1975 and 1979.

Because of comparability problems, measuring breast-feeding trends among many population subgroups was not possible. Each of the surveys did collect information on the education level of female respondents and their husbands, however. The resulting measures of the proportion of women still breast-feeding their most recent child show consistent declines in nursing within all broad education groups, whether measured by the husband's or wife's education, with the possible exception of the most highly educated women. Breast-feeding among the most educated women, however, was low throughout the period of study. Even for the most recent survey, it was lower than for any other group.

Most recent information on breast-feeding is available from the second round of the Contraceptive Prevalence Survey, conducted in 1981. However, certain differences between this and the earlier studies make it impossible to calculate measures comparable to those presented in Table 2. In comparing breast-feeding duration measures from the 1981 survey with the results of prior studies, Knodel, et al.[21] found that the overall decline appears to be continuing, although the rate of decline is much lower and the pattern of change inconsistent. Measurement problems and sampling error, along with some comparability problems between surveys, make it difficult to determine whether the results of the 1981 study provide a reliable measure of recent nursing trends. The authors conclude that the 1981 measures at least validate the breast-feeding levels reported in the 1979 survey.

Malaysia. Data on breast-feeding experiences were obtained from the 1976 to 1977 Malaysian Family Life Survey.[6] The study included 11 questionnaires administered during the period August 1976 to July 1977. The sample consisted of 1,262 private households, each containing at least one "ever-married" woman less than age 50 years. The Round 1 Female Retrospective Life History Questionnaire obtained complete pregnancy and breast-feeding histories from the women in the sample, providing breast-feeding information on 5,592 live births that survived at least one day. For each of these children, data were collected on the initiation of breast-feeding, as well as the duration of both full and partial breast-feeding. Information on other variables associated with breast-feeding practices was obtained from other questionnaires used in the study.

There was a statistically significant decline in both the proportion of children who had ever been breast-fed and the length of breast-feeding during the years since World War II.[6] For children born before 1950, more than 94% were breast-fed for at least a short period of time; by the years 1970 to 1974, the proportion had decreased to 75% (Table 3). For children who had ever been breast-fed, the duration of nursing declined from 13 months to 10.1 months during the same period. In addition, the duration of full breast-feeding declined by more than 50%, decreasing from 2.3 to 1.1 months.

Information on the percent of all infants still breast-feeding at successive months of age makes it possible to examine patterns over time in the

TABLE 3. Malaysia: Percentage of Infants Ever Breast-Fed and Mean Duration (in Months) of Full and Total (Full Plus Partial) Breast-Feeding by Infant's Year of Birth*

	% Ever Breast-Fed	Mean Duration of Breast-Feeding	
		Full	Total
Before 1950	94.1	2.3	13.0
1950–1954	92.3	2.5	12.6
1955–1959	87.4	1.9	11.9
1960–1964	87.0	1.8	11.9
1965–1969	82.5	1.5	12.0
1970+	74.6	1.1	10.1

* Data adapted from Butz and DaVanzo.[6]

cessation of nursing. Placing the children into three groups: those born before 1955, from 1955 to 1964, and from 1965 to 1974 shows that most of the decline in breast-feeding was due to changes in the proportion who had ever been breast-fed and in the percentage weaned during the first year of life. During the study period, little change was noted in the proportion of infants breast-fed for longer periods (greater than 12 months).

The reliability of these measures and the resulting trends are affected by various methodologic limitations of the Malaysian data. As noted above, all of the available information was obtained through a single survey in which breast-feeding histories were recorded for women aged 15 to 49 years. Thus, the measures of breast-feeding practice, particularly those for periods long before the time of survey, may be strongly affected by erroneous recall. This is especially true for measures of nursing duration.

In addition, the sample does not equally represent all women giving birth during the study period. The study uses the experiences of women aged 15 to 49 years at the time of interview to examine changes in nursing during a 20-year period. However, many of the women giving birth during this interval—especially in the early part of the study period—would be beyond the maximum age limit by the time of the interview. As a result, particularly for periods in the distant past, breast-feeding measures are limited to the experience of younger mothers. Although this factor could have been minimized by limiting the measures to first births, this was not done in the Malaysian study.

In spite of these limitations, the extent of the change in both initiation and duration of breast-feeding indicates that a real decline in nursing practices did occur in Malaysia. In addition, changes in nursing varied for different subgroups. The proportion of children who had ever been breast-fed declined in both rural and urban areas, but the decline was slightly greater for urban children. Breast-feeding among Malays changed little; among the more advantaged and westernized ethnic groups, the Chinese and Indians, however, sharp declines took place during the study period.

Korea. The 1974 Korean National Fertility Survey, conducted under the auspices of the World Fertility Survey, collected detailed breast-feeding histories from a nationally representative sample of 5,417 ever-married women.[8,9] For each live birth reported by respondents, information was obtained on both initiation and duration of breast-feeding. The data collected provided documentation of trends during the period 1950 to 1970.

Results from the 1974 survey show a consistent decline in the duration of breast-feeding in Korea during the past 20 years (Figure). The major part of the change has been a shift away from very long periods of nursing. At the same time, women have continued to breast-feed for moderate durations: the proportion nursing for at least 9 months changed little during the same period. The Korean study is based on data collected at a single point in time, as in Malaysia, and hence is subject to the same limitations. In Korea, however, the nursing measures are restricted to first births, reducing the selectivity bias described previously.

Singapore. Information on the proportions of mothers initiating breast-feeding and continuing to nurse 1 month after the birth was obtained through a series of studies covering the period 1951 to 1980.[25] Sample respondents were chosen from women who gave birth in selected hospitals in Singapore. Because nothing is known about differences in breast-feeding behavior of women delivering in the selected hospitals and women delivering elsewhere, the samples selected are perhaps not nationally representative. The majority of births in Singapore did take place in the sampled hospitals, however (1951, 85%; 1960, 90%; 1971, 57%; 1976, 60%; and 1980, 70%), which makes the sampled

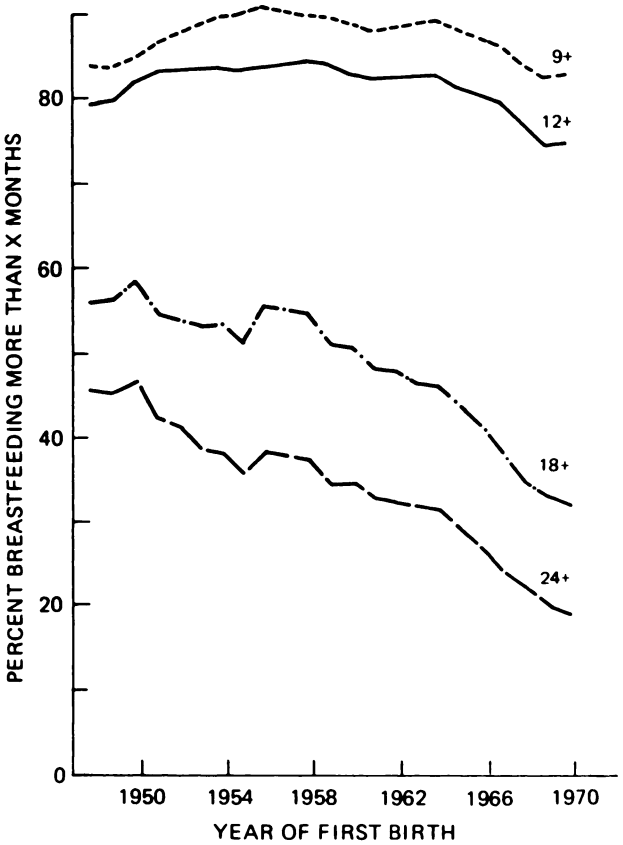

Figure. Percent of women in Republic of Korea who breast-fed for more than 9, 12, 18, and 24 months after first birth, by year of first birth. Note: all values are 5-year moving averages. (Reproduced with permission from Cho et al.[8]

populations worthy of study in and of themselves. In addition, some of the surveys did use fairly small samples. The 1951 and 1960 estimates were each based on responses from about 250 recent mothers; the 1980 survey, on the other hand, interviewed 1,700 women who had recently given birth.

Both the initiation and duration of breast-feeding have shown a sharp downward trend, followed by a recent upturn in the proportion of infants breast-fed (Table 4). Consistent declines in both nursing measures took place from 1951 to 1971 for both upper and lower socioeconomic groups and for a middle group from 1960 to 1971. Sharp increases in the proportion of children ever breast-fed were recorded in subsequent studies of the upper and middle classes, with a similar but small increase noted for the lower class group. It is interesting to note that the recent upturn coincides with breast-feeding promotion campaigns in Singapore.

Trends in nursing practices in Singapore should be interpreted with caution. The use of nonrepresentative samples, described previously, may affect the reliability of the results. In addition, most of the studies, in particular the early ones, are based on relatively small samples.

Mexico. Nationally representative surveys conducted in 1976 and 1979 provided breast-feeding data for Mexico.[18] The Mexican Survey of Fertility (MSF) (Table 5), carried out in 1976 as part of the World Fertility Survey, obtained information on initiation and duration of breast-feeding for last and next-to-last births of a sample of 7,310 women aged 15 to 49 years. Never-married women who had not had a live birth were not included in the sample. The 1979 National Survey on the Prevalence of Contraceptive Use (NSPCU) (Table 5) collected data on the initiation of breast-feeding and the duration of full and partial breast-feeding for the most recent child of a national sample of about 20,000 women.

As in other countries, breast-feeding was not a major focus of the two Mexican studies. Both were general-purpose demographic surveys that concentrated on the measurement of fertility and contraceptive use variables. In addition to the breast-feeding information mentioned above, the surveys also collected data on background variables useful in studying differences in breast-feeding practices between groups.

A comparison of nursing measures from the two studies shows opposite trends in the initiation and duration of breast-feeding of last live-born infants (Table 5). During the 3-year interval, the proportion of children who had ever been breast-fed declined slightly from 80.3% to 77.6%. At the same time, information on the duration of nursing of all infants, whether they had ever been breast-fed or not, shows a slight increase, although the upward trend is not consistent for all durations of breast-feeding. Whether or not the duration of nursing is changing at all is difficult to determine from the results of the two studies. Future studies of breast-feeding, which will provide a longer period of observation when combined with the current studies, should resolve this question.

Panama. As in Mexico, data on breast-feeding in Panama were collected through a survey conducted under the auspices of the World Fertility Survey, and from a study[26] of contraceptive usage. The National Fertility Survey, conducted in 1976 as a part of the World Fertility Survey, obtained information on the initiation and duration of breast-feeding among last and next-to-last children of a sample of 3,701 women aged 15 to 44 years. The 1979 Survey of Contraceptive Prevalence also collected data on the breast-feeding experience of a sample of 2,347 women aged 15 to 44 years. In both studies, the samples used were nationally representative.

TABLE 4. Singapore: Proportions of Mothers Delivering Their Babies at Selected Hospitals Who Breast-Fed Their Infants at Birth and at 1 Month*

Socioeconomic Status of Mother	Year of Infant's Birth (%)				
	1951	1960	1971	1976	1980
Upper class					
At birth	85	73	28	64	...
1 mo	80	30	10	...	...
Lower class					
At birth	90	70	51	56.2	...
1 mo	85	65	43	...	...
Average					
At birth	...	71	44	60.1	65.0
1 mo	...	...	...	...	27.6

* Data from Chen[7]; Milman[25]; Tan[34]; and Wong[42].

TABLE 5. Mexico: Percentage of Last Live-Birth Infants Ever Breast-Fed, and Still Breast-Fed Up to 24 Months After Birth

	Survey*	
	MSF 1976	NSPCU 1979
% ever breast-fed	80.3	77.6
% breast-fed by month:		
1	72.7	76.8
3	61.5	62.1
6	50.4	52.4
9	44.6	46.0
12	37.5	35.6
15	27.1	29.0
18	20.0	20.3
21	13.9	9.5
24	5.9	6.2

* Data adapted from Keller at al.[18] Abbreviations used are: MSF, The Mexican Survey of Fertility; NSPCU, The National Survey on the Prevalence of Contraceptive Use.

The results of the two surveys indicate a somewhat more definite trend than was evident in Mexico, although the decline is modest (Table 6). Information on the percentage of all women still breast-feeding their last live-born child shows consistent declines for all durations of breast-feeding during the study period. Most of the decline in nursing took place in rural areas, however. Little change in the duration of breast-feeding was noted among urban women, perhaps because the length of nursing for these women was already short. In rural areas, the median duration of breast-feeding declined from 11.0 months in 1976 to 9.1 months in 1979. Future studies will provide a longer period of observation, making it possible to determine whether or not the recent decline is part of a long-term downturn in nursing practices.

Cross-Sectional Information on Breast-Feeding

The detailed information on breast-feeding trends presented above covers only a handful of developing countries. The results cannot be considered as representative of the overall situation in the developing world, both because of the small number of countries represented and because most of these countries are among the more westernized of the developing world. National data on breast-feeding practices at a single point in time are available for a much larger number of developing countries, however. The sources of these data are diverse, varying from nutrition surveys (Centers for Disease Control/University of California at Los Angeles [CDC/UCLA] studies) to surveys of breast-feeding practices (World Health Organization nine-country study) to fertility surveys (World Fertility Surveys).

TABLE 6. Panama: Percentage of Women Still Breast-Feeding Last Live-Born-Infant, by Months Since Birth and Residence*

Survey and No. of Months Since Last Live Birth	% Breast-Feeding		
	Overall	Residence	
		Urban	Rural
World Fertility Survey (1976)			
1	68	48	81
6	51	27	66
12	33	12	47
18	20	5	29
24	11	3	17
Survey of Contraceptive Prevalence (1979)			
1	64	45	73
6	47	26	59
12	29	13	42
18	17	6	29
24	10	3	19

* Data from Monteith et al.[26] Data adjusted using the model breast-feeding schedule of Lesthaeghe and Page.[24]

These cross-sectional studies represent the breast-feeding experience of each study population at a single point in time. Certain patterns of nursing practices by age of mother or birth order are found in many of these studies, which some researchers have used to infer the existence of a trend.[19] However, the presence of these patterns is not sufficient to validate a trend, as is discussed in the Appendix. On the other hand, the studies provide interesting measures of differences in current practices across countries and regions.

Nutrition Studies. Information on nursing practices in five African countries (Cameroon, Egypt, Liberia, Sierra Leone, and Togo) was obtained through a series of nutrition surveys carried out in the mid-1970s. Some of these surveys were conducted by the CDC and others by the Nutrition Assessment Unit of UCLA. The data on breast-feeding collected through these studies have been summarized in a recent article.[31] Whereas it is difficult to compare results from the five studies, nearly all children in the samples appear to have been breast-fed during their first year of life. In the five countries, the proportion of infants aged 6 to 11 months who were at least partially breast-fed ranged from 99.9% in Togo to 89.0% in Liberia. The magnitude of the proportions of infants breast-fed during their first year indicates that the initiation of breast-feeding and of nursing for moderate durations has probably changed little, if at all, in these countries. Information from a national nutrition survey[39] in Haiti also shows almost universal breast-feeding of infants in their first year of life, with the exception of urban areas. Among infants aged 6 to 11 months, 90.2% were still breast-feeding in rural areas, but only 56.9% in urban areas.

Breast-Feeding Studies. Surveys of breast-feeding practices were carried out in nine countries with the collaboration of WHO.[43] Of these countries, seven were developing nations (Ethiopia, Nigeria, Zaire, Chile, Guatemala, India, and the Philippines). The samples were purposively selected and were not designed to produce nationally representative measures.

In most of the countries studied, the proportion of children who were ever breast-fed was greater than 90% for all groups studied. The proportion of children ever breast-fed was particularly high in the African countries, where initiation was almost universal for all subgroups. The most notable deviations from this pattern were the wealthier urban families in the Philippines (68%) and Guatemala (77%). As with the nutrition surveys, the high proportion of children ever breast-fed in most subgroups probably means that the initiation of nursing has declined little over the recent past.

Fertility Surveys. Fertility surveys conducted un-

der the auspices of the World Fertility Survey provide comparable information on breast-feeding practices for a wide range of developing countries. World Fertility Surveys have been carried out in more than 40 developing nations, representing all regions of the developing world. Comparable information on breast-feeding is now available for about half of these countries, mainly from Latin America and the Asian and Pacific region.[11] The surveys were conducted in the mid- to late 1970s.

For 18 countries, the proportion of infants who had ever been breast-fed and the duration of nursing are presented in Table 7. These measures are based on the current breast-feeding status of children born 3 years or less before the date of survey. These figures show that for the countries surveyed, breast-feeding is more common in the Asian and Pacific countries than in the Caribbean and Latin American region. Except for Malaysia and the Philippines, nearly all infants in the Asian countries were breast-fed for at least a short period of time; the proportion of children who had ever been breast-fed varied from 91.9% in Thailand to 97.6% in Nepal. The figures available for Latin America show much lower proportions of children who had ever been breast-fed: most of the countries represented reported proportions of infants who had been initiated to breast-feeding of less than 90%.

TABLE 7. World Fertility Survey Countries: Percentage of Infants Ever Breast-Fed, and Average Duration of Breast-Feeding in Months*

	% Ever Breast-Fed	Duration for Children Breast-Fed†
Asia		
Bangladesh	97.5	27
Indonesia	97.1	24
Jordan	92.6	11
Korea	93.1	17
Malaysia	74.4	8
Nepal	97.6	25
Pakistan	95.4	20
Philippines	85.0	15
Sri Lanka	95.8	22
Thailand	91.9	20
Caribbean and Latin American countries		
Colombia	90.0	10
Costa Rica	74.5	7
Dominican Republic	88.1	9
Guyana	88.4	7
Jamaica	94.3	7
Mexico	80.4	11
Panama	79.1	9
Peru	93.1	14

* Data adapted from Ferry.[11]
† Average duration measures are based on the current breast-feeding status of all children born within 36 months of survey. The measures are computed using 3-month moving averages of current status data with 1-month intervals.

A comparison of durations of breast-feeding shows even more marked differences between the two regions. Again with the exception of Malaysia, where length of nursing remains extremely low in comparison with the other countries of the region, the mean duration of breast-feeding among children who had ever been breast-fed in the Asian countries varies from 11 months in Jordan to 27 months in Bangladesh. The mean duration of breast-feeding for the majority of these countries is equal to 20 or more months. In contrast, average duration measures for Latin American countries range from 7 to 14 months, with average length of breast-feeding equal to less than 10 months in most of the countries. The sharply lower breast-feeding measures noted for certain Latin American countries may indicate that breast-feeding has declined in these nations, or that important cross-national differences exist in infant-feeding practices. Even if the differences are due to declines in breast-feeding, it is not possible to measure the amount of change with the cross-sectional data available (see Appendix).

The average duration of breast-feeding by infants' age and birth order for 18 countries is shown in Tables 8 and 9. The measures were calculated from data on penultimate births that survived at least 12 months. These figures are of interest because they show that, in most of these countries,

TABLE 8. World Fertility Survey Countries: Mean Duration (in Months) of Breast-Feeding the Penultimate Child, by Current Age of Mother*

	Current Age of Mother (yr)		
	<25	25–34	35+
Asia			
Bangladesh	24.1	24.8	25.4
Indonesia	19.5	20.8	21.7
Jordan	9.3	11.1	13.5
Korea	15.7	16.9	20.7
Malaysia	4.5	5.2	6.5
Nepal	20.6	23.3	25.8
Pakistan	16.1	17.7	19.2
Philippines	10.9	11.3	12.0
Sri Lanka	14.7	15.9	18.1
Thailand	14.0	17.4	19.5
Caribbean and Latin American countries			
Colombia	7.4	8.3	10.4
Costa Rica	4.5	5.5	7.2
Dominican Republic	8.4	9.2	10.5
Guyana	7.6	8.9	10.5
Jamaica	7.4	7.2	8.3
Mexico	8.7	9.3	11.2
Panama	6.6	7.4	9.6
Peru	10.8	11.1	13.5

* Data adapted from Ferry.[11] Limited to women with at least two live-born infants (including any current pregnancy) with penultimate child surviving at least 12 months.

TABLE 9. World Fertility Survey Countries: Mean Duration (in Months) of Breast-Feeding the Penultimate Child, by Birth Order of Child*

	Birth Order of Child				
	1	2	3	4	5
Asia					
Bangladesh	26.3	25.3	24.6	24.9	24.2
Indonesia	20.5	21.1	21.4	22.0	20.9
Jordan	8.7	9.2	11.1	12.4	13.0
Korea	15.4	17.5	19.7	20.7	21.2
Malaysia	4.5	5.5	5.8	6.4	6.3
Nepal	25.7	24.1	24.5	24.1	22.6
Pakistan	18.1	18.1	18.3	18.4	18.0
Philippines	9.6	10.8	11.1	12.1	12.7
Sri Lanka	14.9	16.2	17.3	18.0	18.0
Thailand	15.4	17.7	18.0	18.7	20.0
Caribbean and Latin American countries					
Colombia	7.2	8.2	8.4	9.5	10.8
Costa Rica	4.1	4.4	5.9	6.2	7.3
Dominican Republic	6.9	8.4	9.4	10.5	11.2
Guyana	7.7	8.1	9.0	10.4	10.6
Jamaica	6.8	7.1	7.4	7.8	8.8
Mexico	7.1	8.7	10.0	10.8	11.6
Panama	5.1	6.5	8.1	9.0	11.3
Peru	8.1	10.5	11.2	13.0	14.7

* Data from Ferry.[11] Limited to women with at least two live-birth infants (including any current pregnancy) with penultimate child surviving at least 12 months.

breast-feeding is more common among older and higher parity women. Such tendencies seem to indicate that recent declines in breast-feeding have taken place among younger women. As discussed in the Appendix, however, the information contained in the Tables 8 and 9 is not sufficient to validate this interpretation. This is primarily because changes in the length of birth intervals (which vary positively with both age and parity) have a confounding effect on the relationship between duration of breast-feeding and either age of mother or birth order. Measures of initiation of breast-feeding are not affected by the length of birth intervals. These figures, however, display inconsistent patterns by age or birth order, or if consistent, differences that are not large.

Information is also available on differences in breast-feeding practices according to other characteristics of the mother or family. Using World Fertility Survey data from eight Asian and Latin American countries, Jain and Bongaarts[15] found that the lowest levels of breast-feeding were to be found among women residing in urban areas, with more than primary education, who work away from home and whose husbands have white-collar occupations.

The methodology and findings of the study by Jain and Bongaarts have been questioned by other researchers working on socioeconomic determinants of breast-feeding behavior.[2] Using data from Sri Lanka, a country included in the article by Jain and Bongaarts, Akin et al carried out a more detailed analysis of breast-feeding determinants. In this study, factors tending to reduce breast-feeding were women's work away from home, higher maternal education (although only for breast-feeding durations of 9 months or more), and to a lesser extent, urban residence.

If the patterns of breast-feeding for each variable are assumed to have remained the same, changes in the composition of national populations will result in changes in levels of breast-feeding. If the compositional changes within a given country result in a more urbanized and better educated population—in which women are more likely to work away from home and living standards improve—nursing practices may well decline. Basic shifts in attitudes toward breast-feeding may also occur, however, tending either to accentuate the decline in nursing practices (as in the case of Taiwan) or to offset the impact of changes in the composition of the population. The effect on nursing practices of changes in both composition and attitudes will vary from country to country, making predictions of future levels of breast-feeding problematic.

PATTERNS OF SUPPLEMENTATION

The weaning of infants, that is, the transformation of their diet from breast milk to normal family foods, is usually a gradual process. In most societies supplementary foods are an integral part of this process. While continuing to be breast-fed, the infant is given other foods as well. Over time, the mix of supplements and breast milk changes; the amount of breast milk given to the child declines until breast-feeding is eventually terminated. At the same time, the choice of supplementary foods is gradually changed from more easily digestible foods to the normal family diet.

Weaning practices can vary greatly from society to society, and even from one group to another within a single society. Both the choice of age at initiation of supplements and the type of supplement used are in large part socially and culturally determined, within certain biologic limits.[41] In developing countries, supplements may be given soon after birth, or after an extended period of breast-feeding.[27] Some infants will not be breast-fed at all, but will receive breast milk substitutes from birth. The types of supplementary foods used will vary, depending on the availability of different foods and their cultural acceptance for use in weaning.

A crucial question in the study of weaning may be the introduction of water into the infant's diet, and the relative cleanliness of the water provided. This may be particularly important in the study of

factors associated with morbidity. Few supplementation studies have included questions on the infant's intake of water.

Information on supplementation patterns at the national level is quite limited in the developing world. In only a few developing countries have national studies collected the necessary data; information on national trends in supplementation practices is practically nonexistent.

Much of the available national data on supplementation has been collected through nutrition surveys. The CDC/UCLA nutrition studies discussed previously provide information on supplementation practices in Cameroon, Liberia, and Egypt in the mid- to late 1970s. Results are also available from nutrition surveys conducted in Kenya and Guyana. The WHO breast-feeding study discussed previously provides supplementation data for seven countries. Information for two additional nations, Mexico and Thailand, was obtained from national surveys of contraceptive use. Data on breast-feeding patterns in Malaysia provide the only available measure of trends in the age at initiation of supplements.

The comparison of patterns of supplementation across countries is complicated by the limited comparability of findings from the various studies. For example, the age at initiation of supplements may refer to the infant's age when any food or drink, including water, is provided on a daily basis. In other studies, age at initiation may be based on the introduction of nonmilk foods, or of solid foods. In addition, study findings are often presented in ways that make comparisons with practices in other countries difficult.

Age at Initiation of Supplements

With the above qualifications in mind, a few general observations can be made. The initiation of supplements occurs at an early age in the Caribbean-Central American region. In Guyana, 45% of infants are given supplements within the first month after birth[30]; in Mexico, more than half (58%) of infants receive supplementary food during the same time period.[18] By age 2 to 3 months, roughly half of Guatemalan infants are given supplements.[43] Similar findings were obtained in nonnational studies of two Caribbean countries. More than two thirds of infants received supplements by age 1 month in a study of births in a single parish of Jamaica.[3] In Trinidad, a study of feeding practices of infants born in general hospitals shows that nearly three fourths have been introduced to artificial feeding by age 1 month.[12]

In the African countries for which there are available data, supplements appear to be introduced somewhat later. In Cameroon, 46% of infants aged 3 to 5 months have received nonmilk supplements[38]; 41% of Liberian infants aged 0 to 5 months have been initiated to nonmilk foods.[40] About one third of infants in Zaire and Ethiopia are given supplements by the age of 2 to 3 months.[43] Approximately half of all infants in Kenya are given supplementary foods (milk or nonmilk) by age 3 months.[20] In Egypt, about three quarters of infants aged 6 to 11 months have been introduced to supplementary foods.[36] In Nigeria, supplementation is begun somewhat earlier, with more than two thirds of infants receiving supplements by age 2 to 3 months.[43]

Information on the age of infants when supplements were initiated is only available for a few Asian countries. Although the results are not completely comparable with figures from other countries, supplements are apparently introduced at an age between that found in the African and Caribbean-Central American countries. In Thailand, approximately 58% of infants receive nonmilk supplements by the age of 3 months.[17] About one third of Filipino infants are given supplements by 2 to 3 months of age.[43] The pattern of supplementation in India differs substantially from that of other Asian countries; less than one quarter of infants 2 to 3 months of age have received supplements.[43] In Malaysia, the average duration of exclusive breast-feeding, in effect the same as the average age at introduction of supplements, has been found to be slightly more than 1 month for infants born in the period since 1970 (Table 3). In this study, supplements were considered to be any food or drink provided on a daily basis, including water. The sharp and steady decline in the average age at initiation of supplements since 1950 in Malaysia is shown in Table 3.

Some interesting methodologic findings on the measurement of infant age at introduction of supplements were obtained from two Egyptian studies: the national study cited previously and a follow-up study in two of the rural areas covered in the national survey.[37] Figures from the two surveys show that, for infants aged 6 to 11 months, significantly more were receiving no supplements in 1980 than 2 years before. In fact, the proportion roughly doubled during the 2-year period. This dramatic change is apparently explained by the seasonal nature of supplementation patterns among Egyptian mothers. In Egypt, women tend to avoid the initiation of supplementary foods during the summer months because of the fear that the infants will contract diarrheal disease. The first survey was conducted in the spring, a period of low incidence of diarrheal disease; the second study took place in the later summer months, the peak period for diarrheal disease. The results of the two studies illus-

trate why seasonal patterns must be taken into account if age at introduction of supplements is to be measured accurately.

Types of Supplementary Foods

National data on types of supplements provided to infants are available for a smaller number of countries. Although the specific foods selected for supplementation tend to vary from country to country, most come from certain common food groups. Typical supplementary foods, especially those used early in the weaning process, tend to be either infant formulas or animal milks, and paps or gruels that use the local staple grain. In general, little detailed information is available on the extent of use of infant formulas in these countries. In Cameroon, for example, 8.4% of children aged 3 to 5 months are given fresh or artificial milk; 39% are given a specific food, commonly a gruel of cassava, corn, rice or millet, or a commercial weaning food. In Liberia, 33% of infants aged 0 to 5 months and 41% of infants aged 6 to 11 months are given specially prepared foods, usually composed of pounded rice or cassava. The first nonmilk food given to Thai infants is rice, either alone or mixed with other foods (79% of all children studied).

Recommendations for Future Studies of Supplementation

As noted above, the available information on supplementation practices is far from adequate for the study of current supplementation behavior, much less for the measurement of trends in supplementation. Future studies should attempt to collect more detailed information on the exact types of liquid or solid foods supplied to infants, the amounts of each and the ages at which they were introduced. More research is needed on the effect of water intake and the consumption of solid foods and other supplements on infant and child health. The determination of trends in supplementary feeding practices can only come after current weaning practices have been well documented.

CONCLUSION

Existing information is inadequate to measure overall trends in infant-feeding practices in the developing world. Information to measure national levels of supplementation and weaning is particularly lacking. The absence of national information on the use of infant formulas is a glaring example of how little is known about national supplementation practices. Although more data exist on breast-feeding, in only a few countries can national trends actually be measured. And these countries cannot be considered as representative of the developing world, because the majority are in a single region, and most are among the more modern of the developing countries. Within a few years, however, information will be available from a much wider range of countries, as the recent upsurge of interest in breast-feeding has persuaded many developing nations to collect national data on nursing practices.

Until the results of additional studies become available, the national trends described in this report constitute the best available evidence of recent changes in breast-feeding in the developing world. A comparison of trends in the seven countries detailed in this section shows substantial variation in the degree, and even in the pattern, of change across countries. Nevertheless, certain common elements can be identified:

1. Although the overall trend in breast-feeding cannot be measured for the developing world, a downward trend exists in most of the seven countries reviewed. An obvious point, but one worth repeating, is that sharp to moderate declines in breast-feeding are evident in six of the seven countries. Unlike other studies of nursing trends, which have concentrated on changes in urban populations or among particular social classes, the changes described here are based on measures of breast-feeding from all major population subgroups.

2. Although the trend in breast-feeding is downward in most of the countries reviewed, the pattern of decline varies markedly from country to country. In Taiwan and Malaysia, both the proportion of infants ever breast-fed and the duration of breast-feeding have declined sharply during the period studied. Additional information available for Malaysia indicates that the decline in nursing duration is chiefly due to an increase in weaning during the first year of life. In Thailand, most of the decline is due to a reduction in the duration of nursing, with little change noted in the proportion of infants ever breast-fed. A reduction in the longer durations of breast-feeding accounts for most of the decline in Korea. In Panama, the decline in nursing is based on measures of breast-feeding duration. Contradictory patterns are found in Mexico, with a small decline in the proportion of infants ever breast-fed offset by inconsistent changes in the proportions of infants breast-fed at different ages.

Interestingly, the pattern of change in Singapore resembles the recent trend in breast-feeding in developed countries: sharp declines in the proportion of infants ever breast-fed and in the shorter nursing durations, followed by an upturn in both measures. The increase in breast-feeding is most prominent among upper-class women. Because Singapore dif-

fers substantially from most developing countries, being entirely urban and possessing a largely modern economy, it is difficult to say whether or not recent changes in breast-feeding in this country describe the pattern of future trends in developing nations. Additional comments on differences in the pattern of change are contained in items 3 to 5 below.

3. Despite the common belief that most breast-feeding change has occurred in urban populations, declines are noted in the rural areas of several countries. In the four countries with information on place of residence (Taiwan, Thailand, Malaysia, and Panama), breast-feeding declines are observed in rural areas. Usually, the amount of change is greater among the urban than the rural population. However, in Panama, nearly all of the recent decline is a result of changes in rural nursing practices.

Such changes may not be common to all developing countries, particularly the least developed nations. However, in countries where breast-feeding practices are already at low levels in urban areas, such as in many parts of Latin America, any future declines will probably take place largely among the rural population.

It would be useful to examine trends in nursing within the various socioeconomic groups residing in rural areas. It is likely that trends within each subgroup differ from the overall trend for the rural population. In Thailand, available information appears to indicate that breast-feeding declines in rural areas have been greatest among the most highly educated women, although these findings are less than conclusive.[22] Unfortunately, reliable information on trends among subgroups of the rural or urban population is not available from published sources for the countries reviewed.

4. Trends vary by ethnicity. In certain countries, declines in breast-feeding rates tend to vary by ethnic group. The distinction is particularly sharp in Malaysia, where the largest declines are attributable to the Chinese and Indian populations, and the smallest to the ethnic Malays. Roughly similar differences exist in Singapore, although the number of Indians and other nonChinese included in these studies is small. At least part of the differentials observed are attributable to the greater exposure of certain ethnic groups to modern influences.

5. Declines are largest for the most modern groups. The relative decline in nursing practices appears to be greatest among the groups most exposed to modern influences. In countries where trends have been measured for population subgroups, frequently the greatest decreases have been in urban areas (Taiwan, Malaysia), among the educated population (Taiwan, Thailand, Malaysia), in the wealthier classes (Singapore, Malaysia, Taiwan), and among women working away from home (Taiwan). In certain instances, relative declines in the most modern groups have been smaller than for other groups because breast-feeding levels in the modern groups were already at very low levels at the beginning of the period of observation (Panama).

Within a few years, it will be possible to make more definitive statements about breast-feeding trends in the developing world. National studies have produced base-line measures of nursing practices for a wide range of developing nations. The cross-sectional results of these surveys appear to indicate that declines are taking place in many countries, although the existence of these patterns is not sufficient to verify this interpretation. Continued interest in the subject has led many of these countries to collect additional information on breast-feeding, often by adding questions on nursing to subsequent national surveys of fertility, contraception, or other topics. As these survey results become available, documenting breast-feeding trends in many of these countries will be possible.

The inadequacy of information on supplementation and weaning practices continues to be a serious concern. Policymakers in developing nations need information on all types of infant feeding if they are to develop appropriate programs for the improvement of infant and child nutrition. It remains to be seen, however, whether the high level of interest in breast-feeding will lead to increased study of supplementation and weaning practices. In the future, more emphasis should be placed on the collection of information on all types of infant and child nutrition in the developing world.

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APPENDIX

Various methodologic considerations mentioned in the text are discussed in greater detail in this section. Problems of measurement and comparability in the analysis of breast-feeding data are considered. Several analytic techniques, including the life table approach and the current status method, are described and evaluated. This is followed by an examination of the usefulness of cross-sectional data in the measurement of breast-feeding trends. The Appendix concludes with a recommended methodology for measuring breast-feeding levels and trends.

Issues in Measurement of Breast-Feeding

The measurement of nursing practices covers both the initiation of lactation among index infants and the length of time in which these infants continue to be nursed. The determination of initiation is relatively straightforward, in particular for periods in the recent past. Mothers who only breast-fed for a short period of time, however, may fail to report this, especially for children born some time before the interview. In addition, some infants may have died too soon after birth to have been breast-fed.

The study of breast-feeding duration is considerably more difficult. In the studies cited above, information on length of lactation is obtained retrospectively from the women in the sample. In general, duration of breast-feeding provided by respondents tends to concentrate around specific periods equivalent to whole or half years. In some countries, the percentage of respondents reporting durations equal to 6, 12, 18, 24, 30, or 36 months represents more than 50% of all reported durations.[11] Although it is theoretically possible that these responses reflect actual breast-feeding behavior, an examination of the current breast-feeding status of respondents does not reveal marked declines in the proportion nursing at periods following multiplies of whole or half years.[18,22] Hence, the heaping of reported durations on certain intervals appears, in large part, to be attributable to recall error.

Another problem associated with reported durations of breast-feeding is that the completed duration will be unknown for infants still breast-feeding. These truncated responses may represent an important proportion of all reported durations, especially if information is only obtained on the most recent child. Use of these data in the measurement of average duration of breast-feeding will result in a serious underestimate of the actual mean duration of nursing for these infants. A related issue concerns the treatment of infants whose breast-feeding is terminated by premature death of the infant, rather than by the mother's decision to stop nursing.

Finally, the measurement of breast-feeding duration may be affected by the index child selected. In some studies, breast-feeding duration has been based on the nursing experience of the next-to-last child (first closed birth interval), because nearly all of these infants will not be breast-feeding at the time of interview, and hence the problem of censored data will be avoided. Other studies have focused on the last child (open birth interval) to obtain data from a more recent period which would be less affected by recall error.

Neither of these groups is representative of all births occurring during a given period of time, however.[28,29] Last (most recent) births tend to be followed by longer-than-average intervals, whereas the interval begun by the next-to-last birth tends to be shorter than average. Because of the strong positive relationship between length of birth interval and duration of breast-feeding, the length of lactation for each of these birth intervals is systematically different: last births tend to experience longer-than-average breast-feeding, whereas next-to-last births tend to be breast-fed for less-than-average periods. In measuring trends, care should be taken to compare breast-feeding duration measures from the same birth interval. Comparing duration measures from two points in time, based on different birth intervals, may tend either to create differences where none in fact exist, or to mask actual changes in the duration of nursing.

Breast-feeding duration is most appropriately measured by collecting information on children from all birth intervals born during a specific, and recent, period. There are several advantages to this approach. First, a representative measure of breast-feeding durations can only be obtained by collecting data on births from all intervals. Restricting the study to a single birth interval will result in breast-feeding duration measures that are either longer or shorter than average, as explained previously. Second, limiting the period to the recent past will reduce the effect of recall error, especially concerning reported durations of breast-feeding. An approach used frequently in breast-feeding studies is to limit the study to a single birth interval, rather than to a specific period of time. This is inappropriate, because data based on a specific birth interval frequently will cover an extended period (often ten or more years). Because breast-feeding behavior may have been changing over time, and at different rates for different groups of women, measurement of duration for a period in the recent past will provide more meaningful information. Finally, the study may also be designed to measure the association between duration of breast-feeding and other characteristics of the mother or family. Because the information on these other variables (income, work status, etc) usually refers to the time of interview, the association between these variables and duration can be best measured with breast-feeding information from the recent past.

The problem of truncated duration responses is not addressed by the approach described above. A procedure used in some breast-feeding studies has been to limit the study to closed birth intervals, such as the next-to-last birth. This will not provide

a representative measure of breast-feeding duration, however, for the reasons previously mentioned. The two analysis techniques described next offer different solutions to the problem of truncated responses.

Life Tables

The measurement of the average duration of breast-feeding among index children is complicated by the fact that certain of these infants may still be breast-feeding at time of interview as noted above. Unless these responses are eliminated or corrected in some way, the effect will be to underestimate the actual mean duration of nursing. Life table techniques are useful in resolving this problem of truncated responses.

In this approach, unbiased estimates of the distribution of completed durations based on truncated data are obtained. The technique assumes that, had the period of observation been longer, the pattern would have been similar to that found among cases for which longer periods of observation were available.[33] Multiple-decrement life table techniques can be used to overcome these censoring problems and the related issue of breast-feeding durations prematurely halted by an infant's death. In effect, this technique measures the probability of breast-feeding surviving children at given ages.[31]

An important advantage of this method is that, in addition to estimates of the mean duration of breast-feeding, in many cases it can provide reliable estimates of the proportion of children who were breast-fed for different periods of time. These measures are essential if one is to examine trends in the pattern of breast-feeding, rather than just in the average length of breast-feeding. The life table approach remains dependent on respondents' estimates of breast-feeding duration, although the impact of such recall error can be reduced by limiting the period of study to a relatively short interval before the date of interview.[29]

Current Status Method

A method of analysis that avoids the problem of recall error is described by Page et al[29] and Smith.[33] This approach, known as the current status technique, also overcomes the problems of data censoring and the use of nonrepresentative data on durations. The method uses information on the current breast-feeding status (whether or not the infant is being breast-fed) of all infants born within a stated period before the survey. The resulting information, when presented by current age of children, forms a synthetic cohort summarizing the breast-feeding experience of the entire sample. Because this cohort should represent the entire nursing experience of index children, the reference period should be long enough so that all or nearly all of the oldest infants have been weaned by the end of the period. Average duration of breast-feeding is obtained by summing the percentage that are breast-feeding (for single months of age) over all ages covered in the period. It is important to remember that measures based on this technique represent the experience of children, rather than of mothers surveyed.

The current status method has several advantages. First, recall error certainly occurs less with this approach than with techniques based on reported durations of breast-feeding. The question of whether or not a child was ever breast-fed is surely more accurately reported by respondents than is the actual duration of nursing experienced. Because the technique relies only on the current breast-feeding status of an infant, the experience of children before the most recent child can be used even if breast-feeding questions concerning these children were not asked. This is possible because almost none of these children will be breast-fed beyond the time of birth of younger siblings. In Taiwan, one analyst[25] has determined that in 1967 to 1968 less than 1% of next-to-last children were being breast-fed at the time of survey. Hence, even when information is only collected on the last child, this technique allows the measurement of breast-feeding duration for a representative sample of children.

Perhaps most important for the study of breast-feeding trends is that this method makes it easier to compare results from surveys using different methodologies. Variations in measurement techniques, selection of index children, or definitions may preclude the use of other analysis techniques for the study of trends in breast-feeding duration. Examples include Taiwan, where the choice of index children varied from one study to another in the series of surveys covering the period 1967–1968 to 1980, and Thailand, where not all studies in the series obtained actual length of lactation for index children. Thus, although in some cases there may be little difference between levels of breast-feeding based on the current status method and the life table approach,[1] the current status approach may be more useful in the study of trends because of greater comparability across surveys.

There are certain disadvantages attached to the current status method. Although this method does eliminate the recall error associated with estimates of breast-feeding durations, it is dependent upon accurate recall of children's dates of birth.[11] Particularly in African countries, date-of-birth data will be of questionable quality. Usually information on recent birth dates will be more accurately reported

than will breast-feeding durations, however. Second, the sample used for each estimate will be small, leading to greater sampling variability than with other methods.

The examination of a current status schedule generally shows large fluctuations from one month to the next in the proportion of children still breast-fed. The mean duration, calculated by summing the individual proportions, is a more stable figure precisely because these large variations tend to cancel each other out in the summation.

The instability of the individual proportions is largely due to the small sample available for the estimation of single-month proportions.[29] In many of the surveys reviewed in this report, the individual cell sizes were small, generally less than 100 cases and often in the range of ten to 30 cases. For this reason it is generally not appropriate to compare changes over time in the proportions of infants still breast-feeding by single months of age. A more appropriate procedure for such comparisons would require calculation of the monthly probabilities via life table techniques. Even this approach would be appropriate only if the retrospective estimates of breast-feeding duration are reliably reported.

Inferring Trends from Cross-Sectional Data

Singe surveys of recent breast-feeding practices are available from a wide range of developing countries. The results of such studies represent the nursing experience of a cross section of the population at a single point in time. Some researchers have used certain patterns found in cross-sectional data to infer the existence of a trend.[19] These attempts have focused on patterns of nursing practices by mothers' age or by birth order.

They argue that, if modern influences on the behavior of women are causing the recent declines in breast-feeding, the impact will be strongest on younger women. Young women will tend to be more receptive to modern influences because they have not been exposed to traditional practices for as long as older women, and because in many countries the younger women are more likely to have received a modern education. Hence, lesser practice of breast-feeding among younger women would appear to indicate the onset of a decline in nursing.

A similar argument can be made for breast-feeding patterns by birth order. Because most lower order births are to younger women, a single survey showing less breast-feeding among lower parity women would appear to indicate that nursing practices are decreasing among young women.

In fact, breast-feeding measures obtained from many recent national studies do show this pattern of reduced nursing among younger and lower parity women. It is highly likely that actual declines in breast-feeding account for at least some of the age and parity differences noted. The existence of these patterns is not sufficient to verify this interpretation, however, for a variety of reasons.

Consider first the pattern of nursing by age of mother. Because these measures refer to a single period of time, it is not possible to determine whether the differences by age are part of a consistent pattern over time (older mothers always breast-feeding more than younger mothers), or whether they indicate that changes in nursing practices are taking place in successive cohorts of women.

Second, the relationship between duration of nursing and mothers' age is confounded by changes in the length of birth intervals. The association between birth intervals and duration of breast-feeding is complex, with each factor in part causing the other. Breast-feeding will tend to lengthen the period between births, but the protection afforded against conception is far from complete. Upon becoming pregnant, most nursing mothers will stop breast-feeding in preparation for their next birth. Thus, longer birth intervals will tend to be associated with longer periods of breast-feeding, and shorter birth intervals with shorter nursing durations. Birth intervals tend to increase with age because of reduced fecundity and less-frequent sexual intercourse, among other reasons.[5] In the present case, the longer breast-feeding durations reported by older mothers thus are at least partly attributable to the longer periods of time in which they can nurse.[11] Conversely, the shorter durations among younger mothers are partly caused by the shorter birth intervals they experience.

Information on nursing patterns by birth order is also insufficient to validate the existence of a trend in breast-feeding. As with the age differences discussed above, the data refer to a single period of time and hence cannot be used to verify that the current pattern represents a change from past practices. Second, the relationship between duration of breast-feeding and birth order is also affected by differences in the length of birth intervals. A recent study[19] of breast-feeding based on cross-sectional data found no consistent relationship between birth order and duration of breast-feeding in ten Asian countries. Kent[19] hypothesized that the inconsistent patterns might be caused by the offsetting effects of a decline in nursing duration and a movement toward reduced family size or increased birth spacing. (This would result in longer birth intervals and hence longer durations of breast-feeding.) A more consistent pattern was found among eight Latin American and Caribbean countries, however. Further consideration of the relationship between

parity and duration of breast-feeding will require detailed information on the length of birth intervals.

Recommended Methodology for Breast-Feeding Studies

Given all of the methodologic difficulties discussed above, which approach is best in the study of breast-feeding levels and trends in developing countries? What follows is a set of general recommendations for such studies. The detailed aspects of individual studies will vary, depending on the characteristics of the particular country.

Because of the existing budget constraints in most developing countries, the methodology used must strike a balance between the range of information required and the costs of data collection. Cost is particularly important because the study will need to be repeated at regular intervals.

Given these factors, breast-feeding studies should incorporate the following recommendations:

1. *Index Children and Study Period.* Breast-feeding studies should collect information on children of all birth intervals born within a specific period before the study. The period should be long enough so that most of the older infants will have ceased breast-feeding before the end of the period.

2. *Sample Size and Design.* The sample used should be nationally representative. It also should be of appropriate size and design to provide reliable measures at the national level and for designated population subgroups. Limiting the study to urban areas or the capital city will mean that changes in breast-feeding among rural women or other important population subgroups will go undetected.

3. *Prospective Retrospective Data Collection.* The need to obtain information from a large, nationally representative sample will mean that data must be collected retrospectively. Prospective studies could avoid many of the limitations associated with retrospective data, particularly when measuring breast-feeding duration. However, prospective surveys are not feasible on the scale required here, because they would be considerably more expensive and difficult to complete than retrospective surveys.

4. *Comparability with Previous Studies.* Information collected by the survey should be sufficiently broad to facilitate comparisons with the results of previous breast-feeding studies. In general, this will include data on the initiation and duration of nursing, and current breast-feeding status for all last and next-to-last live births in the sample.

5. *Questionnaire Content.* At a minimum, the study should collect information on the initiation and current breast-feeding status of infants in the sample, as well as on the duration of nursing for those not currently breast-fed. The duration of both full and partial breast-feeding should be obtained. The age of sample infants should be recorded, and if not known, estimated. The questionnaire should specify whether these infants are living, and if decreased, age at death should be ascertained. Additional questions about characteristics of the infant, mother, or family can be added as required. At a minimum, the following topics should be included: infant's sex and birth order; and mother's age, education, place of residence, and work experience.

6. *Type of Survey.* The necessary information can be collected either through a study devoted entirely to infant feeding or through a module attached to a nutrition or other health survey, or to a demographic survey.[44] Each survey type serves a useful purpose, and if properly coordinated, the two data sets will complement each other.

Infant-feeding surveys can be used to collect the information recommended above, as well as additional data on related topics, such as the types of supplementary and weaning foods used, intake of water and water quality, and the frequency and intensity of suckling. These studies would be used to provide base-line data only, or would be repeated at fairly long intervals.

Breast-feeding modules can be easily added to other surveys as needed, as is currently done with the Contraceptive Prevalence Surveys. The use of these "add-on" modules simultaneously holds down the cost of data collection and provides breast-feeding data at more frequent intervals.

REFERENCES

1. Akin J, Bilsborrow R, Guilkey D, et al: Breast-feeding patterns and determinants in Jordan. Presented at the International Union for the Scientific Study of Population meetings, Manila, December 1981
2. Akin J, Bilsborrow R, Guilkey D, et al: The determinants of breast-feeding in Sri Lanka. *Demography* 1981;18:287–308
3. Almroth S, Latham M: Breast feeding practices in rural Jamaica. *J Trop Pediatr* 1982;28:103–109
4. Berg A, Muscat R: *The Nutrition Factor: Its Role in National Development.* Washington, DC, The Brookings Institution, 1973
5. Brown R: Breast-feeding and family planning: Review of the relationships between breast-feeding and family planning. *Am J Clin Nutr* 1982;35:162–171
6. Butz W, DaVanzo J: Determinants of breast-feeding and weaning patterns in Malaysia. Working draft, WD-995-1-AID Santa Monica, CA, Rand Corp, 1981
7. Chen AJ: Breast-feeding practices among prenatal mothers in Singapore. *Singapore Community Health Bull* 1981;22:32–8
8. Cho L, Arnold F, Kwan T: *The Determinants of Fertility in the Republic of Korea.* Washington, DC, National Academy Press, 1982
9. Coale AJ, Goldman N, Cho LJ: Nuptiality and fertility in the Republic of Korea. Presented at the International Union for the Scientific Study of Population Seminar on Nuptiality

and Fertility. Bruges, Belgium, Jan 8–11, 1979
10. Cole E: Breastfeeding: A critique of the literature, in Raphael D (ed): *Breastfeeding and Food Policy in a Hungry World.* New York, Academic Press, 1979, pp 137–148
11. Ferry B: Breastfeeding. World Fertility Survey Comparative Studies, Cross National Summaries No. 13. Voorburg, The Netherlands, International Statistical Institute, May 1981
12. Gueri M, Justsum P, Hoyte R. Breast-feeding practices in Trinidad. *Bull Pan Am Health Organ* 1978;12:316–322
13. Deleted in proof
14. Hofvander Y: Patterns of breastfeeding and weaning in developing countries, in Hambraeus L, Sjolin S (eds): *The Mother/Child Dyad: Nutritional Aspects.* Stockholm, Almquist and Wiksell International, 1979, pp 69–73
15. Jain A, Bongaarts J: Breastfeeding: Pattern correlates and fertility effects. *Stud Fam Plann* 1981;12:79–99.
16. Jelliffe D, Jellifee E: *Human Milk in the Modern World.* Oxford, England, Oxford University Press, 1978
17. Kamnuansilpa P, Chamratrithirong A: *A New Decade of Fertility and Family Planning in Thailand: 1981 Contraceptive Prevalence Survey.* Bangkok, Thailand, Research Center, National Institute of Development Administration, 1982
18. Keller A, Samano F, Nunez L, et al: Breastfeeding: Recent tendencies in the Mexican experience. Mexico City, Maternal and Child Health and Family Planning Division, Department of Health and Welfare, 1981, unpublished
19. Kent M: *Breast-Feeding in the Developing World: Current Patterns and Implications for Future Trends.* Washington, DC, Population Reference Bureau, 1981
20. Kenya, Republic of: *Report of the Child Nutrition Survey 1978–79.* Nairobi, Central Bureau of Statistics, Ministry of Economic Planning and Development, 1979
21. Knodel J, Chamratrithirong A, Chayovan N, et al: Fertility in Thailand: Trends differentials and proximate determinants. Washington, DC: National Academy Press, 1982
22. Knodel J, Debavalya N: Breastfeeding in Thailand: Trends and differentials 1969–1979. *Stud Fam Plann* 1980;2:355–377
23. Latham M: Infant feeding in national and international perspective: An examination of the decline in human lactation, and the modern crisis in infant and young child feeding practices. *Ann NY Acad Sci* 1977;300:197–209
24. Lesthaeghe R, Page H: The post-partum non-susceptible period: Development and application of model schedules. *Popul Stud* 1980;34:143–169
25. Millman S: *Breastfeeding in Taiwan: A Study of Change,* thesis. University of Michigan, Ann Arbor, MI, 1982
26. Monteith R, Anderson J, Mascarin F, et al: Contraceptive use and fertility in the Republic of Panama. *Stud Fam Plann* 1981;12:331–340
27. Nerlove S: Women's workload and infant feeding practices: A relationship with demographic implications. *Ethnology* 1974;13:207–214
28. Page H, Ferry B, Shah I, et al: The most recent births: Some analytical possibilities and underlying problems. Presented at the World Fertility Survey, International Union for the Scientific Study of Population, London School of Hygiene and Tropical Medicine Seminar on the Analysis of Maternity Histories, London, 1980
29. Page H, Lesthaeghe R, Shah I: *Illustrative Analysis: Breastfeeding in Pakistan.* World Fertility Survey Scientific Reports No. 37, Voorburg, The Netherlands, International Statistical Institute, April 9–11, 1982
30. Pan American Health Organization: *The National Food and Nutrition Survey of Guyana.* Washington, DC, PAHO, 1976
31. Popkin B, Bilsborrow R, Akin J: Breast-feeding patterns in low-income countries. *Science.* 1982;218:1088–1092
32. Potts M: Determinants of duration of breast- and bottle-feeding. Presented to the National Institutes of Health Workshop on Cultural and Economic Determinants of Infant Feeding, Washington, DC, June 9–11, 1981
33. Smith D: *Life Table Analysis.* World Fertility Survey Technical Bulletin, No. 8 Voorburg, The Netherlands, International Statistical Institute, 1980
34. Tan J: Singapore, in Jelliffe D, Jelliffe E, Sai F, et al (eds): *Lactation, Fertility and The Working Woman.* London, International Planned Parenthood Federation, 1977
35. Underwood B, Arsdell H, Blumenstiel E, et al: Implications of available information on breastfeeding worldwide, in Bond J, Filer L, Leveille G, et al: (eds): *Infant and Child Feeding.* New York, Academic Press, 1981, pp 77–96
36. United States Agency for International Development: *Arab Republic of Egypt: Nutrition Status Survey.* Washington, DC, Office of Nutrition, 1978
37. United States Agency for International Development: *Arab Republic of Egypt: Nutrition Status Survey II.* Washington, DC, Office of Nutrition, 1980
38. United States Agency for International Development: *Cameroon United Republic: National Nutrition Survey.* Washington, DC, Office of Nutrition, 1978
39. United States Agency for International Development. *Republic of Haiti: National Nutrition Survey.* Washington, DC, Office of Nutrition, 1979
40. United States Agency for International Development. *Republic of Liberia: National Nutrition Survey.* Washington, DC, Office of Nutrition, 1978
41. Winikoff B: Weaning: nutrition, morbidity and mortality consequences. Presented at the International Union for the Scientific Study of Population Seminar on Biological and Social Aspects of Mortality and the Length of Life, Fuiggi Terme, Italy, May 13–16, 1980
42. Wong H: *Breast Feeding in Singapore.* Singapore, Choon Kee Press, 1971
43. World Health Organization: *Contemporary Patterns of Breastfeeding: Report on the WHO Collaborative Study on Breastfeeding.* Geneva, WHO, 1981
44. World Health Organization: *Methodology for Determination of Breastfeeding Patterns: Based on an Informal Meeting on the Development of a Methodology for the Surveillance of Breastfeeding.* Geneva, WHO, 1981

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