METHODOLOGICAL REPORTS 2

Demographic and Health Surveys

An Assessment of the Quality of Health Data in DHS-I Surveys

The Demographic and Health Surveys (DHS) is a 13-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and maternal and child health. Funded primarily by the United States Agency for International Development (USAID), DHS is administered by Macro International Inc. in Calverton, Maryland.

The main objectives of the DHS program are to: (1) promote widespread dissemination and utilization of DHS data among policymakers, (2) expand the international population and health database, (3) advance survey methodology, and (4) develop in participating countries the skills and resources necessary to conduct high-quality demographic and health surveys.

For information about the Demographic and Health Surveys program, write to DHS, Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705-3119, U.S.A. (Telephone 301-572-0200; Telefax 301-572-0999; Telex 198116).

Demographic and Health Surveys
Methodological Reports No. 2

An Assessment of the Quality of Health Data in DHS-I Surveys

Macro International Inc.
Calverton, Maryland, USA

January 1994

The recommended citation for this publication is:

Macro International Inc. 1993. *An Assessment of the Quality of Health Data in DHS-I Surveys*. DHS Methodological Reports, No. 2. Calverton, Maryland: Macro International Inc.

Contents

Tables

ASSESSMENT OF THE QUALITY OF HEALTH DATA IN DHS-I SURVEYS: AN OVERVIEW

DEMOGRAPHIC ASPECTS OF THE QUALITY OF DATA ON BIRTHS IN THE DEMOGRAPHIC AND HEALTH SURVEYS

ASSESSMENT OF THE QUALITY OF DATA ON MATERNITY CARE IN THE DEMOGRAPHIC AND HEALTH SURVEYS

AN ASSESSMENT OF THE QUALITY OF BREASTFEEDING DATA IN DHS-I SURVEYS

ANTHROPOMETRIC STATUS OF YOUNG CHILDREN IN DHS-I SURVEYS: AN ASSESSMENT OF DATA QUALITY

CAUSES OF DEATH IN CHILDHOOD: AN EVALUATION OF THE RESULTS OF VERBAL AUTOPSY QUESTIONS USED IN SEVEN DHS SURVEYS

Figures

ASSESSMENT OF THE QUALITY OF HEALTH DATA IN DHS-I SURVEYS: AN OVERVIEW

DEMOGRAPHIC ASPECTS OF THE QUALITY OF DATA ON BIRTHS IN THE DEMOGRAPHIC AND HEALTH SURVEYS

THE QUALITY OF DATA ON CHILD IMMUNIZATION IN DHS-I SURVEYS

THE QUALITY OF DATA ON CHILD MORBIDITY AND TREATMENT IN DHS-I SURVEYS

Preface

One of the objectives of the Demographic and Health Surveys (DHS) program is to advance the methodology and procedures pertaining to national-level surveys in the fields of population and maternal and child health.

In the course of implementing 34 surveys during the first five-year phase of the project and 25 surveys during the second phase, questions and issues have arisen regarding the design and implementation of these surveys.

The purpose of the *DHS Methodological Reports* series is to examine some of these questions and issues and to provide answers, explanations, and solutions which will be of benefit to survey researchers, particularly those in developing countries.

Survey methodology can have a substantial impact on data quality. This report deals with issues of health data quality in the DHS surveys. Although considerable experience has been gained in the use of fertility and family planning questions, the addition of health questions to a cross-sectional survey was relatively new. In this report the quality of DHS-I survey data is assessed.

Future reports in this series will examine sampling, survey implementation, and analysis issues, with a view to improving survey research efforts in the future.

Martin Vaessen
Project Director

CHAPTER 1

Assessment of the Quality of Health Data in DHS-I Surveys: An Overview

J. TIES BOERMA
A. ELISABETH SOMMERFELT
JEROEN K. VAN GINNEKEN
GEORGE T. BICEGO
M. KATHRYN STEWART
SHEA O. RUTSTEIN

Acknowledgments

Thanks to the following people for reviewing the subject areas noted:

Noreen Goldman and Roy Miller, immunization;
Ron Gray, verbal autopsy;
Beverley Carlson and John Mason, anthropometry;
Kenneth Hill, maternity care;
Virginia Laukaren and Chessa Lutter, breastfeeding;
Stan Becker, demographic aspects; and,
Roy Miller, morbidity.

Collection of health data through large-scale cross-national survey programs is a relatively new area. During the 1970s, the World Fertility Survey (WFS) was the main instrument through which extensive experience was gained in the collection of data on fertility, family planning, and mortality. Its successor, the Demographic and Health Surveys (DHS), built upon that experience, and also expanded the goals of the surveys to include health data.

Until the beginning of the 1980s the experience with health interview surveys in developing countries was relatively limited. Except for the United Nations-supported Household Survey Capability Programme, which included information on health-related issues, most of the data on health status and health care utilization was collected through the health services or in small-scale epidemiological studies. An important development was initiated by the Expanded Programme on Immunization (EPI) division of the World Health Organization (WHO). EPI developed a simple and reliable sampling technique for the collection of child immunization coverage data, which made immunization coverage surveys the most popular type of survey during the 1980s. The sampling technique was also used to collect other data, such as neonatal tetanus mortality (Galazka and Stroh, 1986) and diarrhea case management (WHO, 1986), and further applications are being investigated (Anker, 1991).

Several authors (Kroeger, 1983; Ross and Vaughan, 1986) have pointed to the weaknesses of health interview surveys. The most difficult area is the collection of data on morbidity, which is subject to a reporting bias. Because health and illness are subjective matters, the magnitude of the reporting bias often is very difficult to evaluate. The measurement of health services utilization is also affected by various reporting biases. For example, the use of health services for diarrhea depends on the reporting of diarrhea; some respondents only report severe cases, whereas others include even the mildest cases. Reporting may also differ for deceased and living children or for births longer ago and more recent.

During Phase I of DHS (DHS-I 1984-1989), questions to measure health and health care utilization, based on the existing knowledge, were developed. There were four main areas: antenatal and maternity care, immunization, child morbidity and treatment, and breastfeeding. Child anthropometry was included in most surveys and the causes of death in early childhood were optional.

This overview briefly deals with the quality of the health data in the DHS-I surveys; a more detailed assessment can be found in the specific papers cited. Subsequent sections include an outline of the materials and methods used in assessing the quality of the health data and some of the most important findings for each of the health-related topics. Where applicable, the sections end with a summary of the changes made in the DHS-II core questionnaire.

1.1 DATA AND METHODS

The DHS project assists developing countries in the organization of nationally representative surveys, which provide information for policy and program decisionmaking and for scientific research. Survey data include information on fertility and childhood mortality levels, use of family planning, and various maternal and child health indicators. Table 1.1 provides a summary of the DHS-I surveys, including date of fieldwork, sample size (number of women and number of children under five), and health modules used.

The quality of the health data is assessed for the following areas:

- Demographic aspects related to birth data
- Antenatal and maternity care
- Child vaccinations
- Child morbidity and treatment (diarrhea, respiratory infections)
- Breastfeeding and supplementary feeding patterns
- Child anthropometry
- Causes of death in childhood.

The methods to evaluate the quality of data vary by topic, but generally include the following:

- Frequencies of missing values and "don't know" responses, and the proportion of responses in "other" categories;
- Occurrence of digit preference for duration questions, dating of events, and anthropometry;
- Prevalence of inconsistencies between different parts of the health section or between the health section and birth history;
- Quality of data for deceased children compared to data on living children;
- Quality of data if the mother has to report on more than one child in the last five years; and
- Comparison of DHS results with external sources.

1.2 DEMOGRAPHIC ASPECTS OF THE QUALITY OF BIRTH DATA IN THE LAST FIVE YEARS

In the DHS surveys, the questions related to health are embedded in a relatively long questionnaire that also includes fertility, family planning, and background characteristics of the respondent. Health data are collected for all children born in the five-year period preceding the survey. The basis for the selection of these births is the birth history, whereby information on

Table 1.1 Summary of DHS-I surveys: Date of fieldwork, sample sizes (women and children under five), and health modules, Demographic and Health Surveys, 1985-1990

Country	Date of Fieldwork	Number of Women	Children born in last 5 years		Health Modules	
			Living	Dead	Child Anthro-pometry	Causes of Death
SUB-SAHARAN AFRICA						
Botswana	Aug-Dec 1988	4368	3068	146		
Burundi	Apr-Jul 1987	3970	3502	385	x	
Ghana	Feb-May 1988	4488	3690	446	x	
Kenya	Dec-May 1988/89	7150	6593	539		
Liberia[a]	Feb-Jul 1986	5239	4307	873		
Mali	Mar-Aug 1987	3200	2904	537	x	
Ondo State, Nigeria	Sep-Jan 1986/87	4213	3018	264	x	
Senegal	Apr-Jul 1986	4415	3708	579	x	x
Togo	Jun-Nov 1988	3360	2803	331	x	
Uganda	Sep-Feb 1988/89	4730	4373	676	x	
Zimbabwe	Sep-Jan 1988/89	4201	3164	194	x	
NORTH AFRICA						
Egypt	Oct-Jan 1988/89	8911	8009	723	x	x
Morocco	May-Jul 1987	5982	5602	500	x	x
Sudan	Nov-May 1989/90	5860	6062	582		
Tunisia	Jun-Oct 1988	4184	4250	227	x	x
ASIA						
Indonesia	Sep-Dec 1987	11884	7592	650		
Sri Lanka	Jan-Mar 1987	5864	3877	104	x	
Thailand	Mar-Jun 1987	6775	3519	132	x	
LATIN AMERICA/CARIBBEAN						
Bolivia	Mar-Jun 1989	7923	5208	585	x	x
Brazil	May-Aug 1986	5892	3224	257	x	
Colombia	Oct-Dec 1986	5329	2615	87	x	
Dominican Republic	Sep-Dec 1986	7649	4106	337	x	
Ecuador	Jan-Mar 1987	4713	2849	202		x
El Salvador	May-Jun 1985	5207	3234	256		
Guatemala	Oct-Dec 1987	5160	4230	397	x	
Mexico	Feb-May 1987	9310	5368	312		
Peru	Sep-Dec 1986	4999	2836	295		
Trinidad & Tobago	May-Aug 1987	3806	1889	59	x	

[a] Last births only in five years preceding the survey.

birth dates, age, and survival status is collected. All age-specific analysis of health data uses the information from the birth history. The quality of the birth history data, therefore, affects thequality of the health data. In Chapter 2 of this report, Bicego and Boerma assess the quality of various aspects of the birth history; their main findings are summarized below.

1.2.1 Response Rates

Response rates, which can be dissected into the levels of household, individual (woman), and health section, were evaluated first. Once a household has been identified in the field, and the household members have been listed, the interviewer ascertains those women who will be eligible for the individual interview (i.e., those women 15-49 years who slept in the household the night before the survey). The individual questionnaire includes a complete birth history, which is administered to each eligible woman. Based on dates of birth, the interviewer identifies those children born since a specific cutoff date, usually 1 January of the fifth year preceding the year of the survey. These children represent the target population for which maternity care data and part of the feeding pattern data are collected (the remaining health information collected is limited to the subsample of living children). Response rates were on average above 95 percent for each of the three sections. Eight surveys had an overall response rate, defined as the product of the three response rates, below 90 percent. This value represents the theoretical percentage of children in the target sample of households for whom health data were collected.

1.2.2 Completeness and Quality of Data on Birth Date and Age

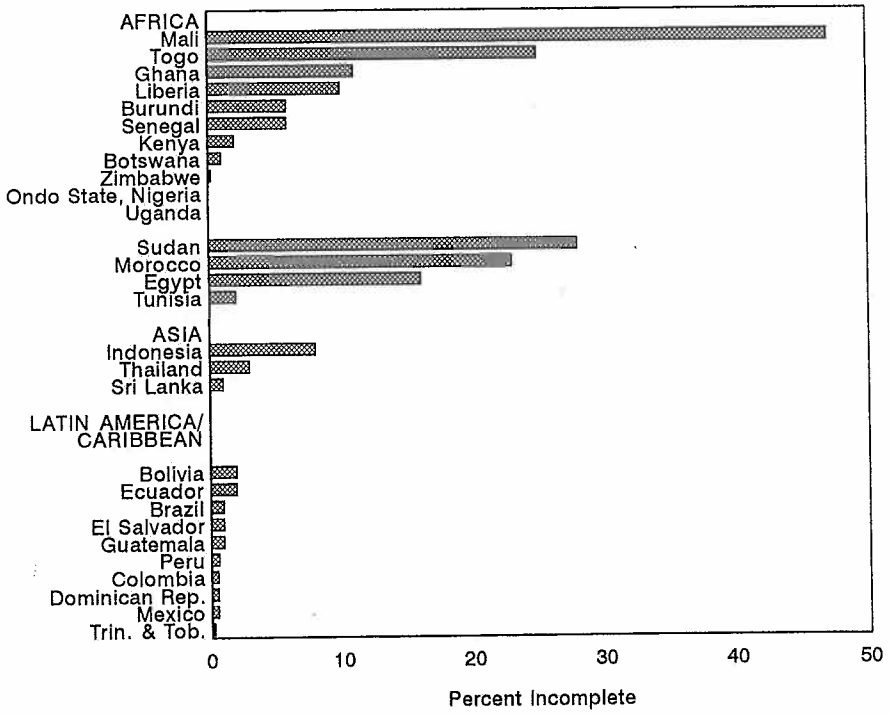
The completeness and quality of data on birth date and age are important for two reasons: age data are used in the analysis of health data, and the age of the child is a criterion of inclusion

in the health section. Arnold (1990) presented evidence of a bias in age reporting related to the latter: some birth dates were pushed back a year or two so that the health section could be skipped for these children. Indeed, several DHS surveys have a deficit of births five years before the survey, but an excess six years before. There is little or no evidence of displacement in the surveys in Asia, Latin America, and the Caribbean, with the exception of Guatemala and, to a lesser extent, Bolivia and Trinidad and Tobago. In Guatemala, the number of births five years before the survey is 16 percent less than expected compared to years four and six before the survey. The North African surveys also show some indication of displacement and in several countries of sub-Saharan Africa the problem of displacement is most severe. Three surveys, Kenya, Liberia, and Ondo State (Nigeria), are especially problematic; the expected number of births at five years before the survey falls short by at least 20 percent compared to the numbers of births in the surrounding years. Ghana is the only African country without evidence of displacement, and Uganda and Zimbabwe have very little displacement.

Virtually all analyses of child health data are undertaken using age groupings. It has been noted that birth dates can be intentionally manipulated, but it is also the case in developing countries that the reporting of birth dates and ages is inherently fraught with uncertainty and imprecision. The current age of a child is most precisely defined when a complete birth date (both month and year) is provided by the mother in the birth history. It becomes less well defined when only the year of birth is reported or when a year of birth and a current age (in years) is given. Several points emerge from an analysis of the incompleteness of birth date information:

- The overall level of incompleteness of birth date information varies widely (see Figure 1.1). Generally, incompleteness is highest in sub-Saharan Africa and North Africa and lowest in Latin America. Incompleteness in Mali is especially problematic, with nearly half the children lacking complete birth-date information. Three countries (Morocco, Sudan, and Togo) have 20- to 30-percent incompleteness and three others (Egypt, Ghana, and Liberia) have 10- to 20-percent incompleteness for all births in the last five years. Nevertheless, the average for all 27 countries is a surprisingly low 3.5 percent.

Figure 1.1 Incomplete birth date information among births in the last 5 years, Demographic and Health Surveys, 1985-1990



- Children no longer alive are, on average, more than four times more likely than surviving children to lack a completely reported birth date. This pattern is particularly pronounced where overall incompleteness is low (i.e., Latin America), but is exhibited in nearly all countries.

- There exists a tendency for the precision of birth date reporting to diminish with increasing age of the child. For example, the birth dates of children born four completed years before the survey are six times more likely to be imprecisely reported than those of children born in the year of the survey.

Becker (1984) has suggested that there is a tendency to misplace the month of birth of young children in birth histories. Using data from four WFS surveys he found overreporting of the month of birth for the survey month and the months immediately preceding it and underreporting of births following the survey month. For example, if the interview was held in August 1992 and the child was born in September 1990, but the respondent cannot recall the month exactly, then the child is likely to be reported as born in July 1990, which implies that the child's age is overreported by two months. Becker suggested it might be easier for the respondent (or interviewer) to recall the names of the months that have just passed than those still to come. Data from 28 DHS-I surveys showed a birth peak in the first month before the interview and in the second and third month before the survey the numbers of births are also higher than expected. There is a shortage of births in the months following the survey months and, contrary to Becker's observations, in the month of interview.

Evidence from both WFS and DHS surveys shows that births have been displaced to the last year before the survey and that births in the last year have been displaced to the more recent months (Grummer-Strawn and Trussell, 1990). A higher number of births were reported for the most recent months than for any other period and for the year preceding the survey than for all other years. Surveys in both sub-Saharan Africa and Latin America show displacement of births into the first year of life, although the level appears to be much stronger in sub-Saharan Africa than in Latin America.

It is difficult to find a satisfactory explanation for the observed pattern. Possibly there is a tendency to move birth dates closer to the interview date for births in the two to three years prior to the survey. In this case children's ages would be underreported. This displacement pattern occurs in addition to the displacement of births caused by the preference to report months that have just passed as opposed to months that are still to come. Generally, the effect of this type of displacement is overreporting the age of young children.

1.2.3 Age-at-death Reporting

Age-at-death reporting is more complete than birth date reporting for births in the past five years. In half of the surveys there were no missing data for age at death, and all surveys had less than 3 percent missing values. The quality of age-at-death data is more difficult to assess. In DHS surveys, deaths under one month had to be recorded in days, deaths under two years in months, and deaths at two years and over in years.

Considerable heaping occurs at 12 months of age in all surveys, except for Sri Lanka and Thailand. There is no precise way to determine the extent of heaping because it assumes knowledge of an "expected" number of deaths at 12 months of age, which in turn assumes knowledge of the true age pattern to mortality as well as of the age range from which the heaped deaths were drawn. An index of heaping was calculated based on the arbitrary assumptions that heaped deaths were drawn from the 6- to 23-month period, and that the expected number of deaths at 12 months is the average number during months 6 through 23. Figure 1.2 shows the amount of heaping at 12 months by survey. The level is highest in sub-Saharan Africa, although Bolivia, Ecuador, Guatemala, Peru, and Sudan also have index values exceeding 5. These figures warn against use of 12 months as a cut-off age for analysis of age-specific determinants of childhood mortality.

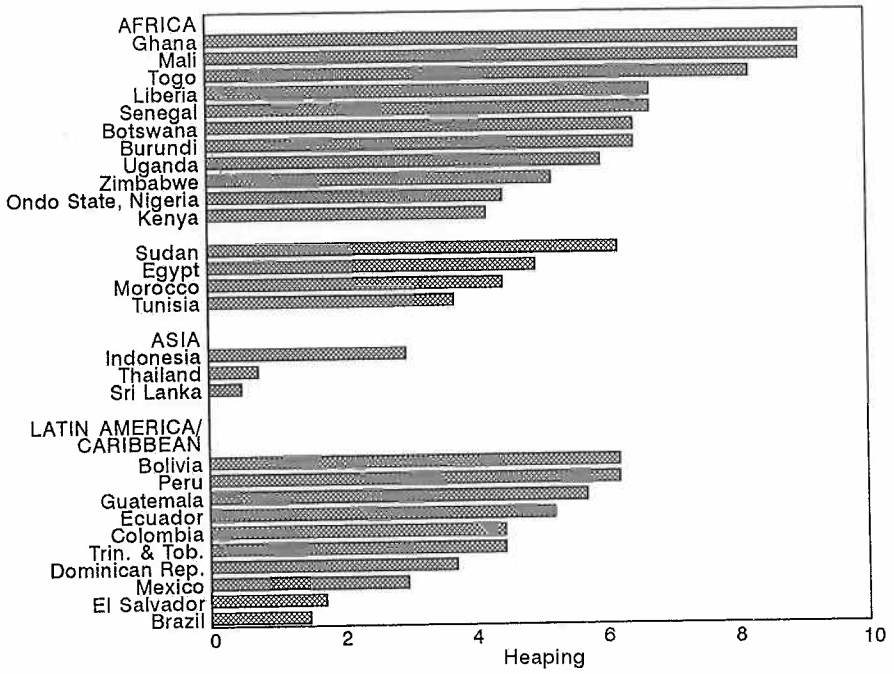
1.2.4 Multiple Births

The proportion of live births in the last five years that were part of a multiple birth ranges from 1.0 in Trinidad and Tobago to 5.4 percent in Togo. The mean for 27 countries is 2.3 percent, which corresponds to a twinning rate of approximately 1.1 percent, which is quite plausible. Considerable variation among the countries may be due to poor data quality and to sampling error (small numbers of multiple births), but part of it is probably real, since substantial regional variation has been demonstrated (Pison et al., 1989). The DHS estimate of the frequency of multiple births is a minimum estimate, since there are several reasons to assume that DHS surveys underestimate multiple births. For instance, DHS surveys do not collect data on stillbirths, which are more common for multiple births. Underreporting of deaths may also affect twinning rates, since twins are more likely to die.

1.2.5 Fostering of Children

The proportion of children who were reported by the biological mother not to live with her varied considerably between surveys. The overall level of fostering is highest in sub-Saharan Africa and lowest in North Africa. In Botswana and Liberia, more than 10 percent of the children under five years were not living with their mothers. In four additional countries, more

Figure 1.2 Heaping of age at death at 12 months, Demographic and Health Surveys, 1985-1990



than 5 percent of the children were "fostered away" (Dominican Republic, Senegal, Uganda, and Zimbabwe). Fostering is clearly age-dependent: it is rare during infancy (mean for 26 countries 0.3 percent) and increases during the second (mean 1.3 percent), third (2.6 percent), fourth (3.7 percent), and fifth years of life (4.7 percent). Fostering affects the quality of data on feeding, morbidity and treatment patterns, and immunization.

1.2.6 Density of Births in the Recent Five-year Period

DHS surveys collect health data on all live births in the five years preceding the survey. The quality of the data may be affected by the sheer volume of information collected from mothers with more than one birth in the last five years. Indeed, more than half of such mothers had to answer questions about at least two births. On average, 36 percent of these mothers had one birth, 47 percent two births, 15 percent three births, and 2 percent four births or more. In several sections of this volume we will attempt to assess whether either the mother or the respondent is overburdened by being asked questions about all births in the last five years.

Less extensive questionnaires that have been used in other health surveys focus on last births only or on the last two births. From the DHS data it can be shown that last birth samples are only appropriate for studies of infant health, since they capture 98.6 percent of all births (mean for 28 surveys), but they are not suitable for studies that include older children. For example, 10 percent of the children age one year would be missed in a last births sample. Samples that include the last two births could be considered if the focus was on the health of children under three years: 98.1 percent of all births were captured by the last two births (mean for 28 surveys).

1.2.7 Implications for DHS-II

The efforts to obtain the best possible information on dates of birth and ages of the children in the DHS-II surveys continued along the same lines as in the DHS-I surveys. During the training of the interviewers, field editors, and supervisors, the birth history is the most time-consuming section of the questionnaire. Emphasis is put on consistency of information; use of various methods, such as historical calendars, to obtain a birth date in case the mother does not know the exact month and/or year; and probing of long intervals between births. During fieldwork, data quality tables, including several tables on the accuracy and completeness of children's birth dates, are run repeatedly. The teams in the field receive immediate feedback to improve data collection.

1.3 MATERNITY CARE

In DHS-I, pregnant women were asked about tetanus toxoid (TT) immunization and antenatal care received during the current pregnancy. In addition, all women were asked about maternity care received during pregnancies completed in the five years prior to the survey. Specifically, they were asked if they had received tetanus toxoid during pregnancy; who, if anyone, provided antenatal care; and who, if anyone, provided delivery care. Fourteen surveys also included a country-specific question about the place of delivery.

The assessment of the quality of maternity care data by Stewart, Boerma and Van Ginneken (Chapter 3 of this report) focuses on:

- The limitations of the questions asked about maternity care;
- The distribution of missing values, "don't know," and "other" responses for the maternity care data ;
- Internal consistency of responses; and
- Comparison of DHS data with other sources of data on maternity care coverage.

1.3.1 Current Pregnancy

Women were asked if they were currently pregnant and, if so, for how many months. The analysis showed that early pregnancies were underreported in all surveys. This underreporting of early pregnancies may be associated with a lack of awareness or an unwillingness to report early pregnancies. In addition, the data on duration of pregnancy should be interpreted with caution, since the majority of the surveys had markedly higher proportions of women pregnant in the second trimester than in the first or third trimesters.

If the respondent was pregnant, questions were asked about who provided antenatal care and whether or not tetanus toxoid was received. These questions were also asked for births during the five years before the survey (i.e., completed pregnancies). Gross underreporting of these events in previous (completed) pregnancies might be detected by comparing this data with service use reported by women currently in the last trimester of pregnancy. However, the opposite was observed. Coverage of tetanus toxoid and antenatal care among currently pregnant women in their last trimester was in many cases lower than in previous (completed) pregnancies, underscoring the difficulty of obtaining reliable data on service coverage by sampling only currently pregnant women. It is, therefore, likely that there is less underreporting of services received in prior pregnancies than in current pregnancies.

1.3.2 Data on Pregnancies Completed in the Five Years Prior to the Survey

The data on service coverage for births from pregnancies completed in the five years prior to the survey include information on who provided delivery care in addition to who provided antenatal care and whether a tetanus toxoid injection was received during pregnancy. The questions about maternity care in DHS-I have a number of limitations:

- The data allow a general assessment of tetanus toxoid coverage by the health care system, but do not facilitate examination of individual coverage, because women are not asked the *number* of doses received and because there is no history of vaccinations received prior to the five years before the survey or of doses received outside of pregnancy.

- In asking about antenatal and delivery care, the DHS questions focus only on the "most qualified" provider of care. Responses to these questions, particularly "Who provided delivery care?" may be misleading since a woman may delay seeking a trained provider until after developing extremely severe complications which other providers have been unable to manage. This lack of information on both the process involved in seeking care and the actual quality of care received circumscribes the role of the data in studying the specific impact of maternity care *per se*.

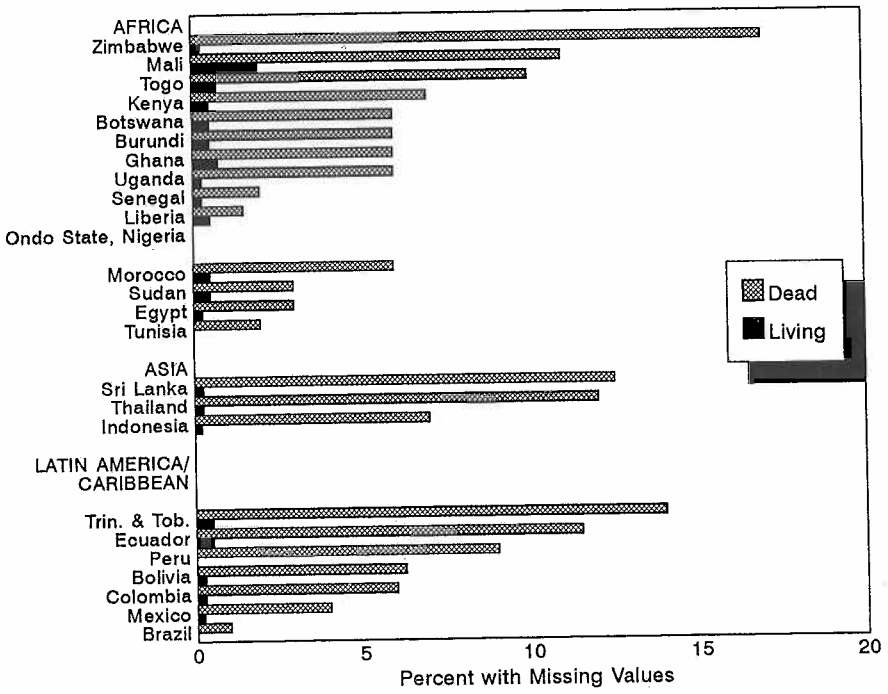
- Utilization of health care is determined by a variety of user- and service-related factors. Service availability data were collected at the cluster level in more than one-third of the countries surveyed in DHS-I. These data are not assessed in this report. However, the lack of household-level information on available services limits the utility of the DHS-I data in examining individual service-related differences in utilization of care.

- Data on the place of delivery were collected in only half of the DHS-I surveys. Tabulations of type of provider by place of delivery for surveys with both types of information show that it is not always correct to assume that deliveries assisted by medical personnel took place in health facilities. In six of the 13 surveys analyzed, more than 5 percent of all home deliveries were attended by doctors, nurses, or midwives. In two surveys this proportion exceeded 10 percent (Indonesia and Liberia).

In general, the analysis did not reveal striking problems with the recall of antenatal care and delivery care for births in the last five years, but the methods to evaluate the existence of a recall bias are limited. In the majority of surveys the proportion of all births with missing values, "don't know" responses, or classified as "other" were within the acceptable range. The length of the recall period did not affect the occurrence of missing values or "don't know" responses, after controlling for other variables. However, two important problems were identified in bivariate analysis and confirmed by multivariate analysis:

- Missing values are much higher for deceased children (see Figure 1.3). In seven surveys data on maternity care are missing for more than 10 percent of the deceased children. "Don't know" responses are also more likely to occur for dead children. This indicates that interviewers are more likely to overlook or be reluctant to ask information about events relating to births in these cases.

Figure 1.3 Missing values for delivery care by survival status of the child, births in the last 5 years, Demographic and Health Surveys, 1985-1990



Both the respondent and the interviewer may feel uncomfortable discussing events related to a child that has died. In some cultures, this may be a taboo subject, the discussion of which may be perceived as causing further adverse consequences. In addition, a woman may have greater difficulty remembering the details of events surrounding a pregnancy and birth where the child is no longer living, particularly if the death occurred soon after birth. It is also conceivable that the interviewer may lack an understanding of the significance of information about deceased children, resulting in less effort to obtain responses about these births.

- Missing values are more common for the next-to-last births and especially the second-to-last births and before than for last births (most recent births), for which the information is collected first. "Don't know" responses do not increase by relative birth order (last birth, next-to-last, second-to-last, and before). This suggests that interviewer "fatigue" is the main reason for the missing values. The magnitude of the problem, however, is within limits. For example, the mean proportion of births with missing values for 26 surveys was 0.4 percent for last births, 1.0 percent for next-to-last births, and 4.2 percent for second-to-last and before births. In multivariate analysis the difference between last and next-to-last births generally was not significant.

1.3.3 Implications for DHS-II

The maternity section of the DHS-II questionnaire has built upon the experience of DHS-I. First, the questions on use of maternity care for current pregnancies have been omitted. Second, the collection of data on maternity care for all births in the last five years was expanded to accommodate questions on the number of antenatal visits and number of tetanus toxoid injections for each pregnancy, the place of delivery (as a standard question and not an option as in DHS-I) in addition to the provider of delivery care, and, to allow the coding of multiple providers in questions, antenatal and delivery care. There also is a question about whether the mother was given an antenatal card.

1.4 CHILD VACCINATION DATA

Vaccination data differ somewhat from most of the other data in the DHS-I questionnaire, since information is copied from records kept by the respondent. Most DHS-I surveys include questions on the vaccination status of children of the respondents born since January of the fifth year preceding the survey. The standard method of collecting vaccination information was to ask about the presence of a child health card and then request to see it. The interviewer then copied the vaccination dates from the health card (day, month, and year of each vaccination). If no card could be presented, the interviewer then

asked whether the child had ever had a vaccination to prevent him/her from getting diseases.

The assessment of the quality of DHS vaccination data by Boerma and Bicego in Chapter 4 of this report includes an analysis of the proportion of child health cards seen by the interviewer, the accuracy and completeness of dates of vaccination copied from cards to questionnaires, the reliability of mother's recall of vaccinations to her child(ren), and a comparison of DHS estimates of vaccination coverage with other sources.

1.4.1 Estimation of Coverage

Most DHS-I surveys were limited to the collection of vaccination data from health cards, with only one question for children whose card was not seen (namely whether the child ever received a vaccination). Estimates based only on card information would underestimate coverage if a proportion of cards were not seen or if a substantial proportion of vaccinations could not be confirmed by cards. In nine countries, however, mothers were asked to report information on specific vaccinations, if no card was presented. In Mexico, this was the only source of information, but in the eight other countries it complemented the information collected from the health cards. Vaccination coverage can be estimated from health card and maternal recall information for these eight countries (using the standard procedure for estimation of coverage recommended by WHO). For the other countries, data from the cards and from the proportion ever vaccinated among children without cards can be used to estimate coverage, as has been described elsewhere (Boerma et al., 1990). Due to the different methods of recording vaccinations and the questions used in the survey, coverage estimates for Egypt are less accurate than in most other DHS surveys, and no estimates could be made at all for the Dominican Republic and Togo. These three countries used questions that differed considerably from those included in the DHS core questionnaire.

1.4.2 Presentation of Health Cards

Regarding health cards for children under five years of age there were three possibilities in the DHS-I surveys: card reported and seen, card reported but not seen, and no card. Missing values were no problem for this question; almost all countries had less than 0.5 percent missing values. The proportion of children under five with no card at all varies considerably between countries, from 3 percent in Botswana to more than 66 percent in Mali. The large proportion of children for whom the mother said she had a card, but did not show it to the interviewer is striking (see Figure 1.4). There are various reasons for cards not being seen. These include, the card is kept somewhere else (e.g., a family has more than one residence, health workers keep child health cards), the card could not be found in the house, the mother is reluctant to search for the card, or the interviewer does not insist on seeing the card.

It can generally be assumed that the lower the proportion of cards reported by the respondent and seen by the interviewer, the poorer the quality of the data from this questionnaire section. As Figure 1.4 shows, more than 70 percent of the cards reported were actually seen by the interviewer in seven countries, which indicates good data quality. In four countries, 60 to 70 percent of the cards were presented, and in six countries the range was 50-60 percent, which may indicate poorer interview quality than the first survey group. In six surveys less than half of the reported cards were presented. The proportion of cards seen among children whose mother said they had a card is particularly low in Bolivia (27 percent), the Dominican Republic (31 percent), Ondo State, Nigeria (35 percent), Mali (39 percent), and Peru (41 percent).

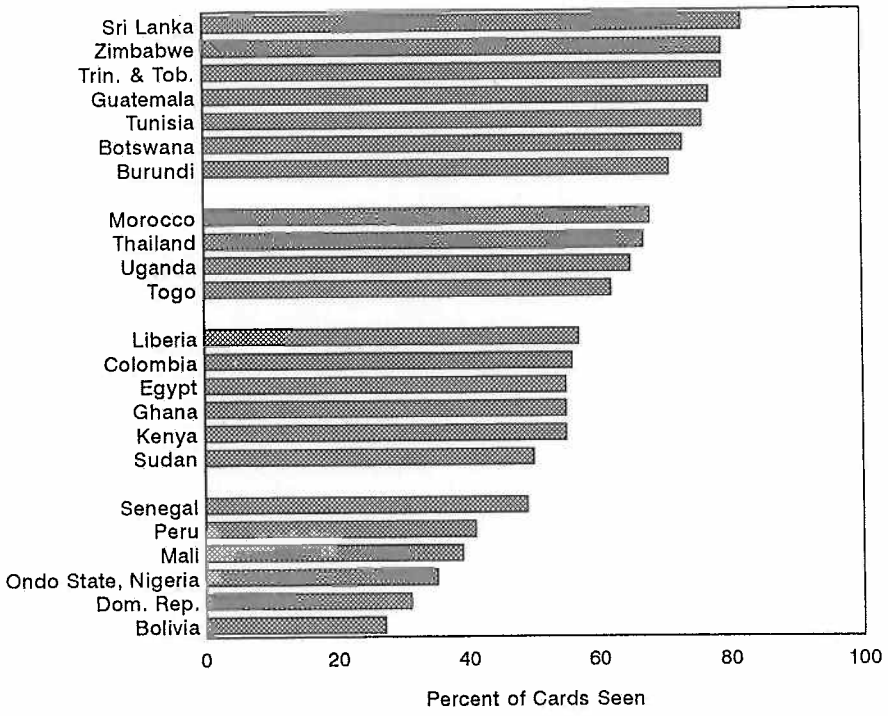
The card problem is age dependent. The older the child, the less likely it is that the interviewer will actually see the card (i.e., the card-present-but-not-seen rate is higher). This situation does not vary much by relative birth order of the child, but there is a slight increase of missing values in the health section: more missing values for the next-to-last and second-to-last children than for the last birth, but the size of the absolute difference is small. This indicates that interviewers become somewhat less attentive for the second, third, and fourth children.

How accurate is the information about the presence of a child health card as reported by the mother? This can be determined somewhat by analyzing data on cards presented and on ever-vaccinated status. In seven surveys the proportion ever vaccinated is more than 2 percentage points lower among those with no card presented than for those for whom a card was presented: six surveys in sub-Saharan Africa (Botswana, Burundi, Ghana, Liberia, Senegal, and Togo) and Morocco. In some cases, it might even be true that the mother had an empty card with no vaccinations on it and did not bother to show this card to the interviewer. In general, however, this can be considered as evidence of a minor inconsistency in mother's reporting of card possession or vaccination status of her children in the seven surveys mentioned above.

1.4.3 Recall Coverage

If no card was presented to the interviewer, mothers in eight surveys were asked to recall specific vaccinations given to their child(ren). Mother's recall of vaccinations is necessary in order to estimate vaccination coverage among all children, with or without cards. In general, coverage is expected to be somewhat lower among children for whom no card was presented to the interviewer, and the discrepancy is expected to be larger for multiple-dose vaccines. Recall coverage is defined as the proportion of children who received a specific vaccination among all children who have no card but had at least one vaccination reported by the respondent.

Figure 1.4 Proportion of cards seen among children under 5 years with cards, Demographic and Health Surveys, 1986-1989



Recall coverage is indeed lower than card coverage in all eight surveys, with the exception of Sudan. The differences are greatest for the third doses of DPT and polio vaccines. For example, polio3 recall coverage is less than 80 percent of polio3 card coverage in 5 of the 8 surveys. In Sudan, recall coverage is almost as high as card coverage and is even higher for measles vaccination, which suggests some overreporting by mothers.

1.4.4 Comparison with Other Data Sources

Vaccination coverage rates are usually derived from either special coverage surveys or routine data from health facilities where vaccinations are given. The coverage surveys are conducted using a standard survey methodology recommended by the Expanded Programme on Immunization (EPI) of the World Health Organization (WHO) (Henderson and Sundaresan, 1982). The survey sample consists of 30 clusters selected with probability proportional to population size. In each cluster the first household is randomly chosen and, to reduce survey costs, all subsequent households are selected from neighboring households until at least seven children in a selected age group are identified. With this method, the level of vaccination coverage can be estimated with a precision of about 10 percent (Lemeshow et al., 1985).

Although the EPI cluster sample coverage surveys are carried out in many countries, two concerns have been raised regarding the reliability of the resulting coverage estimates. First, the sample may be biased by overrepresentation of households located near health facilities. Second, interviews are often conducted by health workers, which may introduce an additional bias. Further, national coverage estimates can be based on routinely reported data from the vaccination clinics. Data from these health information systems, however, are rarely complete and assumptions have to be made to estimate coverage from such data. In addition, the denominator (number of children eligible for vaccination) often has to be estimated from other sources, such as population projections with census data.

DHS surveys can be compared to official estimates of vaccination coverage based on either of the two methods if the survey period coincides with the reference period for estimates from other sources. Since most EPI cluster coverage surveys focus on children 12-23 months of age, the comparison is limited to this age group. As in EPI cluster sample surveys, information on vaccinations given to the child is copied from the child health card if present. In the EPI surveys, if no health card is presented, the mother is usually asked to recall specific vaccinations.

The comparison shows that DHS estimates of vaccination coverage are generally in the same range as coverage estimates based on the cluster sample coverage surveys, whereas reported data from health facilities often differ considerably from DHS estimates. The latter is most likely due to inaccuracy in the estimates based on routine reports. In most countries, DHS estimates and those from EPI cluster sample surveys

were remarkably similar. In some of the more recent DHS-II surveys, however, substantial discrepancies have arisen between results of EPI surveys and DHS surveys in a similar time period. Estimates based on DHS turn out to be considerably lower than the EPI survey results (e.g., Nigeria and Pakistan). The reasons for the discrepancies vary, but mainly appear related to the survey design and execution of the EPI cluster sample surveys. A study is underway to assess the quality of DHS-II vaccination data.

1.4.5 Implications for DHS-II

In general, DHS data appear to be a useful source of information on childhood vaccinations, but recall of specific vaccinations improves estimates of coverage. For most surveys in the period 1986-90, data on specific vaccinations were not collected from the mother if no card was presented, whereas, in the DHS-II core questionnaire, information was collected from the mother on specific vaccinations if no card was presented. In addition, if the card did not show all vaccinations, the mother was asked whether the child had received any additional vaccinations. Lastly, if the mother had no card for her child, she was asked whether she ever had one.

1.5 CHILD MORBIDITY AND TREATMENT

Data on morbidity and treatment patterns were collected for all living children under five years of age. Most surveys included a question on diarrhea prevalence, and about half of the surveys collected information on respiratory symptoms (cough and/or difficult breathing) and fever. Although the primary objective of the questionnaire section on morbidity was to assess treatment patterns, the most attention has been paid to the evaluation of the quality of the prevalence data in the data quality assessment by Boerma and Van Ginneken in Chapter 5 of this report. Methods to evaluate the quality of treatment data are not readily available, whereas there are more opportunities to assess the quality of morbidity reporting. In addition, the quality of data on treatment depends to a large extent on the quality of the morbidity data.

1.5.1 Diarrhea Occurrence

To determine the prevalence of diarrhea, mothers were first asked whether their children under the age of five years had had diarrhea in the last 24 hours. If the answer was negative the interviewer asked whether the children had had diarrhea during the last two weeks. The judgement of what constitutes an episode of diarrhea was made by the respondent.

Missing values for diarrhea prevalence are not common; they are observed for less than 1 percent of the children in all but two surveys. However, there is considerable variation in the percentage of "don't know" responses. Such responses are rare in most surveys, but in seven countries more than 3 percent of the mothers did not know whether diarrhea had occurred in the last two weeks. This problem is particularly common in Botswana (12 percent), Liberia (9 percent), Uganda (8 percent), Bolivia (8 percent), and Zimbabwe (7 percent). Child fostering is the most important reason for lack of mother's knowledge about the health status of her child(ren): the majority of mothers whose children did not usually live with them did not know whether their child(ren) had had diarrhea. The percentage of "don't know" responses is small if the child usually lives with the mother.

The prevalence data can be used to evaluate data quality in DHS surveys where questions were asked about diarrhea prevalence in the last 24 hours and in the last two weeks. The ratio of the proportion with diarrhea in the last 24 hours and in the period 2-14 days before the survey is a valuable indicator of data quality (Boerma et al., 1991a). The analysis shows that virtually all DHS surveys suffer from both underreporting of cases that terminated 2-14 days before the interview and overreporting of current cases. Analysis by mother's level of education also suggests some differential reporting by education: either more overreporting of recent diarrhea or more underreporting of terminated diarrhea for children of mothers with no education, compared to children of mothers with at least a secondary education.

In eight surveys the duration of diarrhea episodes was investigated and several irregularities were seen in the distribution of replies, in particular heaping of durations on seven days. This limits the accuracy of this type of information.

1.5.2 Diarrhea Case Management

Except for Ecuador, all the surveys included questions about the use of oral rehydration therapy (ORT) for diarrhea management. Questions were asked about the use of fluids prepared with ORS packets (oral rehydration salts) and/or home solution (homemade sugar-salt-water solution). Specific questions on both ORS and home solution were asked in five countries, in nine others only ORS packet use was specifically asked, and in another eight surveys both ORS and home solution use were included as response categories in a general question on what was done to treat the diarrhea. In most surveys, the mother was also asked where she took her child with diarrhea. In six surveys there was no coding category for traditional medical practitioners. In five surveys, the utilization of health facilities was not asked specifically, and only part of a general question dealt with what was done to treat the diarrhea. Finally, almost all surveys included a question on what kind of treatment was given, including use of drugs.

The way in which the question was asked strongly affects the results, as was shown in Boerma et al. (1991b). Therefore,

comparability of results is limited, particularly comparing the earlier DHS-I surveys and the later ones.

Analysis of the questions on treatment of diarrhea in 27 DHS surveys shows hardly any missing and "don't know" replies. No other methods were readily available to assess the quality of the data. There is evidence showing that the relationship of morbidity with treatment is complex, as can be deduced from the finding of a negative association of diarrhea prevalence with treatment: the higher the diarrhea prevalence the lower the treatment rate. Therefore the quality of data on type of treatment received could not be evaluated adequately.

The DHS surveys, like most other studies, used a two-week recall period. This time-frame is considered to offer the best balance between the quality of information that can be obtained about treatment (best for current or very recent illness) and the representativeness of that treatment information (possibly best for recent but not current episodes). The selection of a two-week recall period implies that treatment patterns are assessed jointly for a mixed group of sick children: diarrhea that has terminated, diarrhea that has just started, and diarrhea that has been present for a while and still continues. Published DHS data have shown no major differences in treatment patterns for children with terminated diarrhea and those with current diarrhea of at least two days duration (Boerma et al., 1991a). Both could be used to evaluate treatment practices. However, the treatment patterns for children with current diarrhea of less than two days duration differ. These can be analyzed separately to assess home practices in the early stages of diarrhea.

1.5.3 Respiratory Illness

The questions on respiratory illness are specifically intended to elicit information on the treatment of respiratory infections. There is more variation in the questions on the symptoms of respiratory illness used in the various DHS-I surveys than with the questions on diarrhea. This variation is partly responsible for the considerable differences in morbidity levels found in these surveys. In the earlier surveys especially, the questions on respiratory illness were rather non-specific and cannot be used to assess treatment patterns of children with symptoms suggestive of acute lower respiratory infections.

There were hardly any missing data and low percentages of "don't know" responses, which were even lower than for the diarrhea questions. Comparison of the morbidity levels of respiratory illness as obtained in DHS surveys with epidemiological surveys on acute lower respiratory illnesses showed considerably higher levels in the former than in the latter. This is a strong indication that the DHS questions actually provide data on a wider and more diffuse range of conditions than just pneumonia. It is unknown to what extent these measurement problems influence the quality of the information on treatment patterns for lower respiratory illnesses. In addition, the quality of recalled data on specific treatments received is doubtful. For instance, many respondents may not know whether the syrup their children received was an antibiotic or a cough syrup. An evaluation of the quality of such data is, however, not possible with a DHS survey.

1.5.4 Implications for DHS-II

These data point to some difficulties associated with morbidity reporting. In DHS-II, the order of the diarrhea questions was changed because of the suspected overreporting of diarrhea in the last 24 hours: the general question (diarrhea in the last two weeks) preceded the specific question. The core questionnaire included one question on diarrhea with blood and another on duration of current and terminated episodes within the two weeks before the interview. Further improvements in the measurement of diarrhea morbidity in DHS-type surveys (which were not made in DHS-II) are required. Possibly a question on the severity of diarrhea might help (Baqui et al., 1991; Peters et al., 1991), e.g., a question on the number of stools on the worst day of the episode or the mother's subjective classification of the severity. In DHS-II, respondents could spontaneously mention ORS packets as a treatment given to children with diarrhea in the last two weeks. If not mentioned spontaneously, respondents were probed about the use of ORS packets for diarrhea treatment. The same was done for the recommended home solution.

In DHS-II more standardized questions on respiratory infections were asked and this practice appears to lead to more consistent results, although, as expected, the prevalence of cough with rapid breathing in DHS surveys is considerably higher than the prevalence of pneumonia in epidemiological studies. However, the primary objective of the questions is to identify children who need to be evaluated for pneumonia or other lower respiratory infections. Adding fever (which is a standard question in DHS-II) to the diagnostic algorithm reduces the prevalence and may increase specificity. The treatment-recall questions are similar to the ones in DHS-I.

1.6 BREASTFEEDING AND SUPPLEMENTARY FEEDING

Information was obtained regarding breastfeeding behavior for all children born to respondents in the five years preceding the survey. For each child the respondent was asked if the child was ever breastfed, and if so, for how long. The questionnaire structure assumed that only the last-born child could still be breastfed at the time of the survey. In their contribution to this report Boerma and Sommerfelt (Chapter 6) assess the quality of feeding data, with a focus on the recall data on breastfeeding duration.

From earlier work with the World Fertility Survey, it was evident that recall duration data had several problems. Therefore, both the DHS-I and DHS-II reports utilized only current status data for calculating measures of breastfeeding duration.

1.6.1 Breastfeeding Duration Recall

How reliable are mothers' reports on the duration of breastfeeding? The marked heaping of breastfeeding duration data on multiples of six months in retrospective surveys (Ferry, 1981; Lesthaeghe and Page, 1980) was noted in several studies. Reinterview surveys in Brazil (Huttly et al., 1990) and Malaysia (Haaga, 1988) have found inconsistencies between the answers in subsequent survey rounds.

Missing values and "don't know" responses are not common for breastfeeding duration in most surveys. The situation is quite different regarding dead children, where missing values are a problem. Missing values occur for less than 2 percent of the deceased children in only four surveys whereas more than 10 percent of the breastfeeding duration data are missing in seven surveys. In addition, in virtually all countries, there is a strong increase in the proportion of births with missing values for breastfeeding duration with increasing relative birth order (i.e., more serious for births earlier in the five-year period). Multivariate analysis confirmed the importance of survival status of the child and relative birth order for the occurrence of missing values.

Heaping at multiples of six for reported breastfeeding duration is pronounced in most surveys and the amount of heaping varies by background characteristics, such as mother's education. If heaping is a good indicator of the quality of data, then the reported durations of mothers with no education or low levels of education are less accurate than those reported by mothers with higher levels of education.

The analysis of overlap between pregnancy and lactation from the retrospective reports by the mother indicates considerable inaccuracy in breastfeeding duration and/or birth dates. Reports of the duration of breastfeeding may be over- or underestimates, but overlap is clearly associated with overreporting of breastfeeding durations. On the other hand, Trussell et al. (1992) have shown that there appears to be underreporting of breastfeeding duration. Using data from WFS and DHS, they compared estimates of breastfeeding duration from current status data and from retrospective life-table measures. The latter were consistently lower than the current status measures. The average mean duration of breastfeeding for 21 DHS countries was 16.5 months based on the current status data and 15.7 months based on the retrospective life-table measures. Trussell et al. (1992) concluded that this discrepancy was not due to very recent increases in breastfeeding and that "there is a tendency for retrospective reports in DHS to be biased downward." This conclusion is not necessarily inconsistent with our findings of unlikely proportion of overlap, probably due to overreporting of breastfeeding duration. Both overreporting and underreporting may occur, and the analysis by Trussell et al. suggests that underreporting is more common than overreporting.

1.6.2 Feeding in the Last 24 Hours

For children who were still breastfed at the time of the survey, questions were asked about liquids and foods given during the preceding 24 hours. The DHS-I core questionnaire asked about water, juice, powdered milk, cow's or goat's milk, other liquids, and solid or mushy food. The surveys in many countries modified these questions and asked about specific foods and liquids commonly used for infants and young children. In most instances, these country-specific questions can easily be translated into one of the standard categories.

Although the DHS-I questionnaires inquired about the child's food intake during the 24 hours preceding the survey, the mother was not asked whether these foods and liquids were given regularly. Information was also *not* collected to determine if a child sometimes, though not every day, received anything other than breast milk. Hence, an individual child cannot be classified with complete certainty as exclusively breastfed. If the child sometimes received ritual foods, honey or sugar water etc., but not in the last 24 hours before the interview, he or she should be classified as "almost exclusively" breastfed. However, the DHS-I information gives a fairly good picture of the proportion of children who receive something other than breast milk. In addition, there are a few DHS-I surveys in which mothers were asked to recall the age when breastfeeding was supplemented by other liquids or solids on a regular basis.

The questions on the number of breastfeedings given during daytime and nighttime resulted in very high proportions of women answering "on demand." The analysis of the effect of breastfeeding on postpartum amenorrhoea suggested that "on demand" may have very different meanings for different women and in different contexts (Rutstein, 1991).

1.6.3 Implications for DHS-II

In addition to the DHS-I questions, mothers were asked to recall feeding information for all births in the last five years, i.e., the age in months at which the child received (on a regular basis) formula or milk other than breast milk, plain water, other liquids, and any mushy or solid food.

Data collected on the number of breastfeedings during day and night time (for lastborn breastfed children) indicate a very large proportion responding on demand. Since the meaning of on demand varies greatly between populations and individuals,

the DHS-II questionnaire was adapted to make the respondent specify what she meant by on demand.

In DHS-II, the median duration of breastfeeding is calculated based on current status data only. Recalled data on the duration of breastfeeding are not used.

1.7 CHILD ANTHROPOMETRY

Anthropometry provides an objective assessment of children's health and nutritional status. When interpreting such information, it is important to know whether the children in the sample are representative of the population of children from which the sample was drawn, and whether the recorded measurements correctly reflect the child's true weight and height. Although it is possible to assess what proportion of the children earmarked for anthropometric assessment were actually measured for height and/or weight, it is more difficult to assess whether there is a systematic bias in the recorded measurements. The quality of child anthropometric data is assessed in the contribution by Sommerfelt and Boerma (Chapter 7) and summarized below.

1.7.1 Sample of Children

The height and weight of the survey respondents' young children were measured in nineteen surveys in the first phase of the DHS program. In most of the surveys, all children in a specified age group were supposed to be measured. The exceptions were Northeast Brazil, Egypt, and Senegal, where only the children of a subsample of respondents were included.

When anthropometry was included in the survey, the "standard" recommendation in the DHS-I program was to measure all the respondent's children 3 through 36 months of age.[1]

Eleven surveys followed this recommendation. Three of the earliest surveys obtained measurements only for children age 6 through 36 months (Dominican Republic, Ondo State in Nigeria, and Senegal); in the remaining five surveys the age group was extended beyond the "standard." Children were weighed and measured starting from birth in four surveys (Northeast Brazil, Morocco, Togo, and Uganda). In four countries the upper age limit was extended through 60 months of age (Northeast Brazil, Morocco, Uganda, and Zimbabwe).

1.7.2 Missing Values

The proportion of the eligible children whose height and/or weight were measured ranged from 79 percent in Trinidad and Tobago to 98 percent in Morocco. Over 90 percent of the children were measured for height and/or weight in eleven of the countries. Both measurements were obtained for almost all these children; however, in a few cases children were measured only for height or only for weight. The largest proportion of children with only one measurement is seen for Northeast Brazil, where 2 percent of children were weighed, but not measured for height.

Children who were reported as not living with their mother were less likely to have their height and weight measured. Similarly, children whose mothers were visitors and not regular residents in the household may not have accompanied their mother, and hence, may not have been included in the anthropometric assessment. Missing values were also more likely for older children under five years, which was mainly due to fostering status and residency.

There is also a definite trend toward more missing data among the next-to-last children than among last-born children in about two-thirds of the countries (median 14 percent versus 7 percent). However, it is noticeable that this trend is not seen in two of the four surveys that included all children 60 months and younger (Northeast Brazil and Morocco), whereas it is observed in the remaining two countries (Uganda and Zimbabwe), where a sizeable proportion of children do not live with their mother. Finally, missing values were more common in urban areas than in rural areas.

1.7.3 Age Reporting

To be able to compare the nutritional status of children from different population subgroups or from different countries and to assess changes in nutritional status over time, the WHO has recommended that children's height-for-age, weight-for-age, and weight-for-height be expressed as standard deviation units (or z-scores) from the median of the international reference population (usually the NCHS/CDC/WHO international reference population) (Dibley et al., 1987; WHO, 1981; and WHO, 1986). Accuracy and completeness of age information are cru-cial for the analysis of anthropometric data. The height and weight of each child is compared to the height and weight of children of the same age in months in the reference population. Only the third anthropometric indicator, weight-for-height, is independent of the child's age. Several possible systematic biases in the reporting of the child's age may affect the anthropometry results: completeness of reporting, missing data on birth date, field imputation of birth date by the interviewer, digit preference, or systematic over- or underreporting.

In three countries, a large proportion of children did *not* have a month and day of birth reported by their mothers. Mali had the highest proportion (40 percent), followed by Morocco (20 percent) and Togo (16 percent). Between 5 and 10 percent did not have a reported month and year of birth in Ghana and

[1] In the DHS-II program, all children from birth through 60 months of age are measured for height and weight.

Egypt. It should be noted that in Morocco interviewers were allowed to record season instead of month of birth. Each season listed in the questionnaire was approximately three months long. Mothers reported the season, year, and age for 19 percent of all children eligible for height and weight measurement; only 1 percent had neither a month nor a season reported.

In the remaining countries mothers knew the date of birth for almost all children, but an unknown amount of field imputation of the birth dates may have been more common in some countries, i.e., the interviewer may have entered a month and year of birth even if the mother could not give exact information. The analysis of data on month of birth for children under five years by Bicego and Boerma in Chapter 2 raises concern regarding the quality of the data on the ages of children.

1.7.4 Height and Weight Measurements

The accuracy of these measurements can only be definitively assessed in a validation study involving duplicate measurements where the heights and weights recorded by the enumerators are compared to a standard, e.g., measurements carried out by an expert. The identification of intra-observer variation also requires remeasurement of the same child. However, some properties of the quality of the data can be gleaned from an examination of the degree of heaping. Some surveys, such as the Dominican Republic and Morocco, show marked heaping of height and weight measurements on figures ending in .0 and .5. In most surveys, however, there is no heaping.

The height-for-age, weight-for-age, and weight-for-height z-scores have been calculated according to the guidelines developed by the CDC and recommended by WHO, and are included in the DHS recode data files. In cases where month and year of birth are not reported, z-scores are not calculated, and a "missing" value will be shown for the height-for-age and weight-for-age variables. In Morocco, a z-score is calculated for children whose mother reported the child's age as well as the season and year of birth.

Improbably high or low z-scores are not shown; instead the variable is flagged. The guidelines provided by the CDC were followed. Height-for-age and weight-for-age z-scores above +6 and below -6 were flagged, as were weight-for-height scores above +6 and below -4. In addition, the following combinations of z-scores were flagged: height-for-age z-score below -3.09 and weight-for-height z-score above +3.09, and height-for-age z-score above +3.09 and weight-for-height z-score below -3.09.

The percentage of flagging was similar for all three indices within each country. Less than 1 percent of the z-scores was flagged in about half the countries. The lowest percentage was seen in Colombia (under 1 percent) and the highest in Guatemala (4 percent).

1.7.5 Implications for DHS-II

In DHS-II, the age group for anthropometric measurements was expanded to include all children age 0-60 months. Maternal anthropometry was also introduced. The procedures for measuring weight were changed in most DHS-II surveys, i.e., the hanging spring balance scale was replaced by a digital bathroom scale having 100 grams of accuracy. The latter can be used for both mother and child.

1.8 CAUSES OF DEATH IN EARLY CHILDHOOD

In selected DHS surveys the probable causes of death were ascertained for dead children born during the preceding five years. The inclusion of a causes of death module in DHS surveys depended on the country's implementing agency. The questions used differed from survey to survey. The various methods are evaluated in the contribution by Boerma, Sommerfelt, and Van Ginneken (Chapter 8), on a survey-by-survey basis. The assessment of data quality is difficult. For example, consider a survey in which the results indicate that 20 percent of all deaths under five years of age were associated with diarrhea. Although the results seem plausible on the basis of longitudinal epidemiological studies (e.g., Gray, 1991), the data may not be of good quality. In a population where 20 percent of the children had diarrhea in the two weeks before the survey, it would be expected that 20 percent of the deceased children had diarrhea during the illness preceding death, even if having diarrhea does not increase the risk of death.

In this evaluation, the focus is on the types of questions used in the DHS surveys and how this affects the results. The countries involved are Bolivia, Ecuador, Egypt, Morocco, Senegal and Tunisia (all DHS-I surveys) and Cameroon (DHS-II survey). The following are our major conclusions:

- The cause of death section was embedded in the health section of the DHS questionnaire, where only information on children born in the five years before the survey was collected. Therefore, the cause of death data refer to all children born in the preceding five years, but not to children born more than five years ago. Consequently, there is underrepresentation of deaths at older ages among the under-fives.

- In general, the results on the causes of death in the seven DHS surveys analyzed here are disappointing, primarily due to inadequate questions asked in the earlier surveys, which led to a large proportion of deaths reported due to unknown causes and unlikely distributions for the leading causes of assigned deaths. The

more extensive questionnaire was not very successful in Bolivia, but appears moderately successful in Cameroon. Overall, the quality of data is difficult to assess, and caution should be used in interpreting the results of the causes of death distribution. A conservative approach should also be used in evaluating the results from epidemiological studies (Gray, 1991), since validation studies are few.

- Classification into main and contributory causes is not feasible on the basis of a short questionnaire. However, the use of multiple causes gives a better picture of the causes of death pattern than the use of single causes. Therefore, multiple causes should be allowed, as was done for Cameroon, using the diagnostic criteria and without distinguishing between main and contributory causes.

- Based on the results of a few studies a recall period of 6-24 months has been recommended (Gray et al., 1990). The length of the recall period in the DHS surveys is 0-4 years. There was a moderate increase in the proportion of "don't know" responses if the recall period was more than two years in three of the surveys, but no increase in three other surveys. This does not suggest that the length of the recall period is the major problem. However, information given for deaths more than two years ago may be less accurate, but this cannot be evaluated with the DHS datasets.

- Further improvements can possibly be made when more emphasis is placed on traditional names and classifications of causes of death. Such an effort has been shown to be worthwhile in several studies, but may take several weeks to months of research. Since DHS surveys are often carried out in multiple languages, such anthropological studies may not be feasible within the limited timespan of a DHS survey.

- Causes of neonatal mortality generally are more difficult to determine in verbal autopsy than causes of death among older children. DHS has made little effort to determine the causes of neonatal mortality, other than tetanus; however, an effort to determine these causes would certainly be worthwhile.

In sum, it remains to be seen whether it is possible to obtain reasonably accurate data on the leading causes of childhood deaths in large-scale cross-sectional surveys. With a well-developed questionnaire (more validation studies are required) it is possible to obtain a general picture of the causes of death, which can be used for advocacy purposes. If the objective is to assess cause-specific mortality trends (e.g., four of the World Summit for Children health goals are cause-specific mortality reductions) one must be more cautious for two reasons: misclassification and sampling errors. The results of validation studies show that misclassification of causes of death is common, and such studies are assumed to give the best possible picture (since only hospital deaths are used).

1.9 CONCLUSIONS

The methods available to assess the quality of health data in DHS-I surveys are limited and in most cases it is not possible to judge the quality of the data. Nevertheless, the analyses presented in this report have given some insight into the quality of health data. In many areas the questionnaire appears to provide very useful data for health planners, policymakers, and researchers. The most important points that emerged from the data quality assessment include:

- The health section of the core questionnaire was clearly in a developmental stage during DHS-I. Some improvements were made during the first phase, and some countries opted for questions different from the core questionnaire. When interpreting the results, the way the information was gathered should always be taken into account.

- The health section focuses on all births in the five years preceding the survey. In populations where birth dates are not immediately known by the interviewer, who then must do substantial probing, a considerable number of births were displaced out of the birth history. In other words, there is a deficit of four-year-old children. This does not have serious implications for most health indicators. More important, however, is the evidence of displacement of births towards the interview date of more recent births. There appears to be displacement of births into the last year of life and also preference for months just before the survey month. The quality of the data on age in months has important implications on the analysis of anthropometric data and the use of current status measures, such as median duration of breastfeeding.

- Mothers with more than one child born in the five years preceding the survey have to answer the health section questions more than once. The analysis shows that missing values are more common for the next-to-last birth than for the last birth, but the difference is small. The difference is larger for second-to-last births (or before) compared with last birth: yet, the proportion of missing values is still small, even for the second-to-last births (or before). In general, it seems to be possible to collect information on all births in the last five years, although some interviewer fatigue occurs. However, there are not adequate instruments to evaluate the quality of data for more distant births and to compare the results to more recent births.

- A major finding in the assessment of the quality of maternity data is that missing values are rather common for deceased children, which affects certain analysis of such data. The same was found for reports on breastfeeding duration for deceased children. In addition, data on current pregnancy were not considered to be reliable. Apart from these problems, maternity care data appear to be of reasonably good quality.

- Many DHS-I surveys did not gather information about specific vaccinations from the mother, which complicated coverage estimation somewhat. The proportion of cards that were reported by the mother and were actually seen by the interviewer varied considerably between countries, and was well below 50 percent in several surveys. This clearly weakens the quality of the vaccination coverage estimate.

- The child morbidity data in DHS-I are generally not reliable. This is due to the general difficulties one encounters when measuring morbidity, especially to the lack of good questions available to measure morbidity in cross-sectional surveys. The questions on respiratory infections changed considerably during DHS-I and seemed to be more useful at the end of DHS-I. The treatment patterns need to be interpreted carefully, since this information depends on the reporting of morbidity and on mother's recall of type of treatment, which is particularly difficult for medicines.

- The data on breastfeeding give only a rough indication of duration. Heaping at multiples of six months is considerable. The analysis of the overlap of breastfeeding and pregnancy among women with at least two births in the last five years showed that, in many surveys, there is a tendency to overreport breastfeeding.

- Child anthropometric data generally appear to be of good quality, with minor problems of digit preference, flagged values, or missing values.

- Verbal autopsy modules were used in seven surveys and generally did not lead to satisfactory results, which was mostly due to poor questionnaire design. Only in the most recent survey (actually a DHS-II survey) in Cameroon was a more extensive questionnaire used that seemed to give more plausible results; the results might be useful for health planning.

In general, the DHS health data are a sound database for basic health indicators, which are essential for health planning and evaluation in developing countries. In several instances, DHS data also provide a useful basis for research on determinants of child health, although researchers need to be cognizant of the problems summarized above.

References

Anker, M. 1991. Epidemiological and statistical methods for rapid health assessment: Introduction. *World Health Statistics Quarterly* 44(3):94-97.

Arnold, F. 1990. Assessment of the Quality of Birth History Data in the Demographic and Health Surveys. In *An Assessment of DHS-I Data Quality.* DHS Methodological Reports, No. 1. Columbia, Maryland: Institute for Resource Development/Macro Systems Inc.

Baqui, A.H., R.E. Black, M.D. Yunus, A.R.A. Hoque, H.R. Chowdhury, and R.B. Sack. 1991. Methodological issues in diarrheal diseases epidemiology: Definition of diarrheal episodes. *International Journal of Epidemiology* 20(4): 1057-1064.

Becker, S. 1984. *A response bias in the reporting of month of birth in pregnancy history surveys.* IPD Working Paper 1984 - 85, Brussels, Belgium: Vrije Universiteit Brussel, Interuniversity Programme in Demography.

Boerma, J.T., R.E. Black, A.E. Sommerfelt, S.O. Rutstein, and G.T. Bicego. 1991a. Accuracy and completeness of mother's recall of diarrhea occurrence in preschool children in Demographic and Health Surveys. *International Journal of Epidemiology* 20(4): 1073-1080.

Boerma, J.T., A.E. Sommerfelt, and S.O. Rutstein. 1991b. *Childhood Morbidity and Treatment Patterns.* DHS Comparative Studies, No. 4, Columbia, Maryland: Institute for Resource Development/Macro International Inc.

Boerma, J.T., A.E. Sommerfelt, S.O. Rutstein, and G. Rojas. 1990. *Immunization: Levels, Trends and Differentials.* DHS Comparative Studies No. 1, Columbia, Maryland: Institute for Resource Development/Macro Systems Inc.

Dibley, M.J., J.B. Goldsby, N.W. Staehling, P. Nieburgh, and F.L. Trowbridge. 1987. Development of normalized curves for the international growth reference: Historical and technical considerations. *American Journal of Clinical Nutrition* 46(5):749-762.

Ferry, B. 1981. *Breastfeeding.* WFS Comparative Studies No. 13. Voorburg, Netherlands: International Statistical Institute.

Galazka, A. and G. Stroh. 1986. *Neonatal tetanus: Guidelines on the community-based survey on neonatal tetanus mortality.* EPI/Gen/86.8, Geneva: WHO.

Gray, R.H. 1991. Interview-based diagnosis of morbidity and causes of death. Paper presented at seminar, Measurement of Maternal and Child Mortality, Morbidity and Health Care: Interdisciplinary Approaches. Cairo, IUSSP, 4-7 November 1991.

Gray, R.H., G. Smith, and P. Barss. 1990. *The Use of Verbal Autopsy Methods to Determine Selected Causes of Death in Children.* Occasional Papers No. 10, Baltimore, Maryland: Institute for International Programs, The Johns Hopkins University.

Grummer-Strawn, L. and T.J. Trussell. 1990. Computing the mean duration of breastfeeding from current-status data. Princeton, New Jersey: Office of Population Research, Princeton University.

Haaga, J.G. 1988. Reliability of retrospective survey data on infant feeding. *Demography* 25(2): 307-314.

Henderson, R.H. and T. Sundaresan. 1982. Cluster sampling to assess immunization coverage: A review of experience with a simplified sampling method. *Bulletin of the World Health Organization* 60(2): 253-260.

Huttly, S.R.A., F.C. Barros, C.G. Victora, J.U. Beria and J.P. Vaughan. 1990. Do mothers overestimate breast feeding duration? An example of recall bias from a study in southern Brazil. *American Journal of Epidemiology* 132(3): 572-575.

Kroeger, A. 1983. Health interview surveys in developing countries: A review of methods and results. *International Journal of Epidemiology* 12(4):242-254.

Lemeshow, S., A.G. Tserkovnyi, J.L Tulloch, S.K. Dowd, S.K. Lwanga, and J. Keja. 1985. A computer simulation of the EPI survey strategy. *International Journal of Epidemiology* 14(3): 473-481.

Lesthaeghe, R.J. and H.J. Page. 1980. The post-partum non-susceptible period: Development and application of model schedules. *Population Studies* 34(1): 143-169.

Peters, D.H., S. Becker, J. Logarta, R.H. Gray, and R.E. Black. 1991. Estimates of Availability and Use of Oral Rehydration Salts for the Treatment of Diarrhea in Cebu, the Philippines, 353-368. In *Measurement of Maternal and Child Mortality, Morbidity and Health Care: Interdisciplinary Approaches.* Edited by J.T. Boerma, Liege: IUSSP/Derouaux-Ordina Editions.

Pison, G., E. van de Walle, and M. Sala-Diakanda. 1989. Les Jumeaux: Fréquence, statut social et mortalité. In *Mortalité et Société en Afrique au Sud du Sahara*. Paris: Presses Universitaires de France.

Ross, D.A. and J. P. Vaughan. 1986. Health interview surveys in developing countries: A methodological review. *Studies in Family Planning* 17(2):78-94.

Rutstein, S.O. 1991. The impact of breastfeeding on fertility. In *Proceedings of the Demographic and Health Surveys World Conference* Vol. 2, pp. 897-924. Washington, D.C., August 1991. Columbia, Maryland: Institute for Research Development/Macro International Inc.

Trussell, T.J., L. Grummer-Strawn, G. Rodriguez, and M. Van Landingham. 1992. Trends and differentials in breastfeeding behavior: Evidence from the WFS and DHS. *Population Studies* 46:285-308.

World Health Organization. 1981. *Development of indicators for monitoring progress toward Health for All by the Year 2000.* ("Health for All" Series No. 4). Geneva: WHO.

World Health Organization Working Group. 1986. Use and interpretation of anthropometric indicators of nutritional status. *Bulletin of the World Health Organization* 64:929-941.

APPENDIX: NOTES ON SPECIFIC SURVEYS

The DHS results for each survey are summarized below. The reader is referred to the respective chapters of this publication for more detailed results on the quality of the health data in each survey. If there is no comment on a particular section of a survey, this implies that no major data quality problems were found and that the questions used were the same or close to the core questionnaire.

SUB-SAHARAN AFRICA

Botswana

- *Demographic aspects*: considerable displacement of births out of the health section; strong heaping of age at death at 12 months; fostering common (child not with mother); displacement of birth dates towards the interview date
- *Maternity care*: substantial underreporting of current pregnancies; includes question on place of delivery (last birth only)
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: more than 10 percent "don't know" responses for morbidity questions (mainly due to fostering); has some ARI questions; question on fever
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: not included
- *Causes of death*: not included

Burundi

- *Demographic aspects*: considerable displacement of births out of the health section; strong heaping of age at death at 12 months; displacement of birth dates towards the interview date
- *Maternity care*: no problems
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: has some ARI questions; question on fever
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap in lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: no problems
- *Causes of death*: not included

Ghana

- *Demographic aspects*: incompleteness of birth-date information presents problem; strong heaping of age at death at 12 months
- *Maternity care*: no problems
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; has some ARI questions; question on fever
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: no problems
- *Causes of death*: not included

Kenya

- *Demographic aspects*: considerable displacement of births out of the health section; strong heaping of age at death at 12 months
- *Maternity care*: substantial underreporting of current pregnancies; includes question on place of delivery
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; has some ARI questions; question on fever
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: not included
- *Causes of death*: not included

Liberia

- *Demographic aspects*: overall response rate less than 90 percent; considerable displacement of births out of the health section; incompleteness of birth date information presents problem; strong heaping of age at death at 12 months; strong displacement of birth dates towards the interview date; fostering common (child not with mother)
- *Maternity care*: only for last births; includes question on place of delivery (last birth only)
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; 40-60 percent of the reported

health cards actually seen
- *Morbidity and treatment*: diarrhea recall period 4 weeks; more than 5 percent "don't know" responses to morbidity questions (mainly due to fostering); no question on diarrhea in last 24 hours; ORS packet use was not probed if child had diarrhea in last two weeks; has some ARI questions; question on fever
- *Feeding*: no breastfeeding duration recall question
- *Anthropometry*: not included
- *Causes of death*: not included

Mali

- *Demographic aspects*: considerable displacement of births out of the health section; incompleteness of birth date information serious problem; strong heaping of age at death at 12 months; displacement of birth dates towards the interview date
- *Maternity care*: more than 10 percent missing values for maternity care questions among dead children; high proportion of women reported tetanus toxoid injections without antenatal care visit
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; less than 40 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; ORS packet use was not probed if child had diarrhea in last two weeks; has some ARI questions; question on fever
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: no problems aside from birth date information
- *Causes of death*: not included

Ondo State, Nigeria

- *Demographic aspects*: considerable displacement of births out of the health section; strong heaping of age at death at 12 months
- *Maternity care*: no problems
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; less than 40 percent of the reported health cards actually seen
- *Morbidity and treatment*: no questions on diarrhea in last 24 hours; ORS packet use was not probed if child had diarrhea in last two weeks; has some ARI questions; question on fever
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: no problems
- *Causes of death*: not included

Senegal

- *Demographic aspects*: strong heaping of age at death at 12 months; fostering fairly common (child not with mother)
- *Maternity care*: high proportion of women reported tetanus toxoid injections without antenatal care visit
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: no question on diarrhea in last 24 hours; ORS packet use was not probed if child had diarrhea in last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: included (subsample); not possible to assess coverage
- *Causes of death*: short questionnaire used, but incomplete; results not very reliable

Togo

- *Demographic aspects*: overall response rate less than 90 percent; considerable displacement of births out of the health section; incompleteness of birth date information presents problem; strong heaping of age at death at 12 months
- *Maternity care*: more than 10 percent missing values for maternity care questions among dead children; high proportion of women reported tetanus toxoid injections without antenatal care visit
- *Vaccination*: no dates copied from the card; only question on whether child ever vaccinated; coverage estimates not possible
- *Morbidity and treatment*: has some ARI questions; question on fever
- *Feeding*: more than 10 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: no problems
- *Causes of death*: not included

Uganda

- *Demographic aspects*: strong heaping of age at death at 12 months; fostering fairly common (child not with mother)
- *Maternity care*: no problems
- *Vaccination*: if no card, only question on whether the

child was ever vaccinated; more than 60 percent of the reported health cards actually seen; BCG scar checked
- *Morbidity and treatment*: considerable mis- or under-reporting of diarrhea within last two weeks; more than 5 percent "don't know" responses to morbidity questions (mainly due to fostering); ORS packet use was not probed if child had diarrhea in last two weeks; has some ARI questions; question on fever
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: more than 10 percent of eligible children not measured
- *Causes of death*: not included

Zimbabwe

- *Demographic aspects*: overall response rate less than 90 percent; strong heaping of age at death at 12 months; fostering fairly common (child not with mother)
- *Maternity care*: more than 10 percent missing values for maternity care questions among dead children; includes question on place of delivery
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: more than 5 percent "don't know" responses to morbidity questions (mainly due to fostering); sugar and salt solution use was not probed if child had diarrhea in last two weeks; has ARI questions (cough and difficult breathing questions separate); question on fever
- *Feeding*: more than 10 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: more than 10 percent of eligible children not measured
- *Causes of death*: not included

NORTH AFRICA

Egypt

- *Demographic aspects*: incompleteness of birth-date information presents problem; strong heaping of age at death at 12 months
- *Maternity care*: includes question on place of delivery
- *Vaccination*: vaccination card is birth certificate (often incomplete); includes mother's recall of specific vaccinations (but not measles); 40-60 percent of the reported health cards actually seen; coverage estimates problematic
- *Morbidity and treatment*: diarrhea recall period one week; has ARI questions (cough and difficult breathing questions separate)
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: included (subsample); considerable heaping of measurements at .0 or .5
- *Causes of death*: few questions for selected causes; overestimates relative importance of the selected causes.

Morocco

- *Demographic aspects*: incompleteness of birth-date information presents problem (although if month not available, season of birth often is); strong heaping of age at death at 12 months
- *Maternity care*: no tetanus toxoid question; includes question on place of delivery
- *Vaccination*: includes mother's recall of specific vaccinations; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or under-reporting of diarrhea within last two weeks
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: included; considerable heaping of measurements at 0.0 or 0.5
- *Causes of death*: few questions; seems to provide some insight into leading causes of death, but many questions remain

Sudan

- *Demographic aspects*: incompleteness of birth-date information presents problem; strong heaping of age at death at 12 months; displacement of birth dates towards the interview date
- *Maternity care*: more than 10 percent missing values for maternity care questions among dead children
- *Vaccination*: includes mother's recall of specific vaccinations; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or under-reporting of diarrhea within last two weeks; has ARI ques-tions (cough and difficult breathing questions separate); question on fever
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: not included
- *Causes of death*: not included

Tunisia

- *Demographic aspects*: heaping of age at death at 12 months
- *Maternity care*: substantial underreporting of current pregnancies; includes question on place of delivery
- *Vaccination*: includes mother's recall of specific vaccinations; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; ORS packet use was not probed if child had diarrhea in last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: included; more than 10 percent of eligible children not measured; considerable heaping of measurements at .0 or .5
- *Causes of death*: few questions; seems to provide some insight into leading causes of death, but many questions remain

ASIA

Indonesia

- *Demographic aspects*: heaping of age at death at 12 months
- *Maternity care*: substantial under-reporting of current pregnancy; no questions on antenatal care; includes question on place of delivery
- *Vaccination*: no questions
- *Morbidity and treatment*: no questions
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: not included
- *Causes of death*: not included

Sri Lanka

- *Demographic aspects*: no problems
- *Maternity care*: substantial under-reporting of current pregnancy; more than 10 percent missing values for maternity care questions among dead children; includes question on place of delivery
- *Vaccination*: includes mother's recall of specific vaccinations; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: no problems
- *Feeding*: more than 10 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: no problems
- *Causes of death*: not included

Thailand

- *Demographic aspects*: no problems
- *Maternity care*: substantial underreporting of current pregnancy; more than 10 percent missing values for maternity care questions among dead children; includes question on place of delivery
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: no problems
- *Feeding*: more than 10 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: no problems
- *Causes of death*: not included

LATIN AMERICA/CARIBBEAN

Bolivia

- *Demographic aspects*: strong heaping of age at death at 12 months
- *Maternity care*: high proportion of women reported tetanus toxoid injections without antenatal care visit; includes question on place of delivery
- *Vaccination*: includes mother's recall of specific vaccinations; less than 40 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; more than 5 percent "don't know" responses to morbidity questions; has ARI questions (cough and difficult breathing questions separate)
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: more than 10 percent of eligible children not measured
- *Causes of death*: fairly extensive questionnaire used; results not very satisfactory (e.g., virtually no measles)

Brazil

- *Demographic aspects*: overall response rate less than 90 percent

- *Maternity care*: includes question on place of delivery
- *Vaccination*: no code for card not seen; includes mother's recall of specific vaccinations; no code for card not seen
- *Morbidity and treatment*: ORS packet use was not probed if child had diarrhea in last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: included (Northeast region only); no problems
- *Causes of death*: not included

Colombia

- *Demographic aspects*: overall response rate less than 90 percent; strong heaping of age at death at 12 months
- *Maternity care*: no problems
- *Vaccination*: if no card, only question on whether the child was ever vaccinated; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks; some ARI and fever questions
- *Feeding*: more than 5 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: more than 10 percent of eligible children not measured
- *Causes of death*: not included

Dominican Republic

- *Demographic aspects*: heaping of age at death at 12 months; fostering fairly common (child not with mother)
- *Maternity care*: no problems
- *Vaccination*: mother's recall of child ever being vaccinated only pertains to campaigns; less than 40 percent of the reported health cards actually seen; coverage estimates problematic
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: included; more than 10 percent of eligible children not measured; considerable heaping of measurements at .0 or .5
- *Causes of death*: not included

Ecuador

- *Demographic aspects*: strong heaping of age at death at 12 months
- *Maternity care*: substantial underreporting of current pregnancies; more than 10 percent missing values for maternity care questions among dead children; includes question on place of delivery (last births only)
- *Vaccination*: no questions
- *Morbidity and treatment*: no question on diarrhea in last 24 hours; diarrhea recall period 4 weeks; no treatment questions; has some ARI questions (last births only)
- *Feeding*: more than 20 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: not included
- *Causes of death*: coded by the interviewer from the mother's report of the terminal symptoms; results do not appear reliable

Guatemala

- *Demographic aspects*: overall response rate less than 90 percent; strong heaping of age at death at 12 months
- *Maternity care*: high proportion of women reported tetanus toxoid injections without antenatal care visit
- *Vaccination*: includes mother's recall of specific vaccinations; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or underreporting of diarrhea within last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months; overlap of lactation and gestation suggests considerable overreporting of breastfeeding duration
- *Anthropometry*: no problems
- *Causes of death*: not included

Mexico

- *Demographic aspects*: heaping of age at death at 12 months
- *Maternity care*: no tetanus toxoid question
- *Vaccination*: no card questions, only recall of vaccinations by mother
- *Morbidity and treatment*: no question on diarrhea in last 24 hours; ORS packet use was not probed if child had diarrhea in last two weeks
- *Feeding*: strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: not included
- *Causes of death*: not included

Peru

- *Demographic aspects*: overall response rate less than 90 percent; strong heaping of age at death at 12 months
- *Maternity care*: 9 percent missing values for maternity care questions about dead children
- *Vaccination*: if no card, only question on whether the

child was ever vaccinated; 40-60 percent of the reported health cards actually seen
- *Morbidity and treatment*: considerable mis- or under-reporting of diarrhea within last two weeks; ORS packet use was not probed if child had diarrhea in last two weeks
- *Feeding*: more than 10 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: not included
- *Causes of death*: not included

Trinidad and Tobago

- *Demographic aspects*: overall response rate less than 90 percent; strong heaping of age at death at 12 months
- *Maternity care*: more than 10 percent missing values for maternity care questions among dead children
- *Vaccination*: includes mother's recall of specific vaccinations; more than 60 percent of the reported health cards actually seen
- *Morbidity and treatment*: no problems
- *Feeding*: more than 15 percent missing values for breastfeeding duration question for deceased children; strong heaping of breastfeeding duration on 12 and 24 months
- *Anthropometry*: included; more than 10 percent of eligible children not measured; considerable heaping of measurements at .0 or .5
- *Causes of death*: not included

CHAPTER 2

Demographic Aspects of the Quality of Data on Births in the Demographic and Health Surveys

GEORGE T. BICEGO
J. TIES BOERMA

Data from the Demographic and Health Surveys (DHS) are a key source of information about the health and survival of children in developing countries. The approach used in the DHS surveys is to collect data on all births that occurred in the five years preceding the survey. This report is intended to inform data users of some important characteristics of these samples of recent births and thus to encourage wide and appropriate use of these data. In the first section, response rates for the major sections of the DHS questionnaire are examined. Next, analyses of birth date displacement and age and birth date reporting are presented, followed by an examination of the quality of childhood mortality data, focusing on the reporting of age at death. In subsequent sections, the frequency of twinning and child fostering are investigated. The last section looks at the distribution of same-mother births within the last five-year period.

2.1 RESPONSE RATES

The DHS surveys use a standard multistage cluster sample to arrive at a probability sample of households and women of childbearing age.[1] The sampling frame is based on the most recent national census available.[2] Primary sampling units or PSUs (census enumeration tracts) are randomly selected based on their proportional representation in the sampling frame. All households in each of the selected PSUs are listed and from these lists a probability sample of households is drawn. The resulting list of households by *cluster*, representing the target sample of households, is used in the field for data collection.

Once a household has been identified in the field and household members and visitors listed, the interviewer determines which women are eligible for an individual interview: namely, those women aged 15-49 years[3] who slept in the household the night before the survey.[4] The individual questionnaire, which includes a complete birth history, is administered to each eligible woman. The interviewer identifies all children born since a specific cut-off date, normally January 1 of the fifth year preceding the year of the survey. Data on maternity care and some aspects of feeding patterns are collected for all these children, while the remaining health data are collected only for surviving children. The interviewer inquires first about the most recent birth and then systematically works backwards through time until reaching the least recent birth that occurred during the relevant period. During data processing, children found to be older than 59 months at the time of the survey are usually excluded from the calculation of indices of health and use of health services.

There are at least three points in this process where nonresponse to the survey can introduce bias to child health estimates. First is *household nonresponse*: whenever a sampled household fails to respond to the survey, information on all children born to eligible women in that household is excluded. Second, even when a household is interviewed and the eligible women identified, some women may not be available for interview; this is termed *women's nonresponse*. Third, even when an eligible woman is interviewed, information about child health may not be collected for every eligible birth. For convenience, this is termed *nonresponse* to the child health section, although the data are missing due almost exclusively to the interviewer's oversight rather than to the respondent's behavior.

The figures in Table 2.1 reflect generally high levels of response to the household questionnaire—a trimean[5] of 97.6 percent for the 27 countries studied. Exceptions are Liberia (88 percent) and Togo (93 percent). In both of these surveys, the primary reason for nonresponse was refusal to complete the interview.

Women's response rates are also high: a trimean of 96.0 percent for the 27 countries. Only in Brazil (88 percent) and Trinidad and Tobago (91 percent) do levels of nonresponse raise questions of potential bias. Unfortunately, DHS-I surveys did not collect information at the household level that would permit an analysis of the factors associated with nonresponse by individuals.

Nonresponse to the child health section is negligible in nearly all countries. The trimean response rate is 99.6 percent, with a low of 97 percent in Mali. Several countries display a pattern in which nonresponse is more common for older children; however, even among four year olds, nonresponse does not exceed 5 percent in any country (not shown).

Although there is no sure way to determine the proportion of recent births excluded from the sample due to household, women's, and child nonresponse, it is useful to estimate what is termed here the *overall* response rate. In the following analysis it is assumed that (1) the average number and fertility profile of women in nonresponding households are the same as those in responding households, and (2) in interviewed

[1] The sampling methodology used in the DHS-I surveys is described in the *Sampling Manual* (Institute for Resource Development, Inc., 1987).

[2] Lacking census information, primary stage sampling in Sudan employed areal grids and quick counts.

[3] The age range in Brazil and Guatemala was 15-44 years.

[4] Eligibility criteria have been extended so that in later surveys all women age 15-49 years are considered eligible, whether or not they slept in the household the night before the interview. The reason for the change is discussed in Rutstein and Bicego (1990).

[5] The trimean is defined as $(Q_1 + 2Q_2 + Q_3)/4$, where Q_1 equals the first quartile value, Q_2 equals the median value, and Q_3 equals the third quartile value.

households, the fertility profile of nonresponding women is the same as that of responding women. Given these assumptions, the overall response rate is the product of the household, the women's, and the child response rates.

These assumptions undoubtedly lead to an underestimate of the true level of response to the child health section, because nonresponding households are more likely to be composed of a single adult, of all males, or of multiple adults without children who work outside the home during interview hours. Even in households that are interviewed, those eligible women who cannot be interviewed probably are disproportionately composed of young employed women, unmarried women, and women at school, all of whom would be likely to have fewer recent (and hence eligible) births. Thus, the overall response figures in Table 2.1 represent the likely *minimum* level of response to the child health section of the questionnaire.

The trimean of the overall response rate for the 27 countries is 92.7 percent, ranging from a low of about 85 percent in Brazil and Trinidad and Tobago to a high of 98 percent in Burundi. Overall response rates generally are lower in Latin America and the Caribbean than in other regions, in large part due to low women's response rates. In these countries, a larger proportion of the sample is urban and thus more likely to be mobile and employed away from home.

Table 2.1 Response rates for the household questionnaire, the women's questionnaire, and the child health section (of the women's questionnaire), and overall response rate, Demographic and Health Surveys 1986-1990

Country	Household Response Rate[1]	Women's Response Rate[2]	Response to Child Health Section[3]	Overall Response Rate[4]
SUB-SAHARAN AFRICA				
Botswana	96.8	94.0	99.6	90.6
Burundi	99.6	98.1	100.0	97.7
Kenya	98.0	96.3	99.2	93.6
Ghana	97.8	98.1	98.9	94.9
Liberia	88.4	97.4	100.0[5]	86.1
Mali	99.8	98.6	97.1	95.5
Ondo State, Nigeria	97.6	99.4	99.9	96.9
Senegal	99.5	96.5	99.6	95.6
Togo	92.5	98.6	98.5	89.8
Uganda	98.8	97.4	99.6	95.8
Zimbabwe	94.7	94.0	99.9	88.9
NORTH AFRICA				
Egypt	99.4	97.9	99.7	97.0
Morocco	97.2	98.9	100.0	96.1
Sudan	99.2	95.6	99.7	94.6
Tunisia	97.7	96.7	99.1	93.6
ASIA				
Indonesia	96.5	98.5	100.0	95.1
Sri Lanka	97.8	95.1	100.0	93.0
Thailand	98.5	94.1	99.3	92.0
LATIN AMERICA/CARIBBEAN				
Bolivia	98.6	92.8	99.3	90.9
Brazil	97.1	87.5	100.0	85.0
Colombia	95.9	94.2	99.5	89.9
Domin. Rep.	97.2	93.4	99.9	90.7
Ecuador	98.5	94.9	98.9	92.4
Guatemala	96.1	93.3	100.0	89.7
Mexico	97.8	96.0	98.8	92.7
Peru	95.7	94.6	99.0	89.6
Trinidad & Tobago	94.3	90.7	99.1	84.8
Trimean	97.6	96.0	99.6	92.7

[1]Percentage of sampled households for which a household (HH) interview was completed. HH not present night before interview, HH vacant or unoccupied, HH destroyed or not found are all excluded from calculation of Household Response Rates.
[2]Percentage of women identified as eligible with whom an interview was completed
[3]Percentage of children born to interviewed women within 59 completed months of the survey for whom health data were collected.
[4]= (1) x (2) x (3); represents theoretical percentage of children in the target sample of households for whom health data were collected.
[5]Based on last births only

How are response rates related to estimation bias? The answer depends both on the type of analysis undertaken and the assumptions made by the analyst regarding the profile of nonrespondents. Bias may be an important consideration in the case where both the level of nonresponse (for which an upper bound estimate is provided here) and the relative difference between excluded and included children (which is unknown) are high. Before analyzing the data from Trinidad and Tobago or Brazil, for example, where response rates are most problematic, it would be useful to run simulations to evaluate the potential for seriously biased results.

2.2 COMPLETENESS AND QUALITY OF BIRTH DATE AND AGE DATA

2.2.1 Birth Date/Age Displacement

The first *DHS Methodological Report* presented evidence that children's birth dates may be systematically displaced in time from *after* the cut-off date for collection of child health information to *before* that cut-off date (Arnold, 1990). It is thought that some interviewers may push back the birth dates of older, eligible children by one or two years to avoid the time-consuming work of collecting their health data. The main concerns are that, where such displacement is prevalent, the survey will fail to realize a representative sample of births, especially those four years (48-59 months) before the survey, and that trends in period fertility and mortality will be distorted.

Table 2.2 shows the distribution of births during the ten-year period prior to the survey. For most DHS countries, the cut-off date was January of the fifth year prior to the year of survey. In four countries (Mali, Senegal, Togo, and Tunisia), however, the cut-off date was set at the month that fell exactly five years before the survey date. For comparative purposes, the table aligns the yearly birth cohorts from all the surveys so that the fifth year before the survey consists of the 12-month period immediately inside the cut-off date for eligible births. The sixth year then represents the 12-month period immediately preceding the cut-off date. If birth dates are being intentionally displaced (so that some births that actually occur *inside* the window are recorded by the interviewer as occurring *outside* the window), then a shortfall in the aggregate number of births would be apparent in the year 5 column as would an excess of births in the year 6 column.

The extent of displacement can be seen from the birth year ratios for years 5 and 6 before the survey[6] (see Table 2.3.). The value of these birth year ratios is expected to be 100 in the absence of birth year displacement, heaping on particular years of birth, or an erratic rise or fall (as opposed to a monotonic change) in the annual number of births. Displacement is suspected if the ratio in the first column is substantially less than 100 and/or the ratio in the second column is substantially greater than 100 and no other explanation is evident.

There is little or no evidence of displacement in Asia and Latin America and the Caribbean with the exception of Bolivia, Guatemala, and Trinidad and Tobago. The surveys in Egypt and Sudan show some indication of displacement.

The problem is most severe, however, in sub-Saharan Africa, especially in Kenya, Liberia, and Ondo State (Nigeria). In each of these countries, the birth year ratio is less than 80 in year 5 and more than 130 in year 6. The worst case is Liberia, where more than 200 births may have been displaced from 1981 to 1980. Data from Botswana, Burundi, Mali, and Togo also show convincing evidence of displacement, while a lower level of displacement occurs in Morocco, Senegal, Tunisia, Uganda, and Zimbabwe. Ghana is the only African country without evidence for displacement.

Figure 2.1 illustrates the deficit of births in the fifth year prior to the survey for Burundi, Kenya, and Liberia. Colombia, a country showing no evidence for displacement, is included for comparison.

In two of the countries where displacement occurs (Liberia and Senegal), the sixth year before the survey is 1980; this year might be expected to receive extra births because of digit preference or heaping. However, Arnold (1990) notes that no heaping of births on 1970 was found in Senegal, and that in Liberia no heaping on 1970 was found for living children, who account for much of the displacement. In Kenya, the distorted birth year ratio may be explained in part by heaping on even-numbered years.

If the sole reason that interviewers displace births is to avoid asking the large number of health questions, then one would expect the displacement of birth dates to be greater for surviving than for dead children, since most of the health questions are not asked about dead children. Yet, when birth year ratios are calculated by survivorship status, the inverse appears to be true. In most countries with marked displacement (e.g., Burundi, Egypt, Kenya, Mali, and Sudan), the displacement is greater for deceased than for surviving children. (Liberia is an exception to this.) Even in some countries with no displacement of living children, displacement of dead children exists (e.g., Brazil, Dominican Republic, and Peru). Arnold (1990) gives three plausible explanations for the displacement of deceased children.

[6] Birth year ratio is defined as the number of births in year x, divided by the average number of births in the year immediately preceding and the year immediately succeeding year x.

Table 2.2 Number of births by number of calendar years preceding the survey, Demographic and Health Surveys, 1986-1990

Country	Number of Years Preceding the Survey[1]									
	< 1[2]	1	2	3	4	5	6	7	8	9
SUB-SAHARAN AFRICA										
Botswana	593	681	594	630	600	627	742	559	641	567
Burundi	361	869	805	762	734	669	880	736	635	597
Kenya[3]	1814	1410	1542	1275	1432	1223	1661	1098	1488	1237
Ghana	241	888	850	843	787	791	782	688	713	707
Liberia	477	1296	942	1002	984	778	1216	916	843	741
Mali	182	841	625	623	660	597	763	804	698	670
Ondo State, Nigeria[3]	604	677	552	745	661	576	825	653	308	124
Senegal	159	937	857	848	869	794	921	899	797	702
Togo	164	674	654	570	655	534	665	656	543	512
Uganda[3]	1006	1075	1027	982	899	881	932	736	861	743
Zimbabwe[3]	549	685	715	639	722	697	712	582	666	572
NORTH AFRICA										
Egypt	1603	1706	1776	1752	1810	1593	1799	1428	1649	1555
Morocco	667	1250	1211	1223	1262	1190	1339	1353	1250	1141
Sudan[3]	1629	1228	1331	1376	1267	1217	1520	1388	1219	1231
Tunisia	221	932	856	893	942	861	945	879	874	808
ASIA										
Indonesia	1385	1442	1644	1842	1744	1991	1864	2028	1876	1750
Sri Lanka	106	788	799	794	839	810	892	921	838	848
Thailand	215	748	801	661	781	769	812	837	901	745
LATIN AMERICA/CARIBBEAN										
Bolivia	376	1250	1173	1173	1120	1003	1231	1269	1167	1209
Brazil	363	639	663	753	737	730	763	611	681	574
Colombia	435	558	548	513	577	556	577	584	540	495
Dominican Republic	706	943	815	909	902	862	822	904	816	770
Ecuador	82	678	622	562	546	664	634	687	586	603
Guatemala	871	919	926	892	937	835	1041	889	840	734
Mexico	326	1237	1064	1191	1090	1145	1069	1131	1109	1048
Peru	529	597	621	637	686	677	679	613	667	599
Trinidad & Tobago	188	386	390	405	404	371	410	387	356	323

[1] For all countries with a January cut-off date for collection of health data, the "Number of years preceding.." represents calendar years. For Mali, Senegal, Togo, and Tunisia, which had different cut-off dates, "Number of years preceding.." represents 12-month periods starting in March, April, May and June, respectively.

[2] Year of survey

[3] In these countries, data collection occurred during two calendar years. In this table, births during both years of the surveys are placed in the < 1 year category. The cut-off date is January of the fifth year preceding the first year of fieldwork.

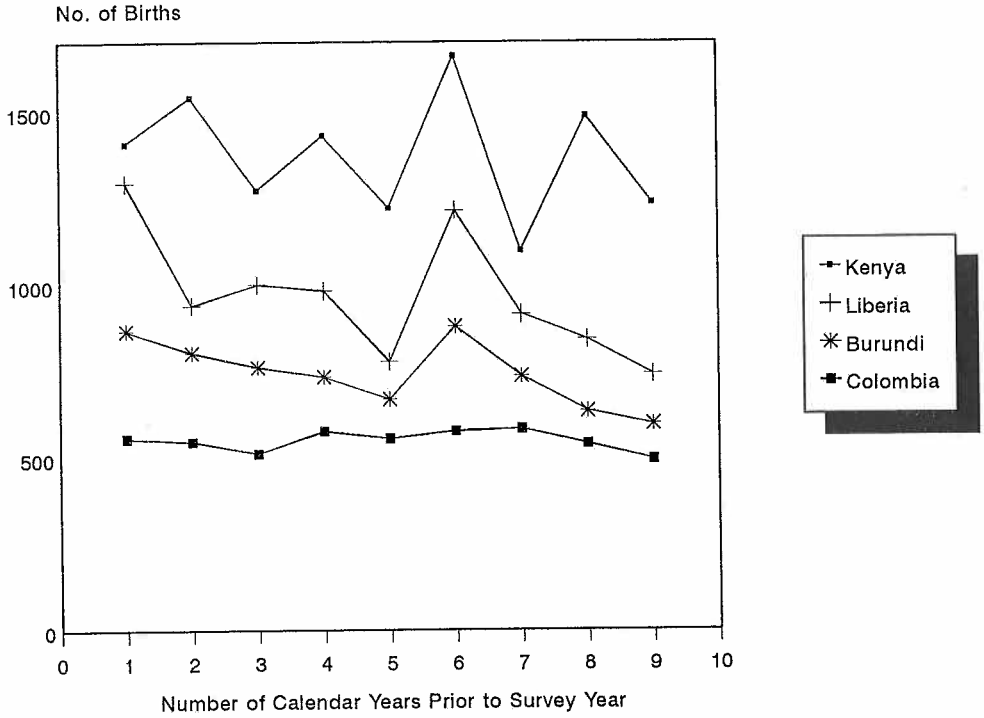
Table 2.3 Birth year ratios by survival status of births, five and six years before the survey, Demographic and Health Surveys, 1986-1990

Country	Centered on Period: Five Years Before the Survey	Centered on Period: Six Years Before the Survey	Centered on Period Five Years Before the Survey: Dead Children	Centered on Period Five Years Before the Survey: Living Children
SUB-SAHARAN AFRICA				
Botswana	93.4	125.1	66.7	95.1
Burundi	82.9	125.3	85.7	82.5
Ghana	100.8	105.7	107.3	99.7
Kenya	79.1	143.1	65.5	80.5
Liberia	70.7	143.6	71.2	70.6
Mali	83.9	108.9	62.5	91.2
Ondo State, Nigeria	77.5	134.3	70.2	78.5
Senegal	88.7	108.8	83.1	90.0
Togo	80.9	111.8	61.8	84.5
Uganda	96.2	115.3	84.9	98.9
Zimbabwe	97.2	111.3	126.0	95.1
NORTH AFRICA				
Egypt	88.3	119.1	61.1	92.7
Morocco	91.5	105.3	95.7	91.0
Sudan	87.3	116.7	68.5	90.7
Tunisia	91.3	108.6	81.4	92.0
ASIA				
Indonesia	110.4	92.8	113.8	110.0
Sri Lanka	93.6	103.1	75.7	94.4
Thailand	96.5	101.1	114.3	95.6
LATIN AMERICA/CARIBBEAN				
Bolivia	85.3	108.4	84.1	85.5
Brazil	97.3	113.8	73.2	99.9
Colombia	96.4	101.2	106.1	95.7
Dominican Republic	100.0	93.1	72.0	103.2
Ecuador	112.5	93.9	93.2	114.4
Guatemala	84.4	120.8	71.7	86.1
Mexico	106.1	93.9	101.4	106.2
Peru	99.2	105.3	80.5	101.7
Trinidad & Tobago	91.2	108.2	33.3	93.8
Trimean	91.2	110.0	81.3	93.4

Note: The birth year ratio x years before the survey = $\frac{Bx}{0.5(Bx-1 + Bx+1)} \times 100$,

where Bx = number of births x years before the survey.

Figure 2.1 Number of births by number of calendar years of birth prior to survey, selected Demographic and Health Surveys, 1986-1989



First, interviewers may be reluctant to ask a series of detailed and probing questions about deceased children. Second, birth date information is likely to be less precise to begin with for deceased children, so there is more leeway in estimating (and displacing) dates of birth. Third, when the year of birth for a child who died is missing altogether, early DHS data processing procedures assumed the child was too old to be included in the health and breastfeeding section of the questionnaire. Further discussion of these patterns is found in Arnold (1990) and Sullivan et al. (1990).

It should be mentioned that an unknown but probably significant fraction of births, although displaced from the fifth to the sixth calendar year of birth before survey, would not in any case have fallen within the age range of 0-59 months used for most child health analyses (i.e., many of the births genuinely born in the fifth year before the year of the survey will not have been less than 60 months old.) All of the remaining results presented here are limited to children 0-59 months of age at the time of the survey for whom health data were collected. The issue of displacement will be raised again in later sections.

2.2.2 Completeness of Birth Date/Age Information

Virtually all analyses of child health data use age groupings. Even in the absence of deliberate displacement, the reporting of birth dates and ages is often inaccurate and unreliable. The current age of a child is considered complete when the mother provides both month and year of birth in the birth history. Current age is less precisely ascertained when only the year of birth is reported or when a year of birth and a current age (in years) is given.

Table 2.4 shows the percentage of births with incomplete birth date information by both age and survival status. As can be seen, the completeness of birth date information varies widely. Generally, the data are least complete in sub-Saharan Africa and North Africa and most complete in Latin America. The data for Ondo State (Nigeria) and Uganda, which indicate virtually no missing months of birth, should be viewed with caution: their completeness is probably due more to field imputation by interviewers than to the respondents' knowledge of the dates. The problem is greatest in Mali, where nearly half of all births lack complete birth date information. In three other countries (Morocco, Sudan, and Togo), 20 to 30 percent of birth date information is incomplete; in three more (Egypt, Ghana, and Liberia), the percentage ranges from 10 to 20. The trimean value for all 27 countries is a surprisingly low 3.5 percent.

Table 2.4 Single-year age distribution of children born in the five years preceding the survey and percentage of births with incomplete birth date information, by age at survey and survival status, Demographic and Health Surveys, 1985-1990

Country		Living Children (Current age in years)						Dead Children (Time since birth in years)						All Births (Current age/time since birth in years)					
		<1	1	2	3	4	0-4	<1	1	2	3	4	0-4	<1	1	2	3	4	0-4
SUB-SAHARAN AFRICA																			
Botswana																			
	Number	712	614	580	604	557	3068	26	36	18	28	35	146	738	651	599	633	593	3214
	% incomplete	0.0	0.2	0.7	1.0	0.8	0.5	2.2	4.0	3.1	5.0	5.6	4.2	0.1	0.4	0.8	1.1	1.1	0.7
Burundi																			
	Number	813	663	767	629	627	3502	43	54	84	99	104	385	857	717	852	728	732	3887
	% incomplete	0.2	1.7	4.1	3.7	13.4	4.3	0.0	14.9	13.6	32.1	23.7	19.8	0.2	2.7	5.0	7.6	14.9	5.9
Ghana																			
	Number	781	782	761	676	690	3690	47	79	115	88	117	446	828	861	876	764	807	4136
	% incomplete	2.6	6.3	10.4	12.1	16.7	9.3	17.0	25.3	29.6	31.8	31.6	28.5	3.4	8.0	12.9	14.4	18.8	11.4
Kenya																			
	Number	1389	1314	1379	1248	1262	6593	65	110	133	98	130	539	1454	1425	1513	1347	1392	7133
	% incomplete	1.5	0.6	1.1	1.8	1.6	1.3	0.8	6.6	2.9	5.4	5.6	4.5	1.5	1.0	1.2	2.0	2.0	1.5
Liberia																			
	Number	1198	817	759	804	727	4307	134	156	181	215	184	872	1332	973	941	1020	912	5180
	% incomplete	4.2	8.0	5.7	12.6	10.1	7.8	16.2	24.2	20.7	22.2	26.3	22.2	5.4	10.6	8.6	14.6	13.4	10.2
Mali																			
	Number	776	554	515	531	526	2904	69	106	129	116	114	536	845	661	645	647	641	3441
	% incomplete	25.0	37.6	54.8	53.4	59.7	44.2	24.0	63.2	54.6	62.7	60.2	55.3	24.9	41.7	54.7	55.1	59.8	45.9
Ondo State, Nigeria[1]																			
	Number	661	590	513	645	609	3018	36	44	51	70	63	264	697	634	564	715	672	3282
	% incomplete	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal																			
	Number	805	791	700	739	673	3708	72	85	127	152	143	579	877	876	827	891	816	4287
	% incomplete	0.9	1.8	4.9	6.1	8.9	4.3	2.8	14.1	15.7	20.4	9.8	13.6	1.0	3.0	6.5	8.5	9.1	5.6
Togo																			
	Number	617	570	558	536	522	2803	46	58	75	87	65	331	663	628	633	623	587	3134
	% incomplete	13.5	16.0	21.0	28.5	38.9	23.1	19.6	31.0	45.3	57.5	58.5	45.0	13.9	17.4	23.9	32.6	41.1	25.4
Uganda																			
	Number	1015	946	838	846	726	4373	90	120	164	134	165	675	1106	1066	1002	981	892	5049
	% incomplete	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Zimbabwe																			
	Number	593	629	670	598	674	3164	29	31	50	39	45	194	622	660	720	637	719	3358
	% incomplete	0.0	0.0	0.1	0.2	0.1	0.1	0.0	0.0	4.0	0.0	2.2	1.5	0.0	0.0	0.4	0.2	0.3	0.2
NORTH AFRICA																			
Egypt																			
	Number	1620	1593	1603	1569	1622	8009	79	110	162	179	190	722	1699	1704	1766	1748	1812	8731
	% incomplete	1.9	8.4	15.1	18.2	20.9	12.9	13.6	41.6	47.3	53.6	59.7	47.5	2.4	10.6	18.1	21.8	25.0	15.8
Morocco																			
	Number	1166	1101	1070	1171	1094	5602	78	88	112	107	115	500	1244	1189	1182	1278	1209	6102
	% incomplete	6.4	13.9	24.8	24.6	29.3	19.7	34.6	53.4	58.9	58.9	65.2	55.6	8.2	16.8	28.0	27.5	32.7	22.6
Sudan																			
	Number	1321	1150	1198	1255	1138	6062	62	91	134	141	154	582	1383	1241	1332	1396	1292	6644
	% incomplete	6.6	16.0	30.0	36.9	38.0	25.2	6.5	35.2	50.0	48.9	51.9	43.3	6.6	17.4	32.0	38.1	39.7	26.8
Tunisia																			
	Number	850	820	863	849	868	4250	29	44	43	47	64	227	879	864	906	896	932	4477
	% incomplete	0.8	1.3	1.6	1.2	2.2	1.4	17.2	13.6	23.3	10.6	7.8	13.7	1.4	2.0	2.6	1.7	2.6	2.1

[1] Only final data with imputed values remain in data file.

Table 2.4—Continued

	Living Children (Current age in years)						Dead Children (Time since birth in years)						All Births (Current age/time since birth in years)					
	<1	1	2	3	4	0-4	<1	1	2	3	4	0-4	<1	1	2	3	4	0-4
ASIA																		
Indonesia																		
Number	1463	1365	1496	1698	1569	7592	74	90	161	152	171	650	1537	1456	1658	1850	1740	8243
% incomplete	0.6	5.1	7.1	9.9	10.0	6.7	14.4	17.7	22.5	32.3	27.5	24.5	1.3	5.9	8.6	11.7	11.7	8.1
Sri Lanka																		
Number	752	774	775	792	782	3877	12	20	23	25	23	104	764	794	798	817	805	3981
% incomplete	0.0	0.1	0.4	0.9	1.6	0.6	0.0	5.8	11.5	13.0	0.0	6.9	0.0	0.3	0.8	1.3	1.6	0.8
Thailand																		
Number	648	758	689	694	729	3519	13	30	26	25	35	132	662	789	716	719	764	3652
% incomplete	0.3	0.5	2.4	2.4	2.6	1.7	7.5	36.3	20.8	53.6	23.5	30.0	0.5	1.9	3.1	4.2	3.5	2.7
LATIN AMERICA/CARIBBEAN																		
Bolivia																		
Number	1098	1109	1017	995	988	5208	70	124	133	126	129	584	1169	1234	1150	1121	1117	5793
% incomplete	0.1	0.2	0.2	0.6	1.2	0.4	10.2	5.8	11.9	10.1	18.3	11.4	0.7	0.7	1.6	1.7	3.1	1.5
Brazil																		
Number	625	577	614	752	654	3224	32	57	52	56	58	257	657	635	666	808	712	3481
% incomplete	0.1	0.2	0.2	0.7	0.3	0.3	8.2	9.1	3.3	9.9	7.6	7.7	0.5	1.0	0.5	1.3	0.9	0.9
Colombia																		
Number	490	555	507	504	556	2615	12	14	23	23	13	87	502	570	531	528	570	2702
% incomplete	0.0	0.0	1.1	0.6	0.3	0.4	0.0	15.1	6.0	4.1	0.0	5.2	0.0	0.4	1.3	0.7	0.2	0.5
Dominican Rep.																		
Number	852	863	770	815	802	4106	42	66	67	71	89	337	895	930	838	886	891	4443
% incomplete	0.0	0.1	0.2	0.1	0.6	0.2	0.0	0.0	1.9	3.5	2.5	1.8	0.0	0.1	0.3	0.4	0.8	0.3
Ecuador																		
Number	629	592	526	503	599	2849	40	33	41	40	48	202	669	625	567	543	647	3051
% incomplete	0.8	1.2	0.8	1.8	2.7	1.4	5.0	9.1	7.3	15.0	8.3	8.9	1.0	1.6	1.2	2.8	3.1	1.9
Guatemala																		
Number	925	823	841	809	832	4230	41	83	84	89	100	397	966	906	925	898	932	4627
% incomplete	0.0	0.1	0.4	0.9	1.8	0.6	2.4	4.8	9.5	6.7	9.0	7.1	0.1	0.6	1.2	1.4	2.6	1.2
Mexico																		
Number	1141	1022	1123	1033	1048	5368	48	59	58	68	76	312	1190	1081	1181	1101	1125	5680
% incomplete	0.1	0.1	0.4	0.4	0.8	0.3	0.0	1.9	2.1	9.6	5.6	4.2	0.1	0.2	0.5	0.9	1.2	0.6
Peru																		
Number	566	526	566	561	617	2836	28	43	67	83	74	295	594	569	633	644	691	3131
% incomplete	0.0	0.0	0.5	0.4	0.6	0.3	0.0	2.3	3.0	3.6	5.4	3.4	0.0	0.2	0.8	0.8	1.2	0.6
Trinidad and Tobago																		
Number	351	380	379	397	380	1887	7	8	13	15	16	59	358	388	392	412	396	1946
% incomplete	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	6.2	1.7	0.0	0.0	0.0	0.0	0.5	0.1
Trimean	0.6	1.9	2.4	3.7	4.4	2.7	4.8	11.5	12.3	14.4	12.4	11.6	0.9	2.6	2.8	4.7	5.3	3.5

A completely reported birth date is more than four times as likely to be lacking in children who have died than in surviving children. This pattern is apparent in nearly every country, but is especially pronounced where overall completeness is high, for example, in Latin America.

The precision of birth date reporting tends to decline with increasing age of the child. The birth dates of children born four years before the survey are six times more likely to be imprecisely reported than those of children born in the year of the survey. While this may be due in part to diminished recall, it probably also reflects the tendency for interviewers to avoid the work necessary to elicit month of birth information, since DHS guidelines allow for only the year of birth and year of age to be recorded. Mothers are naturally more likely to report birth dates and ages in months (without probing) for younger children than for older ones. Thus, the largest jump in the percentage of incompletely reported birth dates occurs between infancy and the first birthday, when many mothers apparently tend to stop routinely thinking about their children's ages in months and start counting in years. Unless interviewers take the time to effectively probe for a month of birth, this information will remain imprecise; either the month of birth will be imputed by computer or, as in Uganda, by the interviewer or field editor.

The relationship between the precision of birth date reporting and age varies by survival status. For children born more than one year before the survey, the increase in incomplete birth date information with age is smaller for dead children than for surviving children. Indeed, in many countries, birth dates for deceased children are reported more precisely for those born four years before the survey than for those born three years before the survey. This may be due to the intentional displacement of children with imprecisely reported birth dates out of the five-year period for the collection of health information when the child's birth date falls near the cut-off date (i.e., when the child was born four years before the survey). As already mentioned, such displacement is particularly likely among deceased children.

Arnold (1990, Table 2.3) provides useful figures on the completeness of birth date reporting in DHS surveys according to several demographic and social variables. Not surprisingly, maternal education is strongly linked with the complete reporting of children's birth dates. However, this association is considerably weaker in countries where the overall level of education is higher (e.g., in Latin America). This suggests that while personal attributes are important in determining knowledge of dates, culture and society also figure prominently in conditioning an individual's attachment or disattachment to age and date concepts. Thus, the uneducated Mexican mother reports her children's birth dates more precisely than does the Malian mother who has some secondary schooling.

2.2.3 Quality of the Month-of-Birth Information

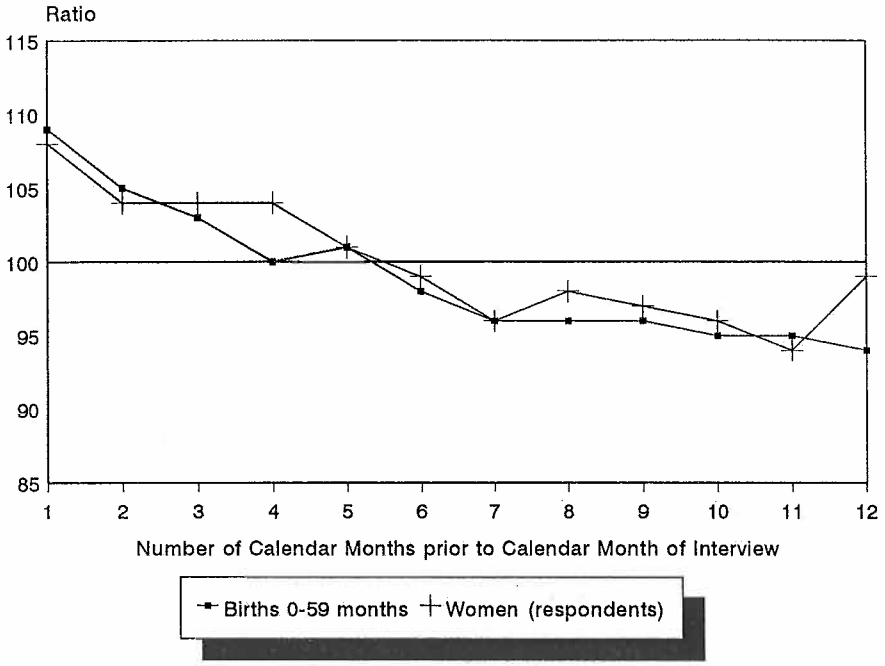
The age of the child in months is important in the analysis of health data, especially so for studies of health patterns in the first two years of life. Misreporting the month of birth affects many current status measures, including the median duration of breastfeeding, the evaluation of anthropometric status (height and weight for age), age patterns of morbidity, immunization coverage estimates by age, and life table analysis of child mortality (censoring). In this section, two data quality problems are examined: the misreporting of the month of birth for months surrounding the month of the interview and the displacement of births towards the interview date.

Becker (1984) has shown some evidence suggesting that the month of birth of young children may be systematically misreported in birth histories. Using data from four WFS surveys, he found an excess of births in both the month of the interview and the months immediately preceding it; there was a deficit of births in the months following the month of survey. This can lead to both over- and underestimation of current age. Excluding explanations of seasonality and data imputations, he concluded that reporting and/or recording errors are responsible for this pattern. Becker reasons that a respondent (or interviewer) may more easily recall the names of the months that have just passed than the names of the months still to come in the calendar year. Grummer-Strawn and Trussell (1990) combined data from 40 WFS and 22 DHS surveys and described a pattern of month-of-birth reporting similar to that shown by Becker.

Figure 2.2 shows the distribution of births by the number of calendar months prior to the survey, standardized to the mean number of births per month for all births in the five years preceding the survey for 27 DHS-I surveys. (The month of interview is included in the twelfth month, but the number of births has been doubled to be comparable to births in the preceding months, since on average interviews were conducted halfway through the month. This is a conservative adjustment since it is expected that some women—and their children—will be missed because they are still recovering from delivery.) Only children with complete reports of birth dates are included, i.e., those with month and year reported. Seasonality is unlikely to influence significantly the pattern of births shown in Figure 2.2, because the data have been pooled over a large number of surveys conducted during different times of the year and spread over a period of 3 to 7 months.

A peak in the number of births is seen in the month before the survey (109, or 9 percent more births than the mean monthly number of births). In the second and third months before the survey, the numbers of births are also higher than expected, by about 5 percent. In contrast, there is a shortfall of births in the months following the month of the survey and in the months

Figure 2.2 Distribution of births by number of calendar months prior to the month of interview relative to the mean number of births per month (=100), for births 0-59 months before the survey and for women age 15-49 years, 27 DHS surveys, 1986-1989



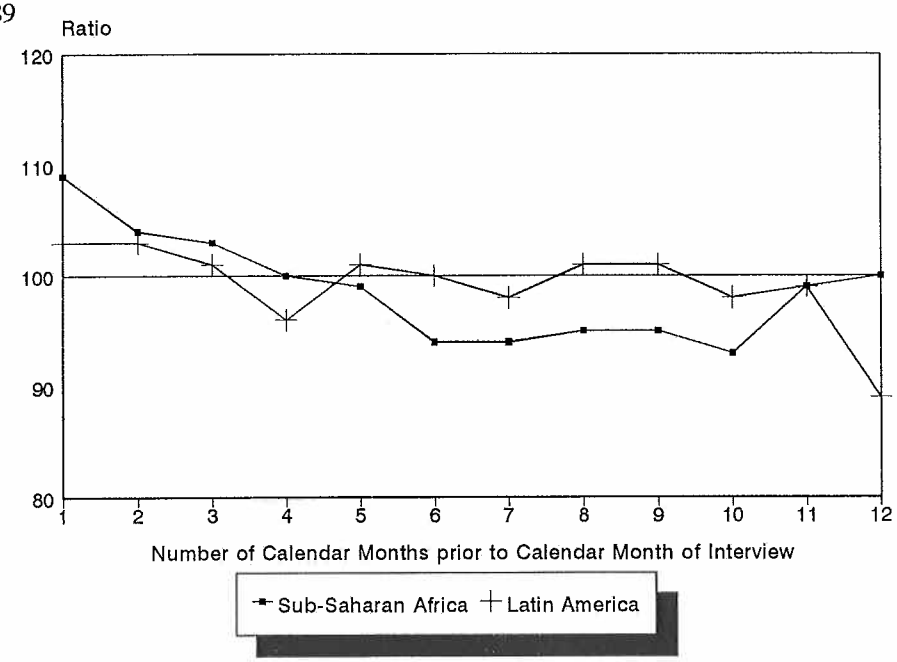
Note: Data are for living and dead children
for whom complete birth dates have been reported;
"12 months" prior to the interview includes month of survey.

falling at one-year intervals from the month of the interview (0, 12, 24, etc. months before the survey). The shortfall for the month of the survey is not caused by a deficit in the actual month of the interview; indeed, as will be shown below, this month has a greater than expected number of births reported.

Reporting of the month of birth of the respondents (women age 15-49 years) follows essentially the same pattern as that of their children (Figure 2.2). There is a surplus of births in the months shortly before the month of interview and a shortfall in the months after the survey. This pattern is particularly pronounced in sub-Saharan Africa.

One likely cause for the overreporting of births during the months before the survey is that often a mother tells the interviewer the current age of her child rather than the birth date. To avoid the work necessary to elicit a birth date, the interviewer may simply subtract the reported age in years from the year of survey to get (sometimes incorrectly) the year of birth. Then the interviewer imputes a month of birth. While the respondent probably collaborates in determining the month of birth to some extent, recently passed calendar months are selected more frequently than upcoming months. There is no way to determine what level of guesswork went into the month of birth recorded or how the respondent and interviewer interacted. Yet it is true that this phenomenon can cause both age underestimation and age overestimation, depending on the month of interview and the extent to which current age, when reported in years, is rounded up to the next birthday.

Figure 2.3 Distribution of births by number of calendar months prior to the month of interview relative to the mean number of births per month (=100), for sub-Saharan Africa and for Latin America, Demographic and Health Surveys, 1986-1989



Note: Data are for living and dead children
for whom complete birth dates have been reported;
"12 months" prior to the interview includes month of survey.

In Figure 2.3, the data on number of births by calendar months prior to the survey is reported separately for 11 DHS surveys in sub-Saharan Africa and 10 DHS surveys in Latin America and the Caribbean. In Latin America and the Caribbean, the number of births per month varies little, except for a marked deficit during the month of interview (that is, 0, 12, 24, 36, and 48 months prior to the survey). In contrast, in sub-Saharan Africa there is no deficit in the survey month, but there are higher than expected numbers of births in the 3 months before the survey, especially in the month immediately preceding the survey.

It is more difficult to analyze data on the month of birth for individual surveys because of country-specific seasonal patterns in fertility. Nonetheless, one clear pattern does emerge, as seen in Table 2.5: those surveys that have a high proportion of incomplete birth dates (e.g., sub-Saharan Africa and North Africa) also show greater displacement of the reported month of birth. Thus, where greater opportunity for guesswork in the field exists, such guesswork may be biased towards recent months. Also shown is that even under the conservative assumptions adopted to estimate the number of births in the actual month of interview, there is a considerable excess of these births in sub-Saharan and North Africa. This is consistent with the observations of Becker (1984).

There is evidence from both WFS and DHS surveys that births have been displaced into the year immediately preceding the survey and that births within that year have been displaced into the more recent months (Grummer-Strawn and Trussell, 1990). Figure 2.4 presents the number of births for each of the 60 months prior to the survey, including both living and dead children, pooled over the 27 surveys. One curve covers all births, including those children with imputed birth dates; the other curve includes only births with completely reported dates. As already seen, there are clear recurrent peaks during the month immediately before the interview and at 12-month intervals back in time (which represent reports of age in whole years converted to birth dates). In addition, the figure shows the displacement of births into the year immediately preceding the survey and a deficit of births in the fourth and fifth years before the survey. This deficit of births is due both to the intentional displacement of children out of the recent five-year period and also to the small effect of truncation of observation for births to women age 45-49.

Figure 2.5 shows a further analysis of births in the 36 months prior to the survey. It presents the relative number of births, grouped into three-month periods, for 11 surveys in sub-Saharan Africa and 10 surveys in Latin America and the Caribbean.[7]

[7]Births in the actual month of interview are not shown in Figure 2.5. However, Table 2.5 shows there is a large excess of births (29 percent) in the month of the interview in sub-Saharan Africa, while near expected numbers of births occur in Latin America.

Table 2.5 Summary of displacement of births in the five-year period before the survey: Percentage of excess births in specified periods relative to number of births expected for that period (=100), Demographic and Health Surveys, 1985-1990

Country	Births during the 3 Months Prior to Survey Month		Births in Actual Month of Interview[3]	Displacement:	
	Among children[1]	Among women[2]		Into last Year[4]	Within Last Year[5]
SUB-SAHARAN AFRICA					
Botswana	103	117	136	115	119
Burundi	114	179	135	110	106
Ghana	103	111	130	100	101
Kenya	102	116	127	103	105
Liberia	110	121	183	128	102
Mali	106	105	168	122	114
Ondo State, Nigeria	99	92	123	114	98
Senegal	104	124	93	105	90
Togo	104	105	133	107	107
Uganda	109	89	101	107	96
Zimbabwe	112	98	85	96	106
Mean (Region)	106	110	129	110	103
NORTH AFRICA					
Morocco	110	110	82	105	115
Egypt	110	95	134	102	119
Sudan	111	111	190	110	140
Tunisia	108	95	102	102	107
Mean (Region)	105	103	131	105	121
ASIA					
Indonesia	113	110	106	102	115
Sri Lanka	108	101	49	99	107
Thailand	108	117	69	94	91
Mean (Region)	108	110	83	99	107
LATIN AMERICA/CARIBBEAN					
Bolivia	105	103	97	101	103
Brazil	101	102	65	102	100
Colombia	99	103	138	98	96
Dominican Republic	102	102	110	104	101
Ecuador	98	94	77	110	101
Guatemala	111	110	117	107	106
Mexico	100	103	59	105	92
Peru	106	106	99	102	116
Trinidad & Tobago	93	96	105	97	77
Mean (Region)	102	103	99	104	100
Mean (All Surveys)	106	106	115	106	106

[1]Percentage of excess births during 3 months prior to interview relative to expected number of births (100 = 3X mean monthly births). Births, 0-59 months.
[2]Percentage of excess births during 3 months prior to interview relative to expected number of births (100 = 3X mean monthly births). Women 15-49.
[3]Percentage of excess births during actual month of interview relative to expected number of births (100 = mean monthly births). Births, 0-36 months.
[4]Percentage of excess births 0-11 months prior to interview relative to expected number of births (100 = mean yearly number). Births, 0-36 months.
[5]Percentage of excess births 0-5 months prior to interview relative to expected number of births (100 = 6X mean monthly births). Births, 0-11 months.

Figure 2.4 Number of births by number of months prior to the survey relative to the mean number of births, for all births (including those with imputed birth dates) and for births with complete birth dates only, 27 DHS surveys, 1986-1989

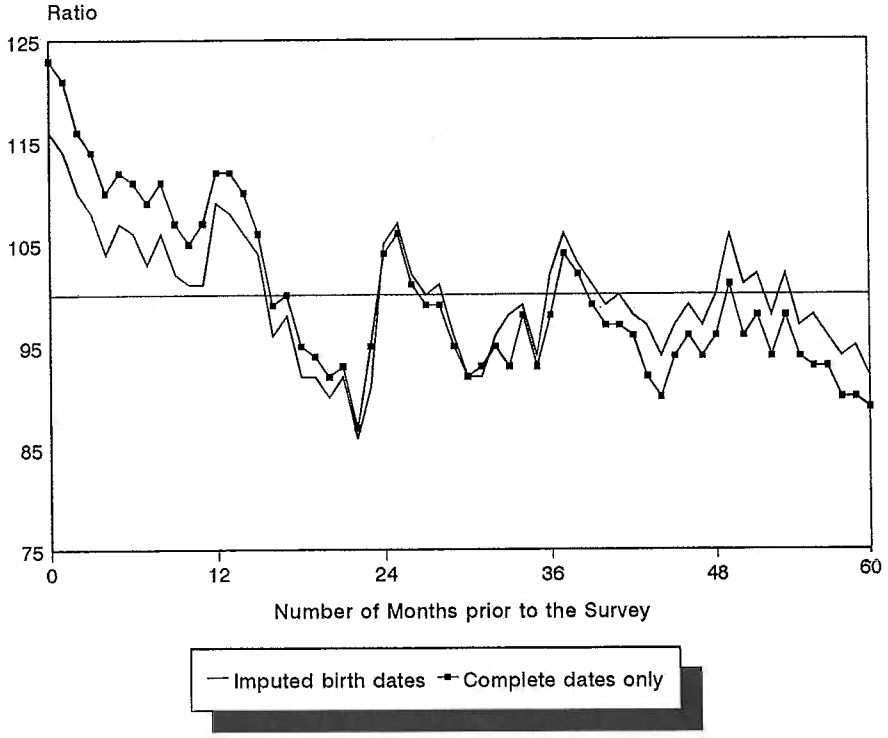
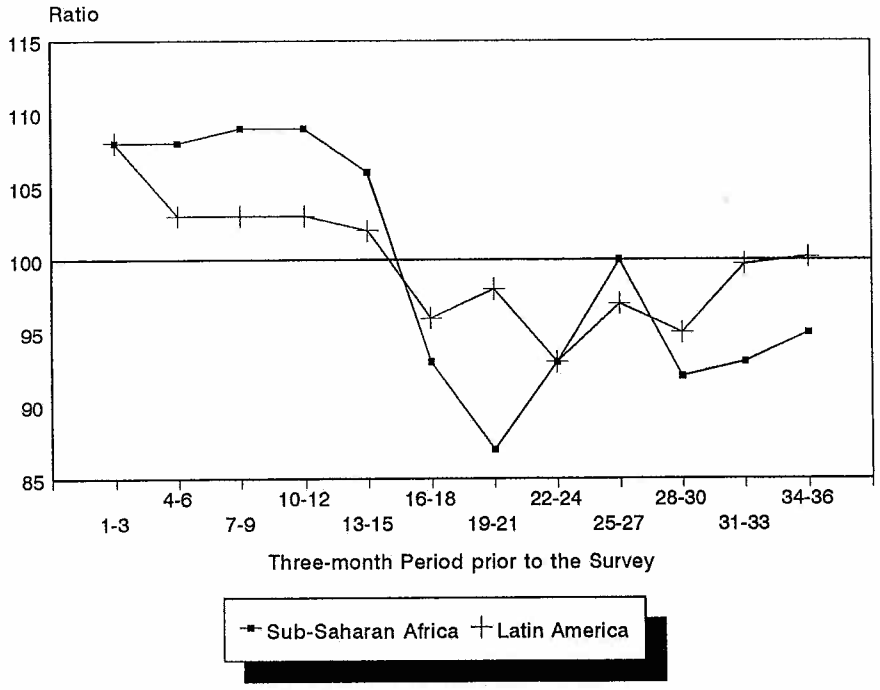


Figure 2.5 Number of births by three-month periods prior to the survey relative to the mean number of births, for sub-Saharan Africa and for Latin America, Demographic and Health Surveys, 1986-1989



Note: Data are for all living and dead children, including those with imputed birth dates.

In Figure 2.5, two phenomena can be seen at work. First, in both groups of surveys, births have been displaced into the year immediately preceding the survey, although displacement is much greater in sub-Saharan Africa than in Latin America. This, in the absence of other forces, will result in the underestimation of children's ages. Second, the number of births does not drop until 15 months before the survey; this reflects the bias towards reporting a month of birth recently passed (13-15 months) as opposed to a month still to come. This effect is also seen at months 25-27 before the survey. This second effect can result in either the under- or overestimation of current age.

An alternative explanation (other than directional age misreporting) for the pattern described above is the selective omission of births that occurred more than one year ago. This does not seem plausible, however, given the short duration of recall and the rather sharply defined displacement.

2.3 REPORTING OF AGE AT DEATH AND ANALYSIS OF CHILDHOOD MORTALITY

The decision to use births during the five years preceding the survey to analyze determinants of child health and survival (as opposed to, for instance, births during the preceding 10 or 15 years) has advantages and disadvantages. Prime among the advantages is the possibility of linking survival data with data on health and the use of health services. Furthermore, using a more recent reference period allows a better temporal link between cross-sectional household and parental information and the retrospective period of exposure to risk. Finally, any inferences drawn from the analysis are more relevant to current policy, simply by virtue of the more recent reference period.

However, there are some problems in analyzing data of this structure. Chief among these is the inherent confounding between the calendar period and the age of the child. Any data on four year olds, for example, must come from those children born at least 48 months before the survey, none of whom could have had their fourth birthday until the twelve months immediately preceding the survey. Therefore, the average reference period for exposure to risk during the fourth year of life is roughly 6 months before the survey date. Compare this to the situation for neonatal exposure: all births in the five-year period before the survey contribute data on neonatal exposure, so the average reference period is roughly 2.5 years before the survey. Hence, sharp secular trends, whether in strength or direction, may be (erroneously) interpreted as the effects of age. Another consequence of this data structure is that the amount of exposure to risk at older ages is substantially more limited than that at younger ages; this may affect statistical reliability.

This section provides users of DHS health and survival data with an *a priori* glimpse of the overall numbers of deaths, by age at death, among births in the five years preceding the survey. It also assesses the potential for misclassification of age at death introduced by misreporting and incompletely reporting age at death. Sullivan et al. (1990) conducted a similar, but differently focused, analysis of the reporting of age at death in earlier DHS surveys.

Before discussing potential problems with the data, the data collection process should be reviewed. Once an interviewer identifies a deceased child during the birth history, he or she elicits the age at death. The DHS instrument requires that age at death be reported more precisely for younger than older children. Age at death is recorded in *days* for children who die during the first month of life; it is recorded in *months* for those who die before their second birthday; and it is recorded in *years* for the remainder.[8] In the final DHS standard recode data file, age at death is recorded as a three-digit variable, the first digit of which indicates the unit of measurement (days, months, or years). The next two digits are the number of units. A second age-at-death variable in the data file, used for most routine analyses, converts all data to month of age at death. In all cases of missing or incomplete age at death, this data field will contain an imputed value (in months), based on a hot-deck procedure.[9]

2.3.1 Missing Date of Death

The number of deaths among children under age five born during the five years preceding the survey varies widely among DHS countries, from less than 100 in Colombia and in Trinidad and Tobago to well over 600 in Egypt, Indonesia, Liberia, and Uganda (see Table 2.6). Most DHS training and fieldwork efforts have placed great emphasis on the collection of age-at-death data. As a result, it is fairly complete. In 14 of 27 countries, no recent deaths lack age-at-death information; in only 3 countries are data lacking for as many as two percent of deaths. In the large majority of cases where information is incomplete, all the data are missing. In many fewer cases, either the unit of measurement was not recorded or the age at death was inconsistent (that is, the birth date plus age at death is greater than the survey date). In sum, little age-at-death data are missing for recent births in the DHS surveys. It should be borne in mind, however, that completeness of the data does not necessarily imply accuracy. One must reason that, in countries like Senegal and Togo, substantial field imputation by interviewers has occurred.

[8] In Mexico, *day*-at-death information was not collected for neonatal deaths.

[9] Essentially, the age at death is imputed to be the same as that of the last deceased child of the same birth order in the data file. Details on the procedure can be found in the DHS Data Processing Manual (Institute for Resource Development Inc., 1989).

Table 2.6 Deaths among births in the five years before the survey and percentage of deaths lacking complete (and consistent) age-at-death information, by type of data defect, Demographic and Health Surveys, 1986-1990

Country	Incomplete Age-at-death Information		Defect in Age-at-death Information			Number of Deaths
	No.	Percent[1]	All Data Missing	Units Missing	Inconsistent[2]	
SUB-SAHARAN AFRICA						
Botswana	0	0.0	0	0	0	146
Burundi	3	0.4	1	0	2	385
Ghana	0	0.0	0	0	0	446
Kenya	12	2.1	8	1	3	539
Liberia	15	1.8	13	2	0	873
Mali	9	0.2	9	0	0	537
Ondo State, Nigeria	2	0.8	0	0	2	264
Senegal	0	0.0	0	0	0	579
Togo	0	0.0	0	0	0	331
Uganda	4	0.6	0	2	2	676
Zimbabwe	1	0.5	0	0	1	194
NORTH AFRICA						
Egypt	0	0.0	0	0	0	723
Morocco	1	0.2	1	0	0	500
Sudan	1	0.2	0	0	1	582
Tunisia	0	0.0	0	0	0	227
ASIA						
Indonesia	0	0.0	0	0	0	650
Sri Lanka	0	0.0	0	0	0	104
Thailand	0	0.0	0	0	0	132
LATIN AMERICA/CARIBBEAN						
Bolivia	15	2.6	13	2	0	585
Brazil	3	1.0	3	0	0	257
Colombia	0	0.0	0	0	0	87
Dominican Republic	4	1.1	0	0	4	337
Ecuador	3	1.5	2	0	1	202
Guatemala	0	0.0	0	0	0	397
Mexico	8	2.5	8	0	0	312
Peru	0	0.0	0	0	0	295
Trinidad & Tobago	0	0.0	0	0	0	59

[1] Percentages are weighted
[2] Age at death plus birth date fall after survey date

2.3.2 Distribution of Age at Death

Table 2.7 gives the percent distribution of deaths under age five by age at death (in years). Apart from reporting bias, two forces impinge on this distribution. As mentioned above, the structure of these data dictates that exposure is increasingly truncated with increasing age. This effect is amplified by the prevailing age pattern of mortality, in which mortality rates generally decrease with the increasing age of the child. The effect is generally less pronounced, however, where mortality levels are still quite high.

From 61 to 93 percent of the deaths under age five occur in the first year of life, with a further 4 to 19 percent during the second year. With the exception of the high mortality countries of Africa, the percentage and number of deaths drop off rapidly after the second birthday. In no country in Latin America do more than 6 percent of deaths under age five occur after the second birthday.

Table 2.7 Percent distribution of deaths under age five among children born in the five years before the survey, by age at death, Demographic and Health Surveys, 1986-1990

Country	Among Deaths Under Age Five, Percentage Reported at Age (years): < 1	1	2	3	4	Number of Deaths
SUB-SAHARAN AFRICA						
Botswana	80	17	1	2	0	146
Burundi	67	15	13	5	1	385
Ghana	67	17	12	4	1	446
Kenya	77	13	8	2	1	539
Liberia	79	16	4	1	1	873
Mali	61	19	14	5	1	537
Ondo State, Nigeria	69	15	12	4	1	264
Senegal	62	20	13	6	1	579
Togo	68	16	8	6	2	331
Uganda	69	18	8	3	1	676
Zimbabwe	80	14	5	1	0	194
NORTH AFRICA						
Egypt	84	11	3	1	0	723
Morocco	84	12	4	0	0	500
Sudan	74	16	7	2	1	582
Tunisia	89	5	3	2	1	227
ASIA						
Indonesia	82	11	4	2	1	650
Sri Lanka	87	5	5	3	1	104
Thailand	92	5	2	1	1	132
LATIN AMERICA/CARIBBEAN						
Bolivia	76	19	3	0	0	585
Brazil	93	4	1	1	0	257
Colombia	93	6	1	0	0	87
Dominican Republic	85	11	3	0	0	337
Ecuador	84	12	3	0	0	202
Guatemala	79	15	4	1	0	397
Mexico	84	12	3	1	0	312
Peru	77	16	5	1	0	295
Trinidad & Tobago	92	7	0	1	0	59

These findings have obvious implications for the analysis of the determinants of under-five mortality. While some variation of multivariate life table analysis may account for the heavy right censoring in these data, it cannot alleviate the problem of sparseness of mortality data at the older ages. Exceptions to this may be Senegal and Mali, where the high level and attenuated age pattern of mortality result in more deaths at age 2-4 years. For the remaining surveys, most analyses will probably need to be limited to mortality under age two. Even with this limitation, analyses will be more efficient if they employ techniques such as conditional logistic regression and hazards models that allow the use of censored observations (i.e., children born within two years before the survey).

2.3.3 Distribution of Deaths Under Age Two

Table 2.8 shows the distribution of deaths under age two by reported age at death in months. The overall number of deaths under age two varies widely from less than 150 in Botswana, Colombia, Sri Lanka, and Trinidad and Tobago to over 500 in Bolivia, Egypt, Indonesia, Liberia, Sudan, and Uganda. In the former group of countries, the small numbers of deaths will constrain statistically meaningful analysis of effects that vary with age.

Table 2.8 Percent distribution of deaths under age two among children born in the five years before the survey, by age at death (in months), and index of heaping at 6, 12, and 18 months, Demographic and Health Surveys, 1986-1990

	Among Deaths under Age Two, Percentage of Deaths Reported at Age (months):						Index of Heaping at Month:[1]			Deaths Under Age 2
	0	1-2	3-5	6-11	12-17	18-23	6	12	18	
SUB-SAHARAN AFRICA										
Botswana	50	9	10	14	13	4	0.9	7.4	4.3	143
Burundi	43	13	12	15	15	3	1.0	6.5	0.5	314
Kenya	48	10	8	14	18	2	1.2	9.0	5.1	376
Ghana	41	11	13	21	11	3	1.1	4.2	1.7	485
Liberia	42	11	14	16	15	2	1.4	6.6	1.3	823
Mali	40	10	11	14	22	2	1.6	9.1	2.7	434
Ondo State, Nigeria	38	8	14	22	14	4	1.8	4.5	1.5	221
Senegal	42	9	8	17	18	6	1.9	6.6	4.8	470
Togo	43	11	11	15	18	1	1.1	8.2	1.6	279
Uganda	37	13	12	17	17	4	1.0	6.0	2.3	591
Zimbabwe	49	12	10	14	12	3	2.1	5.1	1.6	183
NORTH AFRICA										
Egypt	48	11	11	18	9	3	1.5	5.0	3.0	689
Morocco	52	10	12	14	9	4	1.8	4.5	2.1	478
Sudan	54	6	8	14	13	5	1.3	6.2	4.2	528
Tunisia	54	11	12	17	5	0	1.9	3.8	0.0	215
ASIA										
Indonesia	36	19	15	18	7	4	0.7	3.1	1.0	605
Sri Lanka	65	11	7	12	3	2	0.4	0.5	0.4	96
Thailand	56	15	15	9	2	3	0.7	0.7	0.0	129
LATIN AMERICA/CARIBBEAN										
Bolivia	37	15	13	15	16	4	2.1	6.2	1.8	558
Brazil	47	11	20	18	4	0	1.6	1.6	0.0	250
Colombia	60	10	10	15	5	1	1.9	4.4	2.7	86
Dominican Republic	54	9	12	14	8	3	0.7	3.8	2.0	323
Ecuador	56	14	5	12	10	3	1.1	5.3	3.2	193
Guatemala	40	11	13	20	13	2	1.0	5.8	1.3	373
Mexico	51	10	17	9	8	4	0.8	2.9	0.6	298
Peru	40	14	13	15	14	3	1.0	6.1	1.6	275
Trinidad and Tobago	78	1	7	7	7	0	2.3	4.5	0.0	58

[1]Index of heaping at month 6: 9 x (deaths at month 6/deaths at 3-11 months)
Index of heaping at month 12: 18 x (deaths at month 12/deaths at 6-23 months)
Index of heaping at month 18: 11 x (deaths at month 18/deaths at 13-23 months)

In all countries, a large proportion of deaths under age two occurs during the first month of life. Underreporting of child deaths is considered to be most likely for deaths very early in life. Therefore, the quality of the mortality data can be assessed by analyzing the proportion of child deaths that occurs in the neonatal period and the proportion of neonatal deaths that occurs during the first days of life. The latter will be discussed in the next section. As expected, in low mortality countries such as Colombia, Sri Lanka, and Trinidad and Tobago, higher percentages of deaths under age two occur during the neonatal period. In the remaining countries, the proportion of deaths under age two during the neonatal period is quite homogeneous, especially in sub-Saharan Africa where percentages range from 37 to 50 percent. While some omissions are likely, these figures do not suggest gross underreporting of neonatal deaths.

After the neonatal period, the distribution of deaths by age at death varies widely among the 27 countries analyzed here. Three factors may account for this variability: (1) sampling variance, (2) genuine differences in the age pattern of mortality risks, and (3) differences in the extent of reporting errors of age at death.[10] It is difficult to distinguish the isolated effect of each of these factors. There are certain features of re-

[10] Variations in the distribution of births by exposure length (i.e., birth date) will also have a small effect on the age-at-death distributions.

porting error that stand out clearly and lend themselves to analysis. For example, the unusual drop in the number of deaths between the two 6-month periods, 12-17 months and 18-23 months, is more pronounced in many countries than can reasonably be explained by expected declines in risk with age. This is almost certainly due in large part to heaping of age at death at 12 months. The problem is most severe in sub-Saharan Africa (see Mali, for instance), although several countries outside the region show similar, but less marked, heaping.

Heaping at 12 months poses a dilemma for mortality analysis, since the heap falls at the boundary between two age categories, infant (0-11 months) and child (12-59 months), for which rates are conventionally calculated and for which substantive interest is held. There is no precise way to determine the extent of heaping, because it assumes knowledge of an *expected* number of deaths at 12 months of age, which, in turn, assumes knowledge of the true age pattern of mortality and of the age range from which the heaped deaths were drawn. An index of heaping was calculated based on the working assumptions that heaped deaths were drawn from the 6- to 23-month period[11] and that the expected number of deaths at 12 months is the average monthly number during months 6 through 23. An index value of 2.0, for example, means that twice as many deaths were reported (or recorded) at 12 months or "1 year" than would be expected under the above assumptions.

With the exception of Sri Lanka and Thailand, every survey shows evidence of the heaping of deaths at 12 months. Heaping is greatest in sub-Saharan Africa, but Bolivia, Ecuador, Guatemala, Peru, and Sudan also have index values exceeding 5.0. These figures warn against the use of 12 months as a cut-off point for the analysis of age-specific determinants of childhood mortality. Furthermore, a cut-off anywhere inside the 12- to 23-month period for most surveys is also unwise, since it is clear that most of the deaths in the period are reported at 12 months or "1 year." Table 2.8 indicates that the number of reported deaths during the later half of the second year is, in any case, too few to obtain accurate estimates. There is also evidence of heaping at ages 6 and 18 months in several surveys, especially in sub-Saharan Africa.

In sum, it must be recognized that the age pattern of mortality within the second year (12-23 months) cannot reliably be ascertained for most countries. Another analysis of the impact of heaping on estimates of infant and child mortality suggests that infant mortality may be underestimated by up to 8 percent and child mortality underestimated by up to 10 percent as a result of heaping (Sullivan et al., 1990). Thus, the problem of estimating mortality *levels* can be overcome in part through aggregate-level reallocation of a fraction of heaped deaths. Individual (child-level) analysis of the determinants of mortality is more problematic. Individual deaths cannot simply be shifted (either randomly or purposively) from 12 months to a younger or older age without introducing estimation biases. Sophisticated statistical methods will not create precision in data on the age at death where none exists; the analyst is advised to undertake more realistic studies that focus either on overall under-two mortality or on mortality during better defined age segments.

2.3.4 Patterns of Neonatal Mortality

The DHS birth history data on neonatal mortality can potentially be used to assess levels and trends in neonatal tetanus mortality (Boerma and Stroh, 1992) or to study the relationship between hospital delivery and early neonatal mortality. As mentioned above, when neonatal deaths[12] are reported in the DHS birth histories, an age at death in *days* is elicited. This section focuses on whether or not plausible and useful conclusions concerning the age pattern of mortality and (through inference) morbidity within the neonatal period can be drawn from these data. In addition, the level of underreporting of early neonatal deaths is assessed.

There are certain patterns that one expects to observe in data on neonatal age at death. Mortality is typically highest shortly following birth and rapidly decreases with time since birth. Genuine perturbations in this pattern may occur caused, for instance, by a high level of neonatal tetanus, which results in a rise in deaths from 4 to 14 days after birth (Stanfield and Galazka, 1984). Inexplicable departures from this pattern may be due to reporting errors, omissions, or sampling error.

[11] Heaping at 12 months is the result of two reporting phenomena. In the first case, a woman responds "1 year," which may be recorded (incorrectly) as such by the interviewer or converted directly to 12 months without probing. In this situation, the death is probably drawn from the 12- to 23-month period, since it is truncation rather than digit preference that is occurring. The second case exemplifies true heaping, or digit preference, when a respondent reports "12 months" as a convenient or rounded number, when in fact the death occurred during late infancy or at 13, 14, or 15 months. These conclusions are based on the observations that although a shortfall exists in the distribution of deaths at 10 and 11 months (and sometimes 9 months) in nearly all countries, the shortfall is not large enough to absorb all the excess at 12 months. In sum, it appears (but is by no means certain) that the bulk of deaths reported at 12 months actually occurred during the 12- to 23-month period.

[12] In this report, a neonatal death is considered to be a death occurring in the first month. The conventional neonatal rate includes only deaths under 28 days. However, there are a small number of cases in the DHS data where *day* at death was not recorded and all that is included in the data file is "0 months." These are considered neonatal deaths with uncertain day at death. Also, a handful of deaths were reported at 30 days. For the purpose of analyzing the age structure of neonatal mortality, these cases are considered neonatal deaths at 28+ days.

Table 2.9 shows the distribution of neonatal deaths, by day of death, for the five-year period preceding the survey. Normally, susbstantially less than half of all deaths occurring in the first two days of life (completed days 0-1) would be expected to occur on day 1. In 13 of 26 countries, however, this is not the case: half or more of the deaths in this two-day period occur on the second day (that is, completed day 1), so the index of heaping at day 1 $\geq$ 1.0. Ecuador poses an extreme case: there, no deaths were reported on day 0. Clearly, the first day of life was often interpreted and recorded incorrectly as day 1 in some countries, whereas in others it was recorded correctly as day 0.

Table 2.9 Percent distribution of neonatal deaths by day at death and indices of heaping at 1, 7, 14, and 15 days, Demographic and Health Surveys, 1986-1990

Country	Percentage of Neonatal Deaths Reported at Days:							Index of Heaping at Days:[2]				Number of Neonatal Deaths
	0-1	2-3	4-14	15-27	28+	0 m	0 m imp.[1]	1	7	14	15	
SUB-SAHARAN AFRICA												
Botswana	54.5	17.0	26.4	2.0	0.0	0.0	0.0	0.7	4.5	8.6	0.0	71
Burundi	36.2	13.3	41.8	8.7	0.0	0.0	0.0	1.1	3.2	8.7	1.9	135
Ghana	51.7	13.3	31.1	3.9	0.0	0.0	0.0	1.5	1.8	4.1	0.0	180
Kenya	46.8	13.6	31.3	4.9	0.7	0.0	2.7	0.8	6.4	10.0	0.6	197
Liberia	46.6	13.3	32.6	5.6	0.8	0.0	1.2	0.5	5.1	7.6	1.2	348
Mali	35.6	14.0	42.1	8.3	0.0	0.0	0.0	1.4	2.6	1.7	2.5	175
Ondo State, Nigeria	36.1	16.9	41.0	3.6	1.2	0.0	1.2	1.5	2.8	6.7	2.8	83
Senegal	26.5	17.4	47.5	8.7	0.0	0.0	0.0	1.6	2.0	0.7	3.4	196
Togo	49.6	11.6	32.2	6.6	0.0	0.0	0.0	0.6	2.6	3.3	4.4	121
Uganda	42.9	13.6	34.0	8.5	0.0	0.0	1.1	0.7	5.8	7.7	1.5	217
Zimbabwe	55.0	14.6	28.1	1.1	0.0	0.0	1.1	0.9	3.7	10.9	0.0	89
NORTH AFRICA												
Egypt	31.1	13.6	45.4	9.9	0.0	0.0	0.0	1.0	5.1	0.9	5.1	331
Morocco	26.2	16.5	37.5	17.3	2.0	0.0	0.4	1.0	3.8	1.0	4.8	248
Sudan	46.3	11.9	35.2	5.9	0.7	0.0	0.0	0.7	3.6	1.2	2.3	287
Tunisia	35.0	17.1	35.0	12.8	0.0	0.0	0.0	1.2	2.7	0.0	4.8	117
ASIA												
Indonesia	23.0	11.6	52.8	12.5	0.2	0.0	0.0	1.3	3.6	0.7	3.4	220
Sri Lanka	38.5	18.4	35.6	7.6	0.0	0.0	0.0	0.9	2.0	9.9	0.0	62
Thailand	36.0	25.4	29.0	9.6	0.0	0.0	0.0	0.6	2.8	0.0	8.2	73
LATIN AMERICA/CARIBBEAN												
Bolivia	40.5	15.7	32.2	10.8	0.7	0.0	0.1	0.9	3.6	3.7	3.4	206
Brazil	42.0	18.6	24.1	12.3	1.5	0.0	1.5	1.4	2.2	1.9	2.7	117
Colombia	46.7	16.2	26.2	10.9	0.0	0.0	0.0	0.9	0.0	0.0	0.0	51
Dominican Republic	40.4	16.2	30.8	10.6	2.0	0.0	0.0	1.7	0.5	1.8	1.9	174
Ecuador	33.9	20.2	27.5	15.6	0.9	0.0	1.8	2.0	2.7	0.0	6.4	109
Guatemala	48.3	11.9	18.5	18.5	1.3	1.3	0.0	0.7	2.2	0.5	7.6	151
Mexico	NA	NA	NA	NA	NA	NA	2.9	NA	NA	NA	NA	153
Peru	37.8	16.2	33.3	12.6	0.0	0.0	0.0	1.4	3.7	1.3	5.1	111
Trinidad & Tobago	60.0	11.1	15.6	13.3	0.0	0.0	0.0	0.4	2.9	0.0	0.0	45

NA = Not available

[1]Age at death missing, imputed to the neonatal period

[2]Heaping at days:

1: 2 x (deaths at day 1/ deaths at days 0-1)
7: 10 x (deaths at day 7/ deaths at days 4-13)
14: 20 x (deaths at day 14/ deaths at days 8-27)
15: 20 x (deaths at day 15/ deaths at days 8-27)

Heaping at day 1 also may be due in part to the omission of deaths that occur on day 0. Indeed, there is a tendency for the countries with greater heaping on day 1 to also report a relatively low percentage of neonatal deaths during the first two days of life. Senegal and Ecuador illustrate this pattern. Thus, the abnormal pattern of mortality in the first two days of life observed in many DHS countries is probably due in large part to misreporting of *day* at death, but may also result from some omissions of day 0 deaths. Analysts should therefore avoid interpreting mortality age patterns too finely during this period and group day 0 and day 1 deaths together.

The proportion of neonatal deaths reported at 0-1 days is generally greater in countries with lower mortality (e.g., Botswana, 55 percent; Trinidad and Tobago, 60 percent; and Zimbabwe, 55 percent), but this relationship is not strong. In Indonesia, for example, less than a quarter of neonatal deaths occurred during the first two days of life; this is a much smaller proportion than would be expected given the country's relatively low mortality level. This could be partly explained by unusually high mortality later in the neonatal period, due perhaps to neonatal tetanus (see the large percentage of neonatal deaths during the 4- to 14-day period), but it could also be explained by underreporting of early neonatal deaths.

Heaping of deaths at 7 and 14 days occurs when respondents report an age at death in terms of weeks (or fractions of a month), and the interviewer subsequently converts this to days without probing. This pattern is quite common in several countries. In the worst cases (Egypt, Kenya, and Uganda), around half of all 4- to 14-day deaths were reported to occur on day 7. Most other countries also exhibit a significant, but lesser, degree of heaping at day 7. This, of course, warns against using day 7 as a cut-off point for the classification of age at death.

Interestingly, heaping of neonatal deaths occurs at both 14 days and 15 days. In sub-Saharan Africa, heaping at 14 days is the more common pattern, although heaping at day 15 is prevalent in the Francophone nations of Mali, Senegal, and Togo. With the exception of Bolivia and Sri Lanka, which have considerable heaping at day 14, surveys outside sub-Saharan Africa are far more likely to display heaping at day 15. Guatemala and Ecuador are prime examples of the problem. This regional pattern of heaping is probably related to the common French and Spanish usage of *quinzaine* and *quincena*, respectively to mean two weeks. There is no analogue in current English usage. In any case, blind use of day 14 or day 15 as a cut-off for evaluating the age pattern of neonatal mortality may lead to biases.

In summary, DHS birth histories do allow for evaluation of the age pattern of neonatal mortality. However, variations in the reliability of reported age at death make it necessary to carefully review the data before establishing age groupings for analysis.

2.4 FREQUENCY OF TWINS

The incidence of multiple births or twinning is known to vary by race and region of the world (Pison et al., 1989; Bulmer, 1970). It has been established that survival chances are considerably worse for twins than single births, especially during the neonatal period (Rutstein, 1984).

Conventional wisdom suggests that retrospective birth histories typically underestimate twinning. First, twin delivery is associated with higher risks of maternal mortality. Since these women are unrepresented in retrospective surveys, twins will be correspondingly underrepresented in birth history data. This is further compounded by the fact that twins are clustered in families and women, so that one maternal death may exclude from observation more than one pair of twins. Second, twins are more likely to die and to die early. If, as is thought, deaths (and especially neonatal deaths) are more likely to be omitted from birth histories, twinning rates may be further biased downwards. Third, even when one of a pair of twins survives, the survivor may not be recognized or reported in survey data as having resulted from a multiple birth.

Unfortunately, the other widely available source of twinning data in developing countries, i.e., hospital records, is typically biased in the opposite direction. Twin pregnancies tend to be referred to hospitals as high risk, so they are overrepresented in the population of hospital deliveries. Furthermore, stillbirths will normally be included in the calculation of twinning rates obtained from hospital data, making comparisons with DHS survey data (which excludes stillbirths) problematic. Thus, while it seems likely that DHS birth history data omit some twins, it is difficult to determine the extent of omission since there exists little reliable and comparable data in these settings on which to base an external check.

Table 2.10 shows the proportion of all births in the last five years that were the result of a multiple birth (i.e., a twin, triplet, etc.).[13] The trimean for the 27 countries is 2.3 percent, i.e., an approximate twinning rate of 1.1 percent which is quite plausable. Although the figures for individual countries are subject to considerable imprecision (the relative standard error is large), expected regional variation is still observed. First, the expected high rate is noted in the African surveys, especially in West Africa. Four percent or more of births are twins in the surveys of Kenya, Ondo State (Nigeria), and Togo—a region where high twinning frequency has previously been established (Pison et al., 1989). Even in Liberia, Uganda,

[13] This proportion is roughly twice the twinning rate, which is a woman- (or delivery-) based statistic.

and Zimbabwe, more than 3.5 percent of births are twins. Multiplicity of birth is lowest in the Asian, and Latin American and Caribbean countries. Less than 1.5 percent of births are twins in Bolivia, Guatemala, Indonesia, Peru, Thailand, and Trinidad and Tobago.

While part of the observed variation in twinning is probably real, part is due to sampling and measurement errors. The implications for analysis of DHS health and mortality data vary by the frequency of twinning in the country(s) under study, by the level of omission, and by the type of study being undertaken. In an analysis of the levels and trends in under-five mortality or morbidity, for example, the effect of omitting about 20 percent of twins (the figure broadly suggested by Pison et al., 1989 for survey data) will be negligible.

Table 2.10 Percentage of live births resulting from a multiple birth in the five years preceding the survey, Demographic and Health Surveys, 1986-1990

Country	% Twins	Total Births
SUB-SAHARAN AFRICA		
Botswana	2.0	3215
Burundi	1.5	3887
Ghana	4.0	4136
Kenya	2.7	7133
Liberia	3.9	5180
Mali	2.3	3441
Ondo State, Nigeria	4.0	3282
Senegal	2.2	4287
Togo	5.4	3134
Uganda	3.6	5049
Zimbabwe	3.9	3358
NORTH AFRICA		
Egypt	3.1	8731
Morocco	2.4	6102
Sudan	2.9	6644
Tunisia	2.7	4477
ASIA		
Indonesia	1.3	8243
Sri Lanka	1.9	3981
Thailand	1.4	3652
LATIN AMERICA/CARIBBEAN		
Bolivia	1.1	5793
Brazil	1.8	3481
Colombia	2.1	2703
Dominican Republic	2.4	4443
Ecuador	2.2	3051
Guatemala	1.4	4627
Mexico	2.4	5681
Peru	1.4	3131
Trinidad & Tobago	1.0	1946
Trimean	2.3	

2.5 FOSTERING OF CHILDREN

Whether or not a mother lives in the same household as her child obviously affects the quality of a mother's responses to many child health questions, including recent morbidity, current breastfeeding, and the use of preventive and curative health services. This section contains information on the proportion of children under five who were reported *not* to live with their biological mothers, i.e., children who were fostered away.

Table 2.11 shows the level of reported fostering among living children by age group. The overall level of under-five fostering is highest in sub-Saharan Africa and lowest in North Africa. Botswana (16 percent) and Liberia (11 percent) have the greatest proportion of children under five not living with their mothers, while fostering is nearly absent in Egypt and Tunisia.

The proportion fostered increases with the age of the child in all countries of sub-Saharan Africa, especially around the second birthday, which may be related to the end of weaning (see Chapter 6). Outside this region, the same age pattern is evident, but it is pronounced only in the Dominican Republic. In all countries, fostering is negligible through the first year. By age 4, around a quarter of children are not living with their natural mother in Botswana and Liberia, and more than 10 percent of children are fostered out in the Dominican Republic, Senegal, Uganda, and Zimbabwe.

In later chapters, this issue as it pertains to the quality of responses to specific questions will be addressed. It should be mentioned here, that in undertaking analyses of DHS child health data, especially those from sub-Saharan Africa, analysts may want to consider how to treat responses from the biological mother when she does not live with the reference child, i.e., how to treat proxy reports.[14]

2.6 DENSITY OF BIRTHS IN THE RECENT FIVE-YEAR PERIOD

A number of recent studies have explored the relationship between the characteristics of the mother on the one hand and child morbidity, use of health services, nutritional status of children, and childhood mortality on the other. Using DHS data, the sample commonly chosen for this type of study is based on births within a recent calendar period–often the last five years–since these births will be linked to many health-related variables. The number of births per woman in that recent "window" is related to the prevailing fertility level and pattern. A point of method raised in the literature these days

[14] It has been shown that mothers often respond "don't know" when they really don't know about the current status of their children, but analysts cannot always depend on this level of candor.

involves concern over whether or not clustering of events and behaviors in households and women will introduce serious and undesirable statistical properties to the study of covariates of health outcomes (see Curtis et al., 1992). Household- and mother-level data on siblings are autocorrelated (not independent observations) and Hobcraft et al. (1984) have pointed out that, without sophisticated statistical adjustment, the standard errors on estimates of relative risk will be understated.

This section does not explore the statistical implications of intrafamilial clustering of events. This will vary by country, the nature and distributions of the covariates used, and the type of analysis that is being undertaken. Rather, we simply describe the scope for potential problems through a comparative presentation of distributions of births by the frequency of other siblings born during the most recent 5-year period, termed for convenience the *density* of births.

Table 2.11 Percentage of children born in the five years preceding the survey who were reported not to live with the natural mother (i.e., 2 were fostered), by age group of child, Demographic and Health Surveys, 1986-1990

	Age Group of Child (months)						
Country	0-5	6-11	12-23	24-35	36-47	48-59	0-59
SUB-SAHARAN AFRICA							
Botswana	0.0	1.7	12.7	21.1	20.9	25.3	15.5
Burundi	0.0	0.1	0.1	0.6	1.1	2.9	0.9
Ghana	0.0	0.0	0.8	4.2	7.9	9.5	4.3
Kenya	0.0	0.3	1.2	3.0	3.5	4.8	2.5
Liberia	0.8	2.5	7.6	13.9	17.7	22.1	11.4
Mali	0.0	0.2	1.1	3.6	5.3	8.0	3.3
Ondo State, Nigeria	0.0	1.5	1.6	4.3	7.2	6.6	4.1
Senegal	0.0	0.0	1.6	6.6	10.1	12.1	5.8
Togo	0.0	0.0	0.6	2.2	5.8	8.5	3.3
Uganda	0.0	1.1	3.6	8.5	13.3	16.4	7.9
Zimbabwe	0.0	0.4	3.5	5.6	11.9	12.5	6.8
NORTH AFRICA							
Egypt	0.0	0.2	0.0	0.2	0.4	0.4	0.2
Morocco	0.0	0.6	0.5	0.8	1.4	1.6	0.9
Sudan	0.0	0.2	0.4	0.5	1.2	1.5	0.7
Tunisia	0.0	0.5	0.2	0.2	0.3	0.3	0.2
ASIA							
Indonesia	0.1	0.3	0.6	1.2	2.1	1.8	1.2
Sri Lanka	0.0	0.3	0.7	1.4	2.2	1.5	1.2
Thailand	1.3	2.5	3.6	2.9	1.8	3.5	2.8
LATIN AMERICA/CARIBBEAN							
Bolivia	0.2	0.0	0.4	1.0	1.4	1.8	0.9
Brazil	1.3	1.1	2.7	2.5	3.7	3.1	2.7
Colombia	0.9	1.7	2.1	3.2	2.3	4.3	2.7
Dominican Rep.	0.2	3.8	4.1	8.9	12.2	11.5	7.6
Ecuador	0.7	0.0	1.2	1.6	2.0	2.5	1.5
Guatemala	0.3	0.5	0.4	1.2	1.0	1.8	1.0
Mexico							
Peru	0.4	0.4	1.0	1.3	1.5	2.5	1.3
Trinidad & Tobago	1.4	1.5	2.4	2.7	4.8	5.3	3.4
Trimean	0.1	0.6	1.3	2.6	3.7	4.7	2.6

Table 2.12 shows the distribution of children born in the five years preceding the survey according to the number of their siblings born during that same five-year period. As expected, the percentage of children without such siblings is higher in countries that have lower fertility. For instance, in Thailand, only 41 percent of births in the five years preceding the survey had another sibling born during the same time period. This makes the statistical problem of clustering much less compelling than in high fertility Uganda, where the corresponding figure is 76 percent.

The distribution of the number of siblings within the five-year period is not as predictable, however. Figure 2.6 shows the density of births in the last five years in Bolivia, Brazil, and Burundi. Although fertility is much higher in Burundi than in Brazil, children are spaced more widely. Thus, many more women in Burundi than in Brazil report two births in the five-year period and roughly the same number report three children, but fewer women in Burundi report four or more children than in Brazil. Bolivia displays an intermediate pattern.

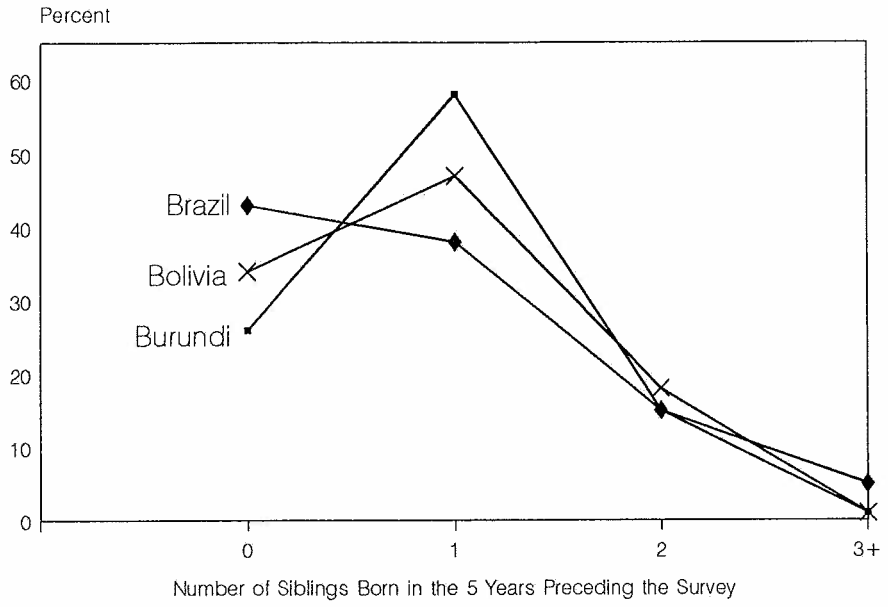
Consequently, there is considerable variation among DHS surveys in the density of births during the five years preceding the survey. Researchers concerned with health and survival data may choose to restrict their analysis to births during a shorter calendar period, such as the three years preceding the survey, in order to reduce the percentage of children with the same mother in the study population. Alternatively, given access to more sophisticated statistical procedures, the intrafamilial correlation (i.e., between siblings) can be accounted for explicitly in the estimation procedure. Even when using births over a ten-year period (which involves more clustering than over a five-year period), Curtis et al. (1992) show that the intrafamilial correlation, although statistically significant, is small and does not figure importantly in the interpretation of covariate effects.

Table 2.12 Percent distribution of births in the five years preceding the survey by number of sibling births in the same period (as reported in the health section), Demographic and Health Surveys, 1986-1990

Country	Number of Births	Number of Siblings			
		0	1	2	3+
SUB-SAHARAN AFRICA					
Botswana	3215	48.7	44.6	6.0	0.5
Burundi	3887	26.4	57.5	14.8	1.2
Ghana	4136	35.7	51.9	10.1	2.1
Kenya	7127	27.0	49.9	20.5	2.4
Liberia[1]	3164	100.0	0.0	0.0	0.0
Mali	3441	29.2	51.8	16.7	2.1
Ondo State, Nigeria	3282	34.9	54.3	9.8	0.8
Senegal	4287	29.0	56.6	13.1	1.1
Togo	3134	35.3	53.1	10.4	1.0
Uganda	5049	24.2	50.9	21.9	2.8
Zimbabwe	3358	38.3	49.5	11.2	0.8
NORTH AFRICA					
Egypt	8727	30.4	46.0	20.8	2.6
Morocco	6102	30.5	48.4	18.5	2.4
Sudan	6644	28.0	52.0	17.5	2.3
Tunisia	4477	28.0	48.2	20.3	3.4
ASIA					
Indonesia	8243	48.5	41.1	9.0	1.2
Sri Lanka	3981	46.1	44.0	9.4	0.3
Thailand	3652	59.3	34.8	4.6	1.0
LATIN AMERICA/CARIBBEAN					
Bolivia	5780	34.3	46.6	17.8	1.2
Brazil	3481	42.8	37.7	14.7	4.7
Colombia	2703	43.2	41.1	12.8	2.8
Dominican Republic	4442	35.9	42.2	17.3	4.4
Ecuador	3051	39.1	41.4	17.1	2.3
Guatemala	4627	27.9	49.6	21.0	1.3
Mexico	5611	40.1	40.6	17.4	1.7
Peru	3131	36.5	42.6	18.4	2.4
Trinidad & Tobago	1946	43.8	38.3	15.7	2.1
Trimean		35.6	47.1	15.4	1.8

Note: Figures are for births reported in the health section of the individual questionnaire.
[1] Only data on last births were collected.

Figure 2.6 Percent distribution of births in the 5 years preceding the survey by the number of siblings born during the same time period, selected DHS surveys, 1986-1989



Another potential problem in analyzing data from children of the same mother is that the quality of data from older siblings may suffer disproportionately from respondent *fatigue*, because data on older siblings are collected after data on younger sib-lings. (This issue should not be confused with the problem of diminished recall with the increasing age of the child or time since birth.)

Table 2.13 gives the percent distribution of live births in the five years preceding the survey by age[15] and index number. The index number reflects the order in which interviewers collected health data from each mother. Thus, the index equals 1 for the first live birth for which health data were collected, i.e., for the most recent birth; for the next-to-last birth, the index equals 2, etc.

Children born within a year of the survey are nearly always the first child for which health data are collected; the exception being those having a very short succeeding birth interval or the second of a twin pair recorded in the health section. At the other end of the age range, the majority of three- and four-year-olds are preceded in the health section by at least one sibling. A markedly larger percentage of 4-year-olds are of index 1 in lower fertility countries than in higher fertility countries. For instance, 59 percent of 4-year-olds in Thailand are index 1 births compared to 15 percent in Uganda, whereas 6 percent are index 3+ births in Thailand versus 32 percent in

[15] For deceased children, this means the difference between the date of birth and the survey date.

variable is thought (or known) to deteriorate with increasing order of data collection (i.e., index number), unless accounted for explicitly, that variable will introduce a spurious age effect.

Table 2.13 also provides an opportunity to evaluate the bias present in surveys or analyses that focuses exclusively on last births (index 1 births) and on the last two births (births with index 1 or 2). Specifically, it is useful to know what fraction of births by age-group would be missed by selecting births based on rank in the birth history rather than on calendar period of birth. Based on DHS data, samples of only index 1 births omit 1 percent of the children under age 1, 9 percent of one-year-olds, 37 percent of two-year-olds, 59 percent of three-year-olds, and 70 percent of four-year-olds born in the five years preceding the survey. Samples of both index 1 and 2 births are more complete, missing 0, 0, 2, 9, and 21 percent, respectively, of the same age groups. If the children excluded by such sampling do not differ appreciably from the children included regarding the parameters being estimated, the bias is negligible. However, in the previous section it has been shown that time since birth (or age) and the density (or spacing) of births are closely related. Closely spaced births will be underrepresented in samples of last births from recent calendar periods. The less recent the calendar period (i.e., the older the children), the more underrepresented these closely spaced births will be. Similar conclusions were drawn from an analysis of WFS birth histories (Page et al., 1982).

Table 2.13 Percent distribution of live births in the 5-year period preceding the survey by index number in birth history and current age, Demographic and Health Surveys, 1986-1990

Country	Age = < 1 year			Age = 1 year			Age = 2 years			Age = 3 years			Age = 4 years		
	i=1	i=2	i=3+	i=1	i=2	i=3+	i=1	i=2	i=3+	i=1	i=2	i=3+	i=1	i=2	i=3+
SUB-SAHARAN AFRICA															
Botswana	98.2	1.8	0.0	95.8	4.2	0.0	72.7	26.7	0.6	50.7	46.0	3.3	41.9	49.9	8.3
Burundi	99.2	0.8	0.0	93.8	6.2	0.0	62.9	36.5	0.6	26.6	67.1	6.3	13.4	64.1	22.5
Kenya	97.7	2.3	0.0	94.5	5.5	0.0	69.6	28.7	1.7	35.6	57.5	6.9	26.2	59.5	14.4
Ghana	98.7	1.2	0.1	88.9	10.6	0.5	56.7	41.0	2.3	29.1	61.2	9.7	20.5	50.2	29.3
Liberia	97.5	2.4	0.0	86.2	13.3	0.5	53.8	41.7	4.4	32.8	55.1	12.1	20.1	52.6	27.3
Mali	98.6	1.4	0.0	88.3	11.8	0.0	55.5	42.1	2.4	32.1	58.7	9.1	19.5	56.3	24.2
Ondo State, Nigeria	97.7	2.3	0.0	95.6	4.3	0.2	67.2	31.9	0.9	38.5	57.5	4.1	31.6	55.5	13.0
Senegal	99.0	0.9	0.0	94.6	4.8	0.6	64.9	34.3	0.7	31.1	63.6	5.3	18.3	62.9	18.9
Togo	96.9	2.9	0.2	94.4	5.4	0.2	72.0	26.2	1.7	36.9	58.8	4.3	23.2	62.2	14.7
Uganda	97.5	2.4	0.0	90.2	9.4	0.4	49.2	47.2	3.7	25.3	63.2	11.5	14.8	52.9	32.3
Zimbabwe	98.0	1.9	0.0	95.8	4.2	0.0	73.8	25.1	1.1	41.1	53.5	5.3	30.3	56.1	13.6
NORTH AFRICA															
Egypt	98.2	1.7	0.0	86.9	12.7	0.4	59.3	38.7	2.0	36.6	52.0	11.4	27.0	46.2	26.8
Morocco	98.8	1.1	0.1	87.9	11.6	0.5	58.0	39.9	2.2	38.7	51.8	9.5	24.7	50.4	24.9
Sudan	98.6	1.4	0.0	91.3	8.6	0.1	60.9	36.9	2.3	30.8	61.6	7.6	21.9	52.6	25.5
Tunisia	98.5	1.5	0.0	84.4	15.3	0.4	56.7	40.0	3.3	37.3	51.6	11.2	25.1	48.4	26.5
ASIA															
Indonesia	99.2	0.8	0.0	93.9	6.0	0.1	72.2	26.3	1.5	60.0	36.7	3.3	44.5	43.4	12.1
Sri Lanka	98.9	1.0	0.0	90.6	8.9	0.5	69.0	30.2	0.8	55.4	40.2	4.4	45.0	44.3	10.7
Thailand	99.0	1.0	0.0	94.8	5.0	0.1	80.3	19.1	0.6	61.6	35.0	3.4	58.8	35.1	6.1
LATIN AMERICA/CARIBBEAN															
Bolivia	99.7	0.2	0.0	89.5	10.5	0.0	56.0	42.2	1.7	41.1	50.2	8.7	29.0	47.2	23.8
Brazil	98.4	1.5	0.0	84.4	15.2	0.4	66.3	30.7	3.0	52.8	36.5	10.8	42.8	36.6	20.6
Colombia	98.8	1.2	0.0	88.2	11.5	0.3	64.5	34.0	1.5	51.2	40.3	8.5	43.0	39.6	17.4
Dominican Republic	97.8	2.1	0.0	80.9	17.9	1.2	60.7	34.4	4.9	46.6	40.4	13.0	32.3	46.2	21.6
Ecuador	99.2	0.8	0.0	86.6	13.1	0.3	62.1	36.7	1.2	42.9	47.3	9.8	35.2	42.0	22.7
Guatemala	99.1	0.8	0.0	91.8	8.1	0.1	54.9	43.6	1.5	32.3	58.1	9.6	20.8	51.8	27.4
Mexico	98.2	1.7	0.0	88.1	11.8	0.2	61.3	36.4	2.4	43.6	45.7	10.7	37.1	40.2	22.8
Peru	98.8	1.2	0.0	90.9	8.6	0.5	62.7	35.9	1.4	43.6	46.9	9.5	34.6	42.4	23.0
Trinidad & Tobago	99.4	0.6	0.0	88.7	11.1	0.3	65.1	33.2	1.8	51.9	40.3	7.8	42.7	36.4	21.0
Trimean	98.6	1.4	0.0	90.7	9.0	0.3	62.8	35.5	1.8	40.3	50.8	8.6	30.1	49.2	20.9

2.7 CONCLUSIONS

Information on all births during the five years preceding the survey is collected in the health section of the DHS questionnaire. In this chapter, the quality of various demographic data on these births was evaluated for the purpose of (1) improving DHS data collection methods and (2) providing researchers with guidelines for understanding the nature of and variations in the data quality and data structure in DHS surveys. The main findings are:

- Rates of response to the various sections of the questionnaire (household, women, and child health) are generally satisfactory. On average, health information was collected for an estimated 93 percent of births in DHS target populations.

- The completeness and accuracy of data on birth dates and age of children vary widely and some surveys will present problems for analysis. In addition, several surveys exhibit considerable displacement of births out of the age range for collection of health information. (Apparently, birth dates were intentionally transferred from five to six years before the survey.)

- Data on the month of birth are subject to reporting errors and interviewers' guesswork and manipulation. There is considerable displacement of births into the year before the interview and within the year before the survey. An excess of births was found in the months prior to the calendar month of the interview relative to the months following the month of the interview. The level and pattern of these distortions appear to vary from survey to survey and thus must be examined on a country-by-country basis in analyses of child health indicators that use children's ages.

- Estimated rates of twinning vary considerably among surveys, but follow broadly expected patterns of variation.

- Child fostering varies widely, with several sub-Saharan surveys showing a substantial percentage of children under five living away from their mother. Fostering increases sharply with age, especially around the second birthday in sub-Saharan Africa.

- There is little evidence of gross underreporting of deaths, but significant departures from expected age at death distributions were shown. In particular, substantial heaping at age 12 months will hinder efforts to ascertain age patterns of mortality and mortality determinants within the 12- to 23-month age range. Researchers are advised to avoid using 12 months as a cutoff point for the analysis of mortality determinants. Within the neonatal period, age (*in days*) at death data are fairly reliable, but they should be carefully examined on a country-by-country basis for distortions in age patterns caused by age misreporting and possible omissions.

- By analyzing the relationship between age and index number in the birth history (that is, last birth, second-to-last birth, etc.), it was shown that samples of last births may seriously underrepresent older children, especially children born to women with short birth intervals. This analysis indicates that only 30 percent of 4-year-olds and 40 percent of 3-year-olds are captured in a last birth sample. The results tend to validate the current DHS approach to collecting health data, which uses all births in a calendar period.

References

Arnold, F. 1990. Assessment of the Quality of Birth History Data in the Demographic and Health Surveys. In *An Assessment of DHS-I Data Quality*. DHS Methodological Reports, No. 1. Columbia, Maryland: Institute for Resource Development/Macro Systems Inc.

Becker, S. 1984. A Response Bias in the Reporting of Month of Birth in Pregnancy History Surveys. IPD Working Paper 1984-85, Brussels, Belgium: Vrije Universiteit Brussel, Interuniversity Programme in Demography.

Bicego, G.T. and J.T. Boerma. 1993. Maternal education and child survival: A comparative study of data from 17 surveys. *Social Science and Medicine* 36(9):1207-1227.

Boerma, J.T. and G. Stroh. 1993. Using survey data to assess neonatal tetanus mortality levels and trends in developing countries. *Demography* 30(3):459-475.

Bulmer, M.G. 1970. *The Biology of Twinning in Man*. Oxford, England: Clarendon Press.

Curtis, S.L., I. Diamond, and J.W. McDonald. 1992. Birth Intervals and Healthy Families in Brazil. In *Proceedings of the Demographic and Health Surveys World Conference*. Vol. 2. pp. 1207-1227. Washington, D.C., August, 1991. Columbia, Maryland: Institute for Resource Development, Macro International Inc.

Grummer-Strawn, L. and T.J. Trussell. 1990. Computing the Mean Duration of Breastfeeding from Current-Status Data. Princeton, New Jersey: Office of Population Research, Princeton University.

Hobcraft, J., J. McDonald, and S. Rutstein. 1984. Socioeconomic factors in infant and child mortality, a cross-national comparison. *Population Studies* 38(2):193-223.

Institute for Resource Development (IRD) Inc. 1987. *Sampling Manual*. Basic Documentation, No. 8. Columbia, Maryland: IRD.

Institute for Resource Development (IRD) Inc. 1989. *Demographic and Health Surveys Data Processing Manual*. Columbia, Maryland: IRD.

Page, H.G., R.J. Lesthaeghe, and I.H. Shah. 1982. Illustrative Analysis: Breastfeeding in Pakistan. *WFS Scientific Reports*, No. 37. Voorburg, Netherlands: International Statistical Institute.

Pison G., E. van de Walle, and M. Sala-Diakanda. 1989. Les Jumeaux: Frequence, Statut Social et Mortalite. In *Mortalite et Societe en Afrique au Sud du Sahara*. Paris: Presses Universitaires de France.

Rutstein, S. 1984. Infant and Child Mortality: Levels, Trends and Demographic Differentials. *WFS Scientific Reports*, No. 43. Voorburg, Netherlands: International Statistical Institute.

Rutstein, S.O. and G.T. Bicego. 1990. Assessment of the Quality of Data Used to Ascertain Eligibility and Age in the Demographic and Health Surveys. In *An Assessment of DHS-I Data Quality*. DHS Methodological Reports, No. 1. Columbia, Maryland: Institute for Resource Development/Macro Systems Inc.

Stanfield, J.P. and A. Galazka. 1984. Neonatal tetanus in the world today. *Bulletin of the World Health Organization* 62(4): 647-669.

Sullivan, J., G.T. Bicego, and S.O. Rutstein. 1990. Assessment of the Quality of Data Used for the Direct Estimation of Infant and Child Mortality in the Demographic and Health Surveys. In *An Assessment of DHS-I Data Quality*. DHS Methodological Reports, No. 1. Columbia, Maryland: Institute for Resource Development/Macro Systems Inc.

Trussell, T.J., L. Grummer-Strawn, G. Rodriguez, and M. Van Landingham. 1992. Trends and differentials in breastfeeding behavior: Evidence from the WFS and DHS. *Population Studies* 46:285-308.

CHAPTER 3

Assessment of the Quality of Data on Maternity Care in the Demographic and Health Surveys, 1986-1989

M. KATHRYN STEWART
J. TIES BOERMA
JEROEN VAN GINNEKEN

Acknowledgments

The authors express their appreciation to David Cantor for programming assistance, and to Kenneth Hill, Robert Black, Stan Becker, Elisabeth Sommerfelt, and Shea Rutstein for their valuable suggestions and insights.

In this report, the quality of data on maternity care services received by women interviewed in the first phase of the Demographic and Health Surveys program (DHS-I) is examined. The quality of these data has relevance in a number of settings. This information is useful to policy makers, program managers, and donors in evaluating the levels and distribution of service coverage in specific countries of interest. Such data are also needed in investigations seeking to identify determinants of use of maternity services.

Data from 27 national surveys in four main regions, sub-Saharan Africa (12), North Africa (3), Asia (3), and Latin America/Caribbean (9) are reviewed. Routine quality checks have been applied to the data from each country to identify surveys with inadequate data quality and to detect questions that may have caused problems in a number of surveys.

In DHS-I, pregnant women were asked about tetanus toxoid (TT) immunization and antenatal care (ANC) received during the current pregnancy. In addition, all women were asked about maternity care received during pregnancies completed in the five years prior to the survey. Specifically, they were asked 1) if they had received TT during pregnancy, 2) who, if anyone, was seen for ANC, and 3) who, if anyone, provided delivery care (DC). Fourteen surveys also included a country-specific question about the place of delivery.

The elements of questionnaire design, including the number, order, content, and quality of questions asked, have a significant impact on data quality. When a broad range of issues are addressed in a survey, as in the DHS, many of the details of interest in specific areas cannot feasibly be explored. These limitations should be well understood and considered by those exploiting the data for various purposes. The questions about maternity care in DHS-I have a number of fundamental limitations worth noting.

Though women were asked about TT received during pregnancy, they were not asked the number of doses received. The WHO recommendation for maternal TT immunization includes an initial two doses, at least a month apart, during or before the first pregnancy. Five doses are regarded as providing life-long protection. Although the DHS-I question allows a general assessment of TT coverage by the healthcare system, it does not facilitate examination of individual coverage, since women are not asked the number of doses received, and because there is no history of immunizations received prior to the five years before the survey or of doses received outside of pregnancy.

In asking about antenatal and delivery care, the core DHS question focuses only on the "most qualified" provider who was seen for care. Responses to these questions may be misleading, particularly for who provided delivery care, since a woman may delay seeking a trained provider until after developing extremely severe complications which other providers have been unable to manage. In such cases, the woman's condition may be beyond treatment when she reaches the "qualified provider." Both this lack of information on the process preceding care and on the actual content of care received circumscribe the role of these data in studying the specific impact of maternity care, per se.

Utilization of health care is determined by a variety of both user- and service-related factors. Service availability data were collected at the cluster level in more than one third of the countries surveyed in DHS-I. That is, the same data on services available are applied to all women in the cluster, such that individual variation between women is not represented. This report does not include an assessment of these data. However, the lack of individual-level information on available services limits the utility of DHS data in examining respondent's service-related differences in utilization of care.

This report focuses on the distribution of missing values (MVs), "don't know" (DK), and "other" responses for the maternity care data described above. Internal consistency of responses is also analyzed. The DHS data are compared to external sources of data on maternity care coverage wherever such data are available.

Methods of assessing the quality of this type of data retrospectively are relatively limited. In contrast to studies of fertility and mortality, "expected" biological and demographic patterns do not exist. Rather, in this case, true frequencies of care received are largely dependent on socioeconomic, behavioral, and cultural differences occurring within the context of services available. None of these factors are universally valid, and even within specific settings there may be little knowledge of exactly how these factors interact to influence health care use. These constraints persist even in surveys where the current analysis fails to identify specific problems of data quality, and this should be recognized at the outset.

In this report, results on data quality for care received during the current pregnancy are presented first, followed by the findings relating to care for births in the five years prior to survey, and then by presentation of results on internal and external consistency checks. Conclusions are summarized in the last section.

Though a standard format was followed for data collection in most surveys, there are several exceptions. Table 3.1 presents a summary of the information collected in each survey, by country, and indicates cases where questions or coding of responses departed from the standard format.

Table 3.1 Summary of information on tetanus toxoid (TT) immunization and antenatal care (ANC) received during current pregnancy, and for TT, ANC, and delivery care (DC) received for live births in the five years prior to survey, Demographic and Health Surveys, 1986-1990

Country	Date of Fieldwork	Current Pregnancy			All Live Births in Past Five Years			
		Duration in Months	TT	ANC Provider[1]	TT	ANC Provider[1]	DC Provider[2]	Place of Delivery
SUB-SAHARAN AFRICA								
Botswana	Aug-Dec 1988	yes	yes	yes[3]	yes	yes[3]	yes	last birth
Burundi	Apr-Jun 1987	yes	yes	yes[3]	yes	yes[3]	yes	no
Ghana	Feb-May 1988	yes	yes	yes	yes	yes	yes	no
Kenya	Dec-May 1988/89	yes	yes	yes	yes	yes	yes	yes
Liberia	Feb-Jul 1986	yes	yes	no	last birth	last birth	last birth	last birth
Mali	Mar-Aug 1987	yes	yes	yes	yes	yes[4]	yes[5]	no
Ondo State, Nigeria	Sep-Jan 1986/87	yes	yes	yes	yes	yes[4]	yes[5]	no
Senegal	Apr-Jul 1986	yes	yes	yes	yes	yes[4]	yes[5]	no
Sudan	Nov-May 1989/90	yes	yes	yes	yes	yes[6]	yes[5]	no
Togo	Jun-Nov 1988	yes	yes	yes	yes	yes[6]	yes[5]	no
Uganda	Sep-Feb 1988/89	yes	yes	yes	yes	yes	yes	no
Zimbabwe	Sep-Jan 1988/89	yes	yes	yes	yes	yes	yes	yes
NORTH AFRICA								
Egypt	Oct-Jan 1988/89	yes	yes	yes[4]	yes	yes	yes[7]	yes
Morocco	May-Jul 1987	yes	no	yes[4]	no	yes	yes[7]	yes
Tunisia	Jun-Oct 1988	yes	no	yes[4]	yes	yes	yes[7]	yes
ASIA								
Indonesia	Sep-Dec 1987	yes	no	no	no	no[8]	yes	yes
Sri Lanka	Jan-Mar 1987	yes	yes	yes	yes	yes[8]	yes	yes
Thailand	Mar-Jun 1987	yes	yes	yes	yes	yes	yes	yes
LATIN AMERICA/CARIBBEAN								
Bolivia	Mar-Jun 1989	yes	yes	yes[9]	yes	yes[10]	yes[11]	yes[11]
Brazil	May-Aug 1986	yes	yes	yes[9]	yes	yes[10]	yes[11]	yes[11]
Colombia	Oct-Dec 1986	yes	yes	yes	yes	yes	yes	no
Domican Rep.	Sep-Dec 1986	yes	yes	yes	yes	yes	yes	no
Ecuador	Jan-Mar 1987	yes	yes	yes	yes	yes	yes	last birth
Guatemala	Oct-Dec 1987	yes	yes	yes	yes	yes	yes	no
Mexico	Feb-May 1987	yes	no	no	no	yes	yes	no
Peru	Sep-Dec 1986	yes	no	yes	yes	yes	yes	no
Trinidad & Tobago	May-Aug 1987	yes	yes	yes	yes	yes	yes	yes

[1]The coding for ANC provider included: doctor, nurse, midwife, traditional birth attendant (TBA), and other, unless otherwise specified.
[2]The coding for DC provider included: doctor, nurse, midwife, TBA, relative, and other, unless otherwise specified.
[3]Women were asked the place where ANC was received, instead of the provider.
[4]Women were asked who provided ANC during the first visit. Response categories included both persons and places.
[5]Response categories omitted "relative" category, and included both persons and places.
[6]Response categories included both persons and places.
[7]Response categories omitted "relative" category.
[8]Two separate questions were asked to determine whether a midwife or a doctor provided ANC.
[9]Women were asked where ANC was received, but response categories included both persons and places.
[10]Women were asked where ANC was received for last birth and births prior to last birth in separate questions.
[11]Women were asked where DC was received for last birth and births prior to last birth in separate questions.

3.1 DATA ON CURRENT PREGNANCY

In DHS-I, women were asked if they were currently pregnant, and if so, for how many months. In assessing the data, an attempt has been made to determine whether all current pregnancies were actually reported, and whether reporting of the duration for current pregnancies was reasonably accurate. The expected number of pregnancies at the time of the survey can be estimated from the number of births in the two years prior to the survey if it is assumed that all pregnancies result in live births (i.e., there is no fetal wastage) and that there is no significant change in fertility. By selecting the number of live births occurring during the twenty-four months prior to the survey, the expected number of pregnancies is less affected by heaping in reporting in the twelfth month (Goldman and Westoff, 1980).

One might expect underreporting of first trimester pregnancies due to lack of awareness or unwillingness to report early pregnancies. Such underreporting of current pregnancies can, to some extent, be examined by studying the distribution of women reporting current pregnancy by month of pregnancy. By assuming no seasonality of births, the number of women expected to be in the first, second, and third trimesters of pregnancy can be estimated by taking one-eighth of the births occurring in the 24 months prior to the survey. Table 3.2 presents, for each of the DHS-I surveys, the ratio of the number of reported pregnancies overall and in each trimester to the expected number of pregnancies.

The average ratio for reported to expected pregnancies was 0.74. The range of ratios for each trimester was 0.30-0.69 (first), 0.69-1.09 (second), 0.67-1.02 (third), and 0.59-0.89 (overall). The countries having ratios under 0.80 throughout pregnancy were Botswana, Ecuador, Indonesia, Kenya, Morocco, Sri Lanka, and Tunisia. The fact that ratios were consistently lower in the first trimester confirms the expected underreporting in early pregnancy. This finding is consistent with conclusions reached by Airey and Campbell (1988) in a critical assessment of the health data from six African DHS surveys.

Sixty-seven percent of the surveys had higher ratios in the second trimester than in the first or third. There are several explanations for this finding. Examination of monthly frequencies (not shown) reveals lower numbers of pregnancies in the ninth month than in the seventh and eighth, presumably because most women deliver within the ninth month. In addition, inaccurate recall of the last menstrual period by the respondent may have resulted in underestimation of pregnancy duration. Seasonal variations in births, combined with the timing of the survey, might have been significant in extreme cases such as Liberia, Ondo State (Nigeria), and Senegal, though it seems unlikely that seasonal effects would be large enough to adequately explain these cases.

Table 3.2 Reporting of duration of current pregnancy: Ratio of reported/expected pregnancies by trimester, Demographic and Health Surveys, 1986-1990

	Ratio of Reported/Expected Pregnancies				
	Trimester			Total Pregnancy	Number Currently Pregnant
	1st	2nd	3rd		
SUB-SAHARAN AFRICA					
Botswana	0.30	0.69	0.79	0.59	309
Burundi	0.44	0.99	0.77	0.73	433
Ghana	0.48	0.77	0.86	0.70	446
Kenya	0.36	0.74	0.68	0.59	638
Liberia	0.60	1.08	0.96	0.88	705
Mali	0.47	0.86	0.88	0.74	417
Ondo State,Nigeria	0.55	1.08	0.81	0.82	406
Senegal	0.62	1.09	0.72	0.81	530
Sudan	0.61	1.02	1.02	0.89	871
Togo	0.61	0.85	0.80	0.75	363
Uganda	0.61	0.88	0.76	0.75	613
Zimbabwe	0.61	0.92	0.82	0.78	375
NORTH AFRICA					
Egypt	0.48	0.87	0.87	0.78	992
Morocco	0.64	0.76	0.78	0.76	690
Tunisia	0.50	0.78	0.77	0.66	430
ASIA					
Indonesia	0.54	0.76	0.76	0.67	752
Sri Lanka	0.49	0.75	0.75	0.65	378
Thailand	0.53	0.91	0.91	0.70	384
LATIN AMERICA/CARIBBEAN					
Bolivia	0.48	0.82	0.80	0.70	630
Brazil	0.69	0.90	0.80	0.80	388
Colombia	0.60	0.87	0.81	0.76	305
Dominican Rep.	0.64	0.96	0.82	0.80	550
Ecuador	0.50	0.78	0.67	0.65	316
Guatemala	0.37	1.00	0.86	0.75	523
Mexico	0.44	0.95	0.86	0.75	629
Peru	0.59	0.89	0.75	0.74	323
Trinidad & Tobago	0.46	0.95	0.68	0.70	194

Note: The number of expected pregnancies per trimester was estimated to be one-eighth of the births occurring in the 24 months prior to the survey.

The percent distribution of missing values for TT injections and ANC received in current pregnancies by reported duration of pregnancy is presented in Table 3.3. If the data on duration of pregnancy and TT are correct, and assuming that TT immunization may occur at any time during pregnancy, the proportion of pregnant women immunized with TT should increase with pregnancy duration. Indeed, the trend is towards an increasing percentage of women reporting having received TT in the later stage of pregnancy (> 7 months) than in the first five months of gestation.

Table 3.3 Percent distribution of responses for tetanus toxoid (TT) injections and antenatal care (ANC) received in current pregnancy by month of pregnancy, Demographic and Health Surveys, 1986-1990

	Tetanus Toxoid		Antenatal Care				
	Did Receive	Missing	No One	Other Re-sponses	Don't Know	Missing	Number of Pregnant Women
SUB-SAHARAN AFRICA							
Botswana							
Preg < 5 months	13.0	0.6	86.0	1.6	0.0	0.6	92
Preg 5-7 months	45.3	0.0	47.2	0.5	0.0	1.1	128
Preg > 7 months	74.8	1.3	37.8	0.0	0.0	0.7	90
Burundi							
Preg < 5 months	1.0	0.0	96.4	0.0	0.0	0.0	146
Preg 5-7 months	37.4	1.1	58.3	0.0	0.0	0.0	204
Preg > 7 months	72.3	0.0	19.4	0.0	0.0	0.0	83
Ghana							
Preg < 5 months	6.3	1.3	70.0	0.0	0.0	0.0	160
Preg 5-7 months	45.2	0.6	32.2	2.3	0.0	0.6	177
Preg > 7 months	65.1	0.0	14.7	0.0	0.0	0.0	109
Kenya							
Preg < 5 months	12.1	0.5	89.5	1.8	0.0	0.8	210
Preg 5-7 months	50.1	1.1	50.0	0.0	0.0	1.1	284
Preg > 7 months	89.1	0.4	28.0	0.4	0.0	0.4	144
Liberia							
Preg < 5 months	26.8	0.0	-	-	-	-	267
Preg 5-7 months	56.8	0.0	-	-	-	-	280
Preg > 7 months	69.4	0.5	-	-	-	-	162
Mali							
Preg < 5 months	7.7	0.4	91.0	0.0	1.0	0.0	139
Preg 5-7 months	19.9	1.3	79.9	0.0	1.8	0.0	176
Preg > 7 months	22.3	0.8	76.9	0.0	3.2	0.0	102
Ondo State							
Preg < 5 months	4.1	0.0	86.3	0.7	0.0	0.0	146
Preg 5-7 months	49.0	0.0	38.3	0.5	0.0	0.0	196
Preg > 7 months	65.7	0.0	17.9	4.5	0.0	0.0	67
Senegal							
Preg < 5 months	4.8	0.0	78.5	0.5	0.0	0.0	209
Preg 5-7 months	24.8	0.0	45.0	0.4	0.0	0.0	238
Preg > 7 months	40.0	0.0	35.3	0.0	0.0	1.2	85
Togo							
Preg < 5 months	5.8	0.0	91.3	1.4	0.0	0.0	138
Preg 5-7 months	39.0	0.7	43.4	7.4	0.0	0.0	136
Preg > 7 months	56.2	1.1	25.8	9.0	0.0	0.0	89
Uganda							
Preg < 5 months	4.6	0.0	87.1	0.0	0.0	0.0	258
Preg 5-7 months	25.0	0.0	51.6	1.0	0.0	0.0	231
Preg > 7 months	53.9	0.0	10.3	0.0	0.0	0.0	124
Zimbabwe							
Preg < 5 months	6.9	0.0	77.8	2.8	0.0	0.0	144
Preg 5-7 months	38.6	0.0	37.3	0.0	0.0	0.0	158
Preg > 7 months	77.5	0.0	11.2	0.0	0.0	0.0	80
NORTH AFRICA							
Egypt							
Preg < 5 months	16.4	0.4	57.6	0.0	0.0	0.0	330
Preg 5-7 months	43.0	0.6	51.3	0.0	0.0	0.0	398
Preg > 7 months	45.3	0.0	45.0	0.0	0.0	0.0	265

Table 3.3–continued

	Tetanus Toxoid		Antenatal Care				
	Did Receive	Missing	No One	Other Re-sponses	Don't Know	Missing	Number of Pregnant Women
Morocco							
Preg < 5 months	-	-	89.6	0.0	0.0	0.0	278
Preg 5-7 months	-	-	81.9	0.0	0.0	0.0	237
Preg > 7 months	-	-	71.4	0.6	0.0	0.0	175
Sudan							
Preg < 5 months	16.1	0.3	62.6	0.0	0.0	0.3	310
Preg 5-7 months	40.5	0.9	40.2	0.0	0.0	0.3	336
Preg > 7 months	56.9	0.4	24.4	0.0	0.0	0.4	225
Tunisia							
Preg < 5 months	-	-	0.0	0.6	0.0	0.0	170
Preg 5-7 months	-	-	0.0	0.0	0.0	0.0	156
Preg > 7 months	-	-	0.0	0.0	0.0	0.0	104
ASIA							
Sri Lanka							
Preg < 5 months	6.6	0.3	75.8	0.0	0.0	0.3	137
Preg 5-7 months	65.8	0.0	11.0	0.0	0.0	0.0	160
Preg > 7 months	79.9	1.2	0.0	0.0	0.0	1.4	83
Thailand							
Preg < 5 months	21.3	0.6	56.2	0.0	0.0	0.0	145
Preg 5-7 months	54.4	0.9	26.3	0.2	0.0	2.1	157
Preg > 7 months	71.4	0.0	17.6	0.0	0.0	0.0	82
LATIN AMERICA/CARIBBEAN							
Bolivia							
Preg < 5 months	14.8	0.0	65.7	0.0	0.0	0.0	219
Preg 5-7 months	21.2	0.0	65.2	0.7	0.0	0.0	278
Preg > 7 months	27.1	0.0	54.2	0.0	0.0	0.0	133
Brazil							
Preg < 5 months	5.9	0.0	52.2	0.6	0.0	0.0	155
Preg 5-7 months	21.2	0.0	29.0	2.1	0.0	0.0	148
Preg > 7 months	31.8	0.0	28.9	0.0	0.0	0.0	86
Colombia							
Preg < 5 months	5.9	1.3	50.2	0.0	0.0	0.7	127
Preg 5-7 months	24.5	0.0	23.6	0.0	0.0	0.0	112
Preg > 7 months	35.2	0.0	13.7	0.0	0.0	0.0	66
Dominican Republic							
Preg < 5 months	8.4	0.0	53.1	0.6	0.0	0.0	204
Preg 5-7 months	38.3	0.0	10.9	0.0	0.0	0.0	233
Preg > 7 months	70.8	0.0	2.7	1.8	0.0	0.0	113
Ecuador							
Preg < 5 months	7.6	0.0	38.7	0.8	0.0	0.0	119
Preg 5-7 months	23.2	0.0	39.1	0.7	0.0	0.0	138
Preg > 7 months	33.8	0.0	30.8	1.5	0.0	0.0	65
Guatemala							
Preg < 5 months	0.6	0.0	61.8	0.0	0.0	0.0	165
Preg 5-7 months	14.5	0.0	41.7	0.8	0.0	0.0	242
Preg > 7 months	26.1	0.0	21.8	0.0	0.0	0.0	119
Peru							
Preg < 5 months	-	-	53.7	4.1	0.0	0.8	123
Preg 5-7 months	-	-	46.2	1.5	0.0	0.0	130
Preg > 7 months	-	-	35.7	4.3	0.0	0.0	70
Trinidad & Tobago							
Preg < 5 months	6.6	0.0	30.3	0.0	0.0	2.6	76
Preg 5-7 months	15.3	0.0	5.9	0.0	0.0	1.2	85
Preg > 7 months	14.3	0.0	0.0	0.0	0.0	0.0	35

A high frequency of missing data may indicate poor interviewing, recording, or data entry techniques, raising questions about data quality. All surveys had less than two percent missing values for TT during current pregnancy; in 45 percent of the surveys the data for this question were complete.

If the data on ANC coverage are correct, the proportion of pregnant women reporting having seen "no one" for a check on their pregnancy should decrease with pregnancy duration. Indeed, there is a trend of decreasing "no one" responses for women reporting on ANC in early pregnancy (< 5 months) compared to mid (5-7 months) or late pregnancy (> 7 months).

A high frequency of "other" responses (i.e., **not** a doctor, nurse, midwife, nor traditional birth attendant) for the question of who provided ANC in the current pregnancy may indicate a failure to capture all of the common responses given. Both "other" and "don't know" responses could indicate recall problems. (However, it seems unlikely that women would experience difficulty recalling the relatively recent care received during their current pregnancy.) In all countries other than Togo (9.0%), less than five percent of the women reported "other" for the question of who provided ANC. A "don't know" response for ANC was found only in Mali. No surveys had more than three percent missing values for this question, and 58 percent of the surveys had no missing data.

3.2 COMPARISON OF DATA ON CURRENT PREGNANCY AND PREVIOUS BIRTHS

Questions were asked about who provided ANC and whether or not TT was received during pregnancy for births occurring during the five years prior to survey. Gross underreporting of these events in previous pregnancies might be detected by comparing these data with service use reported by women currently in the last trimester of pregnancy. In the latter sample, service use is approaching what it will be at the time of pregnancy termination, and recall is less problematic than for events occurring further in the past. Increasing trends in use, which might be expected where services have been newly introduced, may be detected by examining trends in percentages receiving TT one, two, three, four, and five years prior to the survey.

Tables 3.4 and 3.5 present the data for TT and ANC, respectively. In most cases, the coverage is the same or higher for previous births than for current pregnancies. The exceptions for TT are Egypt, Guatemala, and Senegal where the percentages of women reporting TT in current pregnancy are at least four points higher than reported for previous births, specifically 29, 4, and 9 percent, respectively. In Egypt, a TT campaign, sponsored by the Ministry of Health, took place during the EDHS fieldwork (Sayed et al., 1989), which explains the sudden increase in coverage in current pregnancies there. Increases in TT coverage may have occurred over time in Guatemala; no increasing trend is noted for the four years preceding the one year prior to survey in Senegal.

The exceptions in comparisons of ANC are Colombia, Guatemala, Sudan, and Tunisia, where coverage is higher for current pregnancies, with differences of 11, 8, 4, and 5 percent, respectively. Here again, there does not appear to be a trend of increasing use over the five years prior to survey.

Table 3.4 Percent of women currently more than seven months pregnant who have received tetanus toxoid (TT), and percent of births where women were immunized during pregnancy 0-11, 12-23, 24-35, 36-47, and 48-59 months prior to survey, Demographic and Health Surveys, 1986-1989

Country	Percent Receiving TT in Current Pregnancy (>7 mos)	Percent Receiving TT during Pregnancy for Births Five Years Prior to Survey (in months)				
		0-11	12-23	24-35	36-47	48-59
SUB-SAHARAN AFRICA						
Botswana	75	86	85	84	84	82
Burundi	72	68	66	59	51	51
Ghana	65	73	70	70	69	66
Kenya	89	89	90	89	89	87
Liberia	69	71	72	68	69	79
Mali	22	18	20	17	19	18
Ondo State, Nigeria	66	70	71	72	72	72
Senegal	40	31	33	32	28	31
Togo	56	72	74	69	69	67
Uganda	54	68	64	51	49	44
Zimbabwe	78	80	82	80	77	76
NORTH AFRICA						
Egypt	45	16	14	10	9	9
Sudan	57	58	56	46	36	30
ASIA						
Sri Lanka	80	82	86	86	87	90
Thailand	71	70	69	67	64	58
LATIN AMERICA/CARIBBEAN						
Bolivia	27	31	21	18	16	14
Brazil	32	38	40	44	38	42
Colombia	35	48	46	36	37	27
Domican Rep.	71	85	88	87	86	90
Ecuador	34	39	43	40	36	34
Guatemala	26	22	14	14	10	9
Trinidad & Tobago	14	28	31	31	31	33

3.3 DATA ON PREGNANCIES COMPLETED IN THE FIVE YEARS PRIOR TO SURVEY

The data on service coverage for pregnancies ending in live births in the five years prior to the survey include information on who provided DC, who provided ANC, and whether a TT injection was received during pregnancy. The quality of these data may also be examined by studying the distribution of missing values, "don't know," and "other" responses. Since

questions were asked about all live births in the previous five years, the sample includes information about children dying since birth, as well as those surviving at the time of the survey. Information about dead children might be less complete for a number of reasons.

Both the respondent and the interviewer may feel uncomfortable discussing events related to a child that has died. In some cultures, this may be a taboo subject, the discussion of which could be perceived as causing further adverse consequences, such as the evil eye affecting surviving children. In addition, a woman may have greater difficulty remembering the details of events surrounding a pregnancy and birth where the child is no longer living, particularly if the death occurred soon after birth. It is also conceivable that the interviewer may not understand the significance of information about deceased children, and not expend enough effort in obtaining responses about these births.

Table 3.5 Percent of women currently more than seven months pregnant who have received antenatal care (ANC), and percent of births where women received ANC during pregnancy 0-11, 12-23, 24-35, 36-47, and 48-59 months prior to survey, Demographic and Health Surveys, 1986-1990

Country	Percent Receiving ANC in current Pregnancy (>7 months)	Percent Receiving ANC during Pregnancy for Births Five Years prior to Survey (in months)				
		0-11	12-23	24-35	36-47	48-59
SUB-SAHARAN AFRICA						
Botswana	62	92	91	94	93	91
Burundi	81	82	82	82	77	76
Ghana	81	84	83	82	82	80
Kenya	70	76	79	77	79	76
Mali	14	30	34	31	33	28
Ondo State, Nigeria	73	79	78	80	82	82
Senegal	48	64	64	64	58	62
Togo	65	80	83	81	80	79
Uganda	89	88	89	86	86	85
Zimbabwe	87	90	93	91	91	91
NORTH AFRICA						
Egypt	55	57	58	54	50	47
Morocco	28	28	25	27	23	21
Sudan	75	71	73	71	70	68
Tunisia	66	61	61	57	56	53
ASIA						
Sri Lanka	99	98	97	97	95	97
Thailand	81	81	80	80	71	74
LATIN AMERICA/CARIBBEAN						
Bolivia	46	48	46	45	44	41
Colombia	86	75	77	71	72	68
Domican Rep.	96	96	95	93	95	95
Ecuador	65	71	73	68	65	67
Guatemala	44	36	34	36	33	32
Peru	57	56	56	56	52	55
Trinidad & Tobago	97	99	99	97	97	96

Table 3.6 presents the percent distribution of "don't know", "other," and missing responses for TT, ANC, and DC for both dead and surviving children. In most cases, the percentages of these responses are much higher for children that have died.

For TT, the Trinidad and Tobago survey had the highest frequency of "don't know" responses (7.0 percent). The highest frequency of missing values for TT are for dead children in surveys in Ecuador (10.9%), Mali (9.7%), Sri Lanka (11.6%), Thailand (12.1%), Trinidad and Tobago (13.6%), Togo (10%), and Zimbabwe (17.0%). "Don't know" and missing responses occur most frequently for dead children, indicating that interviewers are more likely to overlook or be reluctant in asking for information about events relating to births in these cases. The extraordinarily strong relation between "don't know" responses for TT, ANC, and DC, which are frequently identical, points to a reluctance on the part of the interviewer to ask about dead children. It is very unlikely that true "not knowing" would vary so little across topics.

For ANC provider, there are very few "other" responses, the highest frequency being 3.7 percent for Ondo State, Nigeria. The highest frequency of missing responses for ANC are, again, for dead children in surveys in Ecuador (10.9%), Mali (9.7%), Sri Lanka (11.6%), Thailand (12.1%), Trinidad and Tobago (13.6%), Togo (10%), and Zimbabwe (17.0%). This distribution of missing values seen for ANC, both by dead vs. surviving children and by survey, is very similar to that for TT.

For DC provider, five surveys, Mali, Morocco, Senegal, Togo, and Tunisia have very high frequencies of an "other" response. This finding is most likely due to the omission of the provider category for "relative" in these surveys. The distribution of missing values is again highest for dead children in Ecuador (10.9%), Mali (10.6%), Sri Lanka (11.6%), Thailand (12.1%), Togo (10%), Trinidad and Tobago (13.6%), and Zimbabwe (17.0%).

In assessing the quality of these data, the influence of two factors should be examined, namely, the time since the event took place and the number of events occurring during the recall period. Comparison of frequencies from two time periods, 0-23 and 24-59 months prior to survey, may detect differences in recall affected by time lapse. Table 3.7 presents the frequency of "don't know" and missing responses for these two time periods for TT. If events occurring further in the past are more difficult to recall, there might be a higher frequency of "don't know" responses for the 24- to 59-month period. Although greater differences might be identified by examining a more recent comparison period than the entire 0-23 months, diminishing sample sizes make this less feasible.

For TT, the frequency of "don't know" responses remained low for all surveys. There was not much of a difference in the per-

Table 3.6 Percent distribution of missing or don't know (DK) responses for tetanus toxoid injections, antenatal and delivery care received during pregnancy for births in the past five years, for dead, living, and all children, Demographic and Health Surveys, 1986-1990

	Tetanus Toxoid		Antenatal Care		Delivery Care		Number of Births
	Percent DK	Percent Missing	Percent Other	Percent Missing	Percent Other	Percent Missing	
SUB-SAHARAN AFRICA							
Botswana:Dead	1.0	5.8	0.4	5.8	0.0	5.8	146
Botswana:Living	0.5	0.3	0.7	0.2	2.3	0.3	3069
Botswana:Total	0.5	0.6	0.7	0.5	2.2	0.5	3215
Burundi:Dead	0.6	6.2	0.0	6.0	0.3	6.3	385
Burundi:Living	0.7	0.2	0.0	0.3	0.6	0.3	3502
Burundi:Total	0.7	0.8	0.0	0.8	0.5	0.8	3887
Ghana:Dead	0.2	6.3	0.9	6.1	1.6	6.1	446
Ghana:Living	0.1	0.7	0.5	0.7	1.5	0.7	3690
Ghana:Total	0.1	1.3	0.5	1.3	1.5	1.2	4136
Kenya:Dead	0.1	7.0	0.2	6.9	2.0	7.0	538
Kenya:Living	0.2	0.3	0.5	0.4	1.7	0.3	6589
Kenya:Total	0.2	0.8	0.5	0.8	1.8	0.8	7127
Liberia:Dead	0.1	1.8	0.8	1.4	1.8	1.4	335
Liberia:Living	0.0	0.2	0.1	0.2	0.8	0.2	2829
Liberia:Total	0.1	0.4	0.2	0.3	0.9	0.3	3164
Mali:Dead	1.2	9.7	0.0	9.7	24.5	10.6	537
Mali:Living	0.6	1.8	0.5	1.7	20.8	2.3	2905
Mali:Total	0.7	3.0	0.4	3.0	21.4	3.6	3442
Ondo State, Nigeria:Dead	0.0	0.4	2.7	0.0	3.4	0.0	264
Ondo State, Nigeria:Living	0.2	0.0	3.7	0.3	6.3	0.0	3018
Ondo State, Nigeria:Total	0.2	0.1	3.6	0.2	6.1	0.0	3282
Senegal:Dead	3.3	1.9	0.9	1.6	33.0	1.6	579
Senegal:Living	1.0	0.2	0.5	0.3	25.3	0.2	3708
Senegal:Total	1.3	0.5	0.5	0.4	26.3	0.4	4287
Togo:Dead	0.0	10.0	0.9	10.0	23.6	10.0	331
Togo:Living	0.1	0.6	1.0	0.6	20.9	0.6	2803
Togo:Total	0.1	1.6	1.0	1.6	21.2	1.6	3134
Uganda:Dead	0.0	2.2	0.1	2.2	1.6	2.3	676
Uganda:Living	0.1	0.0	0.5	0.0	1.8	0.1	4373
Uganda:Total	0.1	0.3	0.5	0.3	1.8	0.4	5049
Zimbabwe:Dead	1.0	17.0	0.0	17.0	2.1	17.0	194
Zimbabwe:Living	1.5	0.2	0.7	0.2	0.9	0.2	3164
Zimbabwe:Total	1.5	1.2	0.6	1.2	0.9	1.2	3358
NORTH AFRICA							
Egypt:Dead	1.4	2.2	0.2	2.4	0.7	2.1	720
Egypt:Living	1.2	0.3	0.1	0.5	0.7	0.2	8007
Egypt:Total	1.2	0.5	0.2	0.7	0.7	0.4	8727
Morocco:Dead	-	-	0.0	0.4	18.4	6.4	500
Morocco:Living	-	-	0.0	0.1	15.1	0.4	5602
Morocco:Total	-	-	0.0	0.1	15.4	0.9	6102
Sudan:Dead	0.5	2.7	0.0	2.7	1.2	2.9	582
Sudan:Living	0.2	0.1	0.0	0.1	0.9	0.3	6062
Sudan:Total	0.2	0.4	0.0	0.4	0.9	0.5	6644
Tunisia:Dead	0.4	1.8	0.0	1.8	13.7	1.8	227
Tunisia:Living	0.7	0.0	0.0	0.0	12.9	0.0	4250
Tunisia:Total	0.7	0.1	0.0	0.1	12.9	0.1	4477

Table 3.6–Continued

	Tetanus Toxoid		Antenatal Care		Delivery Care		Number of Births
	Percent DK	Percent Missing	Percent Other	Percent Missing	Percent Other	Percent Missing	
ASIA							
Indonesia:Dead	-	-	-	-	0.1	7.4	650
Indonesia:Living	-	-	-	-	0.2	0.1	7593
Indonesia:Total	-	-	-	-	0.3	0.6	8243
Sri Lanka:Dead	0.0	11.6	0.0	11.6	0.0	11.6	104
Sri Lanka:Living	0.6	0.3	0.0	0.3	1.5	0.3	3877
Sri Lanka:Total	0.6	0.6	0.0	0.6	1.5	0.6	3981
Thailand:Dead	0.7	12.1	0.0	12.1	0.0	12.1	132
Thailand:Living	1.5	0.3	0.1	0.3	0.6	0.3	3520
Thailand:Total	1.4	0.7	0.1	0.7	0.6	0.7	3652
LATIN AMERICA/CARIBBEAN							
Bolivia:Dead	0.9	3.8	0.4	2.4	1.5	2.4	571
Bolivia:Living	1.0	0.2	0.5	0.2	1.2	0.2	5209
Bolivia:Total	1.0	0.5	0.5	0.4	1.2	0.4	5780
Brazil:Dead	3.7	0.3	1.7	0.0	2.3	0.3	257
Brazil:Living	2.2	0.0	0.6	0.0	2.2	0.0	3224
Brazil:Total	2.3	0.1	0.7	0.0	2.2	0.1	3481
Colombia:Dead	0.0	5.7	0.0	5.7	1.0	5.7	87
Colombia:Living	1.0	0.3	0.3	0.3	1.2	0.3	2616
Colombia:Total	0.9	0.5	0.3	0.5	1.2	0.5	2703
Dominican Republic:Dead	1.8	0.0	0.9	0.0	1.1	0.0	337
Dominican Republic:Living	0.8	0.0	0.1	0.0	0.7	0.0	4105
Dominican Republic:Total	0.9	0.0	0.1	0.0	0.8	0.0	4442
Ecuador:Dead	4.5	10.9	0.5	10.9	4.0	10.9	202
Ecuador:Living	1.2	0.4	0.7	0.4	3.2	0.4	2849
Ecuador:Total	1.4	1.1	0.7	1.1	3.2	1.1	3051
Guatemala:Dead	1.0	1.3	0.8	0.0	1.8	0.0	397
Guatemala:Living	1.6	0.0	0.4	0.0	1.0	0.0	4230
Guatemala:Total	1.5	0.1	0.5	0.0	1.1	0.0	4627
Mexico:Dead	-	-	0.0	4.3	0.0	3.5	295
Mexico:Living	-	-	0.3	0.1	0.6	0.1	5316
Mexico:Total	-	-	0.3	0.3	0.5	0.3	5611
Peru:Dead	0.7	9.8	1.4	9.8	1.4	9.8	295
Peru:Living	0.9	0.0	1.2	0.0	3.3	0.0	2836
Peru:Total	0.9	0.9	1.2	1.0	3.1	0.9	3131
Trinidad & Tobago:Dead	6.8	13.6	0.0	13.6	0.0	13.6	59
Trinidad & Tobago:Living	7.0	0.5	0.0	0.6	0.3	0.6	1887
Trinidad & Tobago:Total	7.0	0.9	0.0	1.0	0.3	1.0	1946

Table 3.7 Percent distribution of missing or don't know (DK) responses for tetanus toxoid injections received during pregnancy for births 0-23 and 24-59 months before interview for dead, living, and all children, Demographic and Health Surveys, 1986-1990

	0-23 Months Before Interview			24-59 Months Before Interview		
	Percent DK	Percent Missing	Number of Births	Percent DK	Percent Missing	Number of Births
SUB-SAHARAN AFRICA						
Botswana:Dead	0.0	4.2	63	1.7	6.9	84
Botswana:Living	0.3	0.0	1327	0.7	0.6	1742
Botswana:Total	0.3	0.2	1389	0.7	0.9	1826
Burundi:Dead	0.0	5.0	97	0.8	7.1	288
Burundi:Living	0.7	0.0	1477	0.7	0.4	2025
Burundi:Total	0.7	0.3	1574	0.7	1.2	2313
Ghana:Dead	0.0	2.4	126	0.3	7.8	320
Ghana:Living	0.2	0.1	1563	0.1	1.1	2127
Ghana:Total	0.2	0.2	1689	0.1	2.0	2447
Kenya:Dead	0.0	4.2	175	0.2	8.4	363
Kenya:Living	0.1	0.0	2700	0.2	0.6	3889
Kenya:Total	0.1	0.3	2875	0.2	1.2	4252
Liberia:Dead	0.2	2.0	208	0.0	1.6	127
Liberia:Living	0.0	0.1	1931	0.2	0.5	898
Liberia:Total	0.0	0.3	2139	0.1	0.7	1025
Mali:Dead	0.9	5.6	176	1.3	11.7	361
Mali:Living	0.8	0.0	1331	0.4	3.3	1574
Mali:Total	0.8	0.7	1507	0.6	4.9	1935
Ondo State, Nigeria:Dead	0.0	0.0	80	0.0	0.5	184
Ondo State, Nigeria:Living	0.2	0.0	1251	0.2	0.1	1767
Ondo State, Nigeria:Total	0.2	0.0	1331	0.2	0.1	1951
Senegal:Dead	1.9	0.6	157	3.8	2.4	422
Senegal:Living	0.8	0.0	1596	1.2	0.5	2112
Senegal:Total	0.9	0.1	1753	1.6	0.8	2534
Togo:Dead	0.0	2.9	104	0.0	13.2	227
Togo:Living	0.1	0.2	1187	0.1	1.0	1616
Togo:Total	0.1	0.4	1291	0.1	2.5	1843
Uganda:Dead	0.0	0.8	211	0.0	2.8	465
Uganda:Living	0.0	0.0	1962	0.1	0.0	2411
Uganda:Total	0.0	0.1	2173	0.1	0.5	2876
Zimbabwe:Dead	1.7	18.3	60	0.7	16.4	134
Zimbabwe:Living	1.1	0.0	1222	1.7	0.4	1942
Zimbabwe:Total	1.2	0.9	1282	1.6	1.4	2076
NORTH AFRICA						
Egypt:Dead	0.6	0.9	190	1.7	2.2	530
Egypt:Living	1.1	0.2	3214	1.3	0.4	4793
Egypt:Total	1.1	0.2	3404	1.3	0.6	5323
Sudan:Dead	0.7	1.3	153	0.5	3.5	429
Sudan:Living	0.1	0.0	2471	0.3	0.2	3591
Sudan:Total	0.1	0.1	2624	0.3	0.5	4020
Tunisia:Dead	0.0	0.0	73	0.6	2.6	154
Tunisia:Living	0.7	0.0	1670	0.7	0.0	2580
Tunisia:Total	0.7	0.0	1743	0.7	0.1	2734

Table 3.7–Continued

	0-23 Months Before Interview			24-59 Months Before Interview		
	Percent DK	Percent Missing	Number of Births	Percent DK	Percent Missing	Number of Births
ASIA						
Sri Lanka:Dead	0.0	7.8	33	0.0	13.3	72
Sri Lanka:Living	0.4	0.0	1527	0.7	0.5	2350
Sri Lanka:Total	0.4	0.2	1559	0.7	0.9	2422
Thailand:Dead	0.0	7.4	45	1.1	14.5	88
Thailand:Living	1.7	0.2	1407	1.3	0.4	2113
Thailand:Total	1.6	0.4	1452	1.3	0.9	2201
LATIN AMERICA/CARIBBEAN						
Bolivia:Dead	1.2	4.6	194	0.7	4.1	378
Bolivia:Living	0.7	0.1	2209	1.2	0.3	3000
Bolivia:Total	0.7	0.5	2402	1.1	0.7	3378
Brazil:Dead	2.8	0.0	90	4.2	0.5	167
Brazil:Living	1.5	0.0	1203	2.6	0.0	2021
Brazil:Total	1.6	0.0	1293	2.8	0.1	2188
Colombia:Dead	0.0	9.9	27	0.0	3.8	60
Colombia:Living	0.4	0.2	1046	1.4	0.4	1569
Colombia:Total	0.4	0.4	1073	1.3	0.6	1630
DR:Dead	4.4	0.0	110	0.5	0.0	227
DR:Living	0.7	0.0	1717	0.9	0.0	2389
DR:Total	1.0	0.0	1826	0.9	0.0	2616
Ecuador:Dead	0.0	5.5	73	7.0	14.0	129
Ecuador:Living	1.1	0.0	1221	1.4	0.7	1628
Ecuador:Total	1.0	0.3	1294	1.8	1.7	1757
Guatemala:Dead	0.0	0.0	124	1.5	1.8	273
Guatemala:Living	1.5	0.0	1748	1.6	0.0	2482
Guatemala:Total	1.4	0.0	1872	1.6	0.2	2755
Peru:Dead	1.4	8.5	71	0.4	10.3	224
Peru:Living	0.5	0.0	1092	1.1	0.0	1744
Peru:Total	0.6	0.5	1163	1.0	1.2	1968
Trinidad & Tobago:Dead	0.0	6.7	15	9.1	15.9	44
Trinidad & Tobago:Living	6.0	0.0	731	7.6	0.9	1156
Trinidad & Tobago:Total	5.9	0.1	746	7.7	1.4	1200

centage of "don't know" answers for recent births compared to births that took place two to five years prior to the survey. The only exception is Trinidad & Tobago where, in particular for dead children, the percentage of "don't know" answers is high for births that occurred two to five years prior to the survey. For TT, ANC, and DC, percentages with missing information were, in general, higher for births that took place a long time ago than for more recent births. This finding can be examined further by considering the number of events (i.e., births) occurring during the recall period.

Since interviewers ask about the last pregnancy first, and then the next-to-last, and then the 2nd to last, etc., it is conceivable that the accuracy of collected information could deteriorate with increasing numbers of births. Interviewers may become fatigued in the process, losing interest and motivation if, perhaps, they consider events further in the past as less important. A higher frequency of missing values among earlier births might suggest this type of problem. This is assessed by comparing responses about service use during pregnancy for different order births. However, births of higher order will also be, on average, earlier and therefore might have occurred when service coverage was lower. Consequently, a control for the interval since birth must be introduced when comparing these responses. This was done by examining the data for births occurring more than 23 months prior to the survey, which appears to be the most appropriate cut-off after examination of trends.

The responses about DC received for births occurring 24-59 months before the survey, for dead and surviving children, by relative birth order can be compared in Table 3.8. Tabulations

Table 3.8 Percent distribution of missing responses for who provided delivery care for births prior to the last two years, for dead, living, and all children, (24-59 months), by relative birth order, Demographic and Health Surveys, 1986-1990

	Last Birth		Next-to-last Birth		2nd to 5th from Last	
	Percent Missing	Number	Percent Missing	Number	Births Missing	Number
SUB-SAHARAN AFRICA						
Botswana:Dead	8.3	35	3.5	42	21.7	7
Botswana:Living	0.4	970	0.2	705	4.3	67
Botswana:Total	0.7	1005	0.4	747	5.9	74
Burundi:Dead	2.9	48	5.4	183	14.1	57
Burundi:Living	0.1	780	0.1	1087	3.2	158
Burundi:Total	0.3	828	0.9	1270	6.1	215
Ghana:Dead	6.7	89	4.8	168	15.9	63
Ghana:Living	0.3	1004	1.3	1002	5.8	121
Ghana:Total	0.8	1093	1.8	1170	9.2	184
Kenya:Dead	7.3	68	3.6	200	19.1	95
Kenya:Living	0.1	1468	0.5	1943	2.0	477
Kenya:Total	0.4	1536	0.8	2143	4.8	573
Mali:Dead	3.6	85	14.7	214	16.6	62
Mali:Living	0.6	606	2.7	799	21.0	169
Mali:Total	0.9	691	5.3	1014	19.8	230
Ondo State, Nigeria:Dead	0.0	53	0.0	108	0.0	23
Ondo State, Nigeria:Living	0.0	813	0.0	856	1.0	98
Ondo State, Nigeria:Total	0.0	866	0.0	964	0.8	121
Senegal:Dead	0.0	96	0.8	261	9.2	65
Senegal:Living	0.0	867	0.5	1103	2.1	142
Senegal:Total	0.0	963	0.6	1364	4.3	207
Togo:Dead	7.7	52	12.7	134	22.0	41
Togo:Living	0.3	770	1.3	763	3.6	83
Togo:Total	0.7	822	3.0	897	9.7	124
Uganda:Dead	0.6	97	2.5	256	6.1	113
Uganda:Living	0.1	777	0.2	1309	0.2	325
Uganda:Total	0.1	873	0.6	1565	1.7	438
Zimbabwe:Dead	23.1	39	17.4	69	3.8	26
Zimbabwe:Living	0.2	972	0.2	856	2.6	114
Zimbabwe:Total	1.1	1011	1.5	925	2.9	140
NORTH AFRICA						
Egypt:Dead	1.8	120	1.3	260	3.7	150
Egypt:Living	0.1	2057	0.3	2170	0.6	566
Egypt:Total	0.2	2177	0.4	2430	1.2	716
Morocco:Dead	11.2	80	6.0	168	10.5	86
Morocco:Living	0.1	1399	0.7	1574	3.0	362
Morocco:Total	0.7	1479	1.2	1742	4.5	448
Sudan:Dead	4.6	109	3.5	231	2.2	89
Sudan:Living	0.1	1415	0.4	1799	0.5	377
Sudan:Total	0.4	1524	0.7	2030	0.9	466
Tunisia:Dead	0.0	28	0.0	78	8.3	48
Tunisia:Living	0.0	1054	0.0	1197	0.0	329
Tunisia:Total	0.0	1082	0.0	1275	1.1	377

Table 3.8–Continued

	Last Birth		Next-to-last Birth		2nd to 5th from Last	
	Percent Missing	Number	Percent Missing	Number	Births Missing	Number
ASIA						
Indonesia:Dead	6.5	181	9.2	239	13.7	65
Indonesia:Living	0.0	2900	0.1	1631	1.1	232
Indonesia:Total	0.4	3081	1.3	1870	3.9	297
Sri Lanka:Dead	8.0	33	0.0	1	-	0
Sri Lanka:Living	0.0	1334	0.0	78	0.0	4
Sri Lanka:Total	0.2	1367	0.0	79	0.0	4
Thailand:Dead	0.0	33	21.1	40	28.5	15
Thailand:Living	0.2	1436	0.5	617	3.0	61
Thailand:Total	0.2	1468	1.8	657	8.1	76
LATIN AMERICA/CARIBBEAN						
Bolivia:Dead	0.0	89	0.7	189	11.0	99
Bolivia:Living	0.3	1333	0.1	1387	0.9	281
Bolivia:Total	0.2	1422	0.2	1576	3.6	380
Brazil:Dead	0.0	53	0.0	72	2.1	42
Brazil:Living	0.0	1121	0.1	688	0.0	212
Brazil:Total[1]	0.0	1174	0.1	760	0.3	254
Colombia:Dead	0.0	23	0.0	29	29.8	8
Colombia:Living	0.0	835	0.4	590	2.5	144
Colombia:Total	0.0	858	0.4	619	3.8	152
Dominican:Dead	0.0	75	0.0	93	0.0	60
Dominican:Living	0.0	1135	0.0	965	0.0	288
Dominican:Total	0.0	1210	0.0	1058	0.0	348
Ecuador:Dead	13.2	38	9.5	63	25.0	28
Ecuador:Living	0.1	775	0.6	674	3.9	179
Ecuador:Total	0.7	813	1.4	737	6.8	207
Guatemala:Dead	0.0	56	0.0	146	0.0	71
Guatemala:Living	0.0	936	0.0	1262	0.0	284
Guatemala:Total	0.0	992	0.0	1408	0.0	355
Mexico:Dead	1.3	49	3.0	95	3.8	47
Mexico:Living	0.0	1572	0.0	1276	0.5	329
Mexico:Total	0.0	1622	0.2	1371	0.9	375
Peru:Dead	4.7	64	10.7	103	15.8	57
Peru:Living	0.0	853	0.0	719	0.0	172
Peru:Total	0.3	917	1.3	822	3.9	229
Trinidad & Tobago:Dead	18.2	11	19.0	21	8.3	12
Trinidad & Tobago:Living	0.5	627	0.5	419	4.5	110
Trinidad & Tobago:Total	0.8	638	1.4	440	4.9	122

[1] The question asked in the Brazil DHS was where delivery occurred rather than who was in attendance.

for ANC and TT gave similar results to those for DC. A higher frequency of missing values was seen for TT, ANC, and DC received for earlier births than later births in nearly all of the 23 countries where these questions were asked. This interviewer fatigue was most prominent for surveys in Bolivia, Burundi, Ecuador, Ghana, Kenya, Mali, Peru, Senegal, Thailand, Togo, Tunisia, and Zimbabwe.

3.4 INTERNAL CONSISTENCY OF RESPONSES

Tetanus toxoid immunization is a fundamental component of appropriate antenatal care. Although questions on the content of ANC were not included in the DHS survey, information on TT received during pregnancy gives some indication of the quality of ANC. Women receiving ANC without obtaining TT might represent "missed opportunities" for vaccination during pregnancy.

On the other hand, women reporting that they did not have a check up (ANC) but did receive TT during pregnancy may suggest problems of data quality. Though it is most likely that women would be immunized during ANC visits, some women could have received TT in vaccination campaigns without obtaining other ANC. Other potential explanations include misreporting or recording errors made by interviewers, and confusion by mothers about other injections received during pregnancy.

Table 3.9 Tetanus toxoid (TT) coverage and antenatal care (ANC): The number of births in the last five years where the mothers received a vaccination and the percentage of those births where the mothers did or did not receive ANC, Demographic and Health Surveys, 1986-1990

	Among Births with TT:		
Country	Percentage with ANC	Percentage without ANC	Number of Births with TT
SUB-SAHARAN AFRICA			
Botswana	98	2	2700
Burundi	99	1	2266
Ghana	97	3	2862
Kenya	83	17	6275
Liberia	96	4	2187
Mali	63	37	610
Ondo State	98	2	2340
Senegal	53	47	1318
Sudan	85	15	2991
Togo	78	22	2169
Uganda	90	10	2802
Zimbabwe	100	0	2634
NORTH AFRICA			
Egypt	93	7	949
Tunisia	83	17	1464
ASIA			
Sri Lanka	99	1	3410
Thailand	95	5	2360
LATIN AMERICA/CARIBBEAN			
Bolivia	72	28	1153
Brazil	90	10	1420
Colombia	87	13	1042
Dominican Republic	98	2	3829
Ecuador	90	10	1152
Guatemala	70	30	641
Peru	89	11	466
Trinidad & Tobago	98	2	598

Note: Adapted from Boerma, T. et al. 1990. Immunization: Levels, Trends, and Differentials. DHS Comparative Studies, No. 1, Table 5.2, p. 31.

In Table 3.9 (adapted from Boerma et al. 1990) the percentage of cases where TT was reported, both with and without ANC, is summarized. In five countries, more than 20 percent of the respondents reported that they had received TT without ANC. These countries are Bolivia (28%), Guatemala (30%), Mali (37%), Senegal (47%), and Togo (22%).

Table 3.10 shows who provided delivery care according to the place of delivery for thirteen countries where both of these questions were asked. The focus here is on the percentage of women reporting the least likely combination of events for each country: doctors attending deliveries at home, traditional birth attendants or relatives reported as the highest qualified person attending deliveries in a hospital or clinic setting, and deliveries where "no one" was reported as attending delivery for hospital or clinic deliveries. In general, there is good agreement between these two responses. Only Egypt and Ecuador have more than five percent of all home deliveries attended by doctors.

Table 3.10 Percent distribution of delivery attendant and place of delivery, Demographic and Health Surveys, 1986-1990

Country	Doctor at Home	Nurse or Midwife at Home	TBA/Relative in a Hospital or Clinic	No One in a Hospital or Clinic	Total Numbers
Botswana[1]	0.7	6.5	2.6	0.1	3302
Kenya	0.4	2.3	0.7	0.2	7127
Liberia[1]	0.6	13.9	0.6	0.0	3164
Zimbabwe	0.3	3.9	0.5	0.1	3358
Egypt	5.4	6.3	0.1	0.0	8732
Morocco	0.5	2.5	0.3	0.0	6102
Tunisia	0.1	1.2	0.4	0.0	4477
Indonesia	0.2	16.6	0.1	0.0	8243
Sri Lanka	0.1	1.2	1.7	0.1	3981
Thailand	0.5	4.3	0.1	0.0	3652
Bolivia	2.4	2.8	1.0	0.1	5779
Ecuador[1]	5.4	1.2	2.1	0.1	2049
Trinidad & Tobago	0.3	1.3	0.1	0.0	1946

[1] In these three countries, place of delivery was only asked for the last birth.

3.5 DETERMINANTS OF MISSING DATA

A multivariate analysis was carried out on five surveys to quantify the relative importance of factors influencing the occurrence of missing data. Surveys from Ghana, Kenya, Mali, Morocco and Togo were selected because of both the frequency of missing data and considerations of sample size. The relationship between the dichotomous outcome (missing data for DC provider: yes=0, no=1) and six explanatory variables was modeled using logistic regression. Factors examined included residence, maternal education, the interval between the birth and the interview, the period of survey fieldwork, the relative birth order, and the survival status of the birth outcome.

The findings are summarized in Table 3.11, with odds ratios and p-values based on the Wald statistic for each variable, by country. Reference categories were urban residence, mothers with any education, birth within 12 months of the interview, the earliest survey period, the most recent birth, and children surviving at the time of the interview. Relative birth order and survival status were highly significant, with categories for births prior to the last two births and births of children dying prior to the interview being at greatest risk of having missing data in all five surveys. The interval between birth and interview was only significant for the Ghana survey in the group with the longest interval. The first period of fieldwork had higher rates of missing data in all five surveys. There did not appear to be any increase in risk of missing data according to residence or maternal education. These findings are consistent with results presented in the stratified tabulations (Tables 3.6-3.8) and further reinforce the theory of "interviewer fatigue."

Table 3.11 Odds ratios for factors influencing missing data on who provided delivery care in five surveys, Demographic and Health Surveys, 1986-1990

Country	Rural Residence	Mother's Education	Interval between Birth and Interview (months)			Period of Survey		Relative Birth Order		Survival Status of Birth Outcome	-2 Log Likelihood	Improvement Chi-square
		None	12-23	24-35	36-59	Middle	End	Next to Last	Prior to Last Two			
Ghana	1.13	1.33	0.80	1.76	4.94*	0.61	---	1.38	4.21**	6.62***	549.73	107.97***
Kenya	1.25	1.19	1.86	2.84	3.87	0.82	0.87	1.06	4.92***	12.56***	632.55	137.76***
Mali	0.71	1.07	2.35	1.11	2.60	0.26***	0.67	3.93***	14.14***	4.00***	920.59	202.62***
Togo	1.70	1.38	0.27	1.00	3.53	0.92	0.57	1.59	3.28*	14.73***	504.74	139.59***
Morocco	1.06	1.14	0.19	0.74	2.90	0.81	0.52	1.18	2.53*	12.32***	646.04	137.48***

Note: Reference categories were urban residence, mothers with education, birth within 12 months prior to interview, the earliest survey period, the most recent birth, and surviving children.

* $p < 0.05$
** $0.001 < p < 0.01$
*** $p < 0.001$

3.6 COMPARISONS OF DHS DATA WITH EXTERNAL DATA SOURCES

The DHS data on ANC and DC coverage can be compared with data from the World Fertility Surveys (WFS) and other studies with similar information compiled by WHO (1989) in Tables 3.12 and 3.13. For ANC (Table 3.12), there are few studies with which DHS data can appropriately be compared. However, in the cases of the non-WFS studies in Ecuador and Botswana, the overall rates of coverage of ANC by trained providers are quite consistent between surveys. Moreover, in the four WFS - DHS comparisons it can be seen that, as expected, ANC use was always higher in DHS than in WFS.

For DC (Table 3.13), there are more studies for comparison, but in all cases except Ecuador, consistency between surveys is less than for ANC. The greatest difference is between the Thailand DHS (66 percent) and a national study (40 percent). A large portion of this difference may reflect a true change over time, since the national study was conducted seven years earlier than the DHS survey. The same may be the case in Botswana, where higher percentages were obtained in the DHS survey, conducted four years after the comparison studies. In Egypt, on the other hand, the DHS survey was conducted two years later but the DC coverage was lower than the comparison study. This could indicate either underreporting in the Egypt DHS or overreporting in the other study.

Table 3.12 Percent of births where women received antenatal care (ANC) during pregnancy. Data from Demographic and Health Surveys, the World Fertility Surveys (WFS), and other sources. Demographic and Health Surveys, 1986 - 1989.

Country	Type of Study	Source	Year(s)	Births (N)	Percent ANC
Dom. Rep.	WFS	Fernandez, 1984	1979	968	92
	DHS		1982-86	4536	95
Ecuador	WFS	Fernandez, 1984	1978-79	4086	64
	DHS		1983-87	3032	70
Mexico	WFS	Fernandez, 1984	1975-76	5597	66
	DHS		1983-87	5517	71
Peru	WFS	Fernandez, 1984	1976-77	5041	50
	DHS		1982-86	3075	55
Botswana	Urban study	Manyeneng, 1985	1983-84	289	96
	DHS, urban		1984-88	838	97
Botswana	Rural study	Manyeneng, 1985	1983-84	1234	89
	DHS, rural		1984-88	2339	91
Ecuador	National study	CEPAR, 1986	1982	4300	72
	DHS		1983-87	3032	70

Note: WFS data refer to antenatal care received during current pregnancy (of more than six months gestation) or prior to the last delivery. The year(s) indicates the year(s) in which the pregnancy or delivery took place (approximately).

Table 3.13 Percent of births where women received delivery care (DC) by a trained attendant. Data from Demographic and Health Surveys (DHS), the World Fertility Surveys (WFS), and other sources. Demographic and Health Surveys, 1986 - 1989.

Country	Type of Study	Source	Year(s)	Births (N)	Percent (DC)
Dom. Rep.	WFS	Fernandez, 1984	1979	814	81
	DHS		1982-86	4536	90
Ecuador	WFS	Fernandez, 1984	1978-79	4358	53
	DHS		1983-87	3032	61
Mexico	WFS	Fernandez, 1984	1975-76	5971	71
	DHS		1983-87	5517	69
Peru	WFS	Fernandez, 1984	1976-77	5404	48
	DHS		1982-86	3075	49
Botswana	Urban study	Manyeneng, 1985	1983-84	289	89
	DHS, urban		1984-88	838	94
Botswana	Rural study	Manyeneng, 1985	1983-84	1234	61
	DHS, rural		1984-88	2339	72
Egypt	National study	WHO/EPI, 1987	1986	12000	47
	DHS		1984-88	8624	35
Thailand	National study	WHO, 1981	1980	13659	40
	DHS		1983-87	3649	66
Ecuador	National study	CEPAR, 1986	1982	4300	62
	DHS		1983-87	3032	61

Note: WFS data refer to delivery care received during the last delivery. The year(s) indicate the approximate year(s) in which the delivery took place.

3.7 SUMMARY AND CONCLUSIONS

The various problems identified in this analysis of data quality of DHS surveys are summarized in Table 3.14. At least one problem was identified in seventy-four percent of the surveys. More than three problems were identified from surveys in Ecuador, Mali, Senegal, and Togo. A major problem identified in this assessment is the relatively high frequency of missing data on dead children. This condition most likely reflects inadequate interviewing techniques. Don't know responses were not coded for ANC and DC, so it is conceivable that missing values for these variables may include "don't know" responses as well. Another finding of this study was that there were more missing and "don't know" answers when a relatively high number of children were born in the five years prior to the survey.

Multivariate analysis of predictors of missing data confirmed that information was less complete in cases where children had died and in cases where there were relatively many births in the last five years. Residence and maternal education were, however, not significant factors. An implication of these findings is that interviewer training should emphasize and explain the importance of obtaining good quality data on dead children and in cases where two or more children were born in the past five years.

Another implication of these findings is that in the few DHS surveys with a high proportion of missing information on dead children, potential selectivity of omissions may bias relationships between the risk of dying and risk factors in studies of determinants of mortality. These findings also indicate that, in general, there are fewer problems with recall for TT, ANC, and DC than have been observed with questions in another part of the DHS questionnaire, namely, morbidity. Morbidity apparently refers to events that are more difficult to define and measure unambiguously than is the case with maternity care.

Regarding reporting of current pregnancies, early pregnancies were underreported in all surveys and the accuracy of data on duration of current pregnancy is quite suspect. Coverage of TT and ANC among women with more advanced pregnancies was in many cases lower than in previous pregnancies, underscoring the difficulty of obtaining reliable data on service coverage by sampling only currently pregnant women. It is therefore possible that there is less underreporting of services received in prior pregnancies than with reporting for current pregnancies, or that many women receive TT and/or ANC very late in pregnancy, resulting in a lower coverage among those who are currently pregnant.

The internal consistency between the percent of women receiving TT and ANC and between the place of delivery and DC provider is good in most surveys.

No other major recall problems were identified, but methods for detecting recall bias in this type of assessment are relatively limited. This issue can only be pursued further in studies in which respondents are reinterviewed. Problems of data entry and editing would also be difficult to detect in this type of assessment, and have not been addressed in this report.

One problem identified in the questionnaire used in Francophone countries was the absence of a category for relatives who provided DC. Additionally, the inclusion of both persons and places as possible responses to a single question about who provided ANC and DC creates difficulties in analysis and may be confusing for interviewers in the field.

Other limitations of the survey instrument are primarily dictated by the need to keep the total questionnaire to a reasonable length. However, further information about the process and content of maternity care would enhance the utility of these data in a variety of settings.

Table 3.14 Summary of data quality assessment findings by table and country, Demographic and Health Surveys, 1986-1990

	Table and Brief Title										
Country	3.2 Reporting Current Pregnancy	3.3 TT and ANC Current Pregnancy	3.4 TT Current and Earlier Pregnancies	3.5 ANC Current and Earlier Pregnancies	3.6 TT, ANC, DC: Don't Know, Missing by Survival Status	3.7 TT Don't Know, Missing by Survival Status	3.8 DC: Missing by Relative Birth Order and Survival Status	3.9 ANC among Births Given TT during Pregnancy	3.10 DC: Attendant and Place of Delivery	3.12 ANC: Comparison with other Surveys	3.13 DC: Comparison with other Surveys
SUB-SAHARAN AFRICA											
Botswana	a						a				
Burundi							a		NA	NA	NA
Ghana							a		NA	NA	NA
Kenya	a						a			NA	NA
Liberia				NA			NA			NA	NA
Mali	a	a			a		a	a	NA	NA	NA
Ondo State	a				a				NA	NA	NA
Senegal	a		a		a		a	a	NA	NA	NA
Sudan									NA	NA	NA
Togo		a			a		a	a	NA	NA	NA
Uganda									NA	NA	NA
Zimbabwe					a					NA	NA
NORTH AFRICA											
Egypt			a						a	NA	a
Morocco			NA		a	NA		NA		NA	NA
Tunisia	a		NA		a		a			NA	NA
ASIA											
Indonesia		NA	NA	NA		NA		NA		NA	NA
Sri Lanka					a					NA	NA
Thailand					a		a			NA	
LATIN AMERICA & CARRIBEAN											
Bolivia							a	a		NA	NA
Brazil				NA					NA	NA	NA
Colombia				a					NA	NA	NA
Dominican Republic									NA		
Ecuador	a				a		a		a		
Guatemala				a				a	NA	NA	NA
Mexico		NA	NA	NA		NA		NA	NA		
Peru			NA				a		NA		
Trinidad & Tobago					a	a				NA	NA

[a]A problem was identified in the assessment presented in this table.

References

Airey, P. and O.M. Campbell. 1988. *Demographic and Health Surveys: A Critical Assessment of the Health Component Based on Six African Surveys*. London: London School of Hygiene and Tropical Medicine.

Boerma, T., A.E. Sommerfelt, S.O. Rutstein, and G. Rojas. 1990. *Immunization: Levels, Trends and Differentials in the Demographic and Health Surveys*. DHS Comparative Studies No. 1, Columbia, Maryland: Institute for Resource Development/Macro Systems, Inc.

CEPAR. 1986. *Fecundidad en el Ecuador, 1979 y 1982*. Quito: Centro de Estudios de Poblacion y Paternidad Responsable.

Fernandez, R. 1984. Analysis of information about mother-child care taken from fertility surveys in Latin America. Unpublished manuscript. Voorburg, the Netherlands: International Statistical Institute.

Goldman, N. and C.F. Westoff. 1980. Can fertility be estimated from current pregnancy data? *Population Studies* 34(3):535-550.

Manyeneng, W. G., P. Khulumani, M.K. Larson and A.A. Way. 1985. *Botswana Family Health Survey 1984*. Columbia, Maryland: Family Health Division, Ministry of Health, Botswana, and Westinghouse Public Applied Systems.

Sayed, H.A.A., M.I. Osman, F. El-Zanaty, and A.A. Way. 1989. *Egypt Demographic and Health Survey 1988*. Columbia, Maryland: Egypt National Population Council and Institute for Resource Development/Macro Systems, Inc.

WHO. 1989. *Coverage of Maternity Care: A Tabulation of Available Information*. Second edition. Geneva: World Health Organization.

WHO/EPI. 1987. Neonatal tetanus mortality surveys. *Weekly Epidemiological Record*, 323-335.

WHO. 1981. Report of the EMR/SEAR Meeting on Prevention of Neonatal Tetanus in the Eastern Mediterranean Region. Geneva: World Health Organization.

CHAPTER 4

The Quality of Data on Child Immunization in DHS-I Surveys

J. TIES BOERMA
GEORGE T. BICEGO

Acknowledgments

We wish to acknowledge Roy Miller, Shea Rutstein, and Noreen Goldman for comments on earlier drafts of this paper.

The immunization of children is one of the most powerful interventions to reduce child morbidity and to improve child survival. In addition, vaccination coverage is a good indicator of the degree of utilization of health services, unless independent vaccination campaigns are used extensively. Therefore, monitoring and evaluation of vaccination coverage are very important. The methods used to collect vaccination data in the DHS surveys are described first in this chapter. The quality of the data is then assessed by analyzing the amount of child health cards presented to the interviewer, the accuracy and completeness of transferring the vaccination data from cards to questionnaires, and the reliability of the mother's recall of the vaccinations to her child(ren). The assessment concludes with a summary of changes made in the DHS-II core questionnaire.

4.1 COLLECTION OF VACCINATION DATA

Vaccination data differ somewhat from most other data in the DHS questionnaire since use is made of records kept by the respondent and information is copied from these records. Most DHS surveys include questions on the vaccination status of the respondents' children born since January of the 5th year preceding the survey. The standard method of collecting vaccination information in the DHS during 1986-90 was as follows:

- "Do you have a health card for (NAME)?" If yes, "May I see it please?"
- Interviewer records the dates of vaccinations from the health card (day, month, and year of each vaccination).
- If no card could be presented, the interviewer asked: "Has (NAME) ever had a vaccination to prevent him/her from getting diseases?"

The information obtained when collecting vaccination information in DHS surveys is summarized in Table 4.1. Indonesia and Ecuador had no vaccination questions. In Mexico, mothers

Table 4.1 Summary of information available on immunization of children under five years, Demographic and Health Surveys, 1985-1990

	Card Information		Mother's Recall	
Survey	Card Seen/ Not Seen[1]	Dates of Vaccination[2]	Ever Had Vaccinations[3]	Specific Vaccinations
SUB-SAHARAN AFRICA				
Botswana	yes	yes	yes	no
Burundi	yes	yes	yes	no
Ghana	yes	yes	yes	no
Kenya	yes	yes	yes	no
Liberia	yes	yes	yes	no
Mali	yes	yes	yes	no
Ondo State, Nigeria	yes	yes	yes[4]	no
Senegal	yes	yes	yes[4]	no
Togo	yes	no	yes	no
Uganda	yes	yes	yes	BCG scar
Zimbabwe	yes	yes	yes	no
NORTH AFRICA				
Egypt	yes, birth cert.	yes, but incomplete	no	yes, partly
Morocco	yes	yes	no	yes
Sudan	yes	yes	no	yes
Tunisia	yes	yes	no	yes
ASIA				
Indonesia	no	no	no	no
Sri Lanka	yes	yes	yes	yes
Thailand	yes	yes	yes	no
LATIN AMERICA/CARIBBEAN				
Bolivia	yes[5]	yes	no	yes
Brazil	yes[5]	yes	no	yes
Colombia	yes	yes	yes	no
Dominican Republic	yes[5]	yes	no, campaigns only	no
El Salvador	yes[5]	no	no	no
Ecuador	no	no	no	no
Guatemala	yes	yes	no	yes
Mexico	no	no	yes	yes
Peru	yes	yes	yes	no
Trinidad & Tobago	yes	yes	yes	yes

[1] "Do you have a health card for (NAME)"? If yes, "May I see it please?"
[2] Record dates of immunizations from health card.
[3] "Has (NAME) ever had a vaccination to prevent him/her from getting diseases?"
[4] If age > 2 months (< 3 months was included as a response category).
[5] No code for not seen.

were not asked to present child health cards to the interviewer. The Mexico survey uses only maternal recall for specific vaccinations. In the Togo survey the mother was asked to present a card, but no information was copied from it. In Brazil and El Salvador, the mother was asked to present a card, but, if no card was shown, no distinction was made between "no card presented" and "card reported but not presented." No information was copied from the card in El Salvador.

The DHS questionnaires of the Dominican Republic and Egypt differ considerably from the standard. In the Dominican Republic the question, "Has the child ever been vaccinated?" was replaced by "Has the child ever received a vaccination during a campaign?" followed by queries about specific campaigns in the last three years. Most of the vaccinations appeared to have been given during campaigns, and the extent to which health cards were used is unclear. In Egypt, vaccination information is recorded on birth certificates rather than on child health cards; however, it often is incomplete (no dates; vaccinations missing). In addition, mothers in Egypt were asked how many times each child had received oral polio vaccine (OPV) and whether their child(ren) had ever received a vaccination by injection.

In nine countries, mothers were asked to report information on specific vaccinations. In Mexico, this was the only source of information, but in the other eight countries it was complementary to the information collected from the health cards. Vaccination coverage can be estimated using the health card and maternal recall information for these eight countries. For the other countries, data from the cards and the proportion ever vaccinated among children without cards can be used to estimate coverage, as has been described elsewhere (Boerma et al., 1990). Due to the differences in the methods of recording vaccinations and asking the questions in the survey coverage, estimates for Egypt were considered less accurate and no estimates could be made at all for the Dominican Republic and Togo.

4.2 PRESENTATION OF CARDS

Table 4.2 provides the percentages of children under five years for whom a card was presented to the interviewer, for whom the mother claimed she had a card but did not show it to the

Table 4.2 Percentages of children with no child health cards, with cards and seen by the interviewer, with cards but not seen by the interviewer, and missing values for all children under five years, Demographic and Health Surveys, 1985-1990

	No Card	Card Seen	Card Not Seen	Missing	Total	Number of children
SUB-SAHARAN AFRICA						
Botswana	3.1	71.0	25.6	0.3	100.0	3031
Burundi	34.5	46.5	18.8	0.2	100.0	3456
Ghana	38.3	33.2	27.6	0.8	100.0	3646
Kenya	7.7	50.7	41.3	0.3	100.0	6511
Liberia	39.5	34.4	25.8	0.4	100.0	4227
Mali	68.5	11.6	17.9	2.1	100.0	2858
Ondo State, Nigeria	30.4	24.3	45.2	0.1	100.0	2986
Senegal	51.7	23.6	24.4	0.2	100.0	3677
Togo	13.4	52.6	32.8	1.2	100.0	2768
Uganda	32.6	44.0	23.3	0.0	100.0	4330
Zimbabwe	7.0	72.9	19.7	0.3	100.0	3140
NORTH AFRICA						
Egypt	3.0	53.3	43.5	0.2	100.0	7913
Morocco	38.2	41.6	20.0	0.2	100.0	5562
Sudan	30.7	34.4	34.8	0.2	100.0	5957
Tunisia	8.1	70.1	21.8	0.0	100.0	4212
ASIA						
Sri Lanka	6.2	76.4	17.1	0.3	100.0	3861
Thailand	55.8	29.3	14.6	0.3	100.0	3499
LATIN AMERICA/CARIBBEAN						
Bolivia	27.3	19.5	53.0	0.1	100.0	5161
Brazil	34.4	65.6	NR	0.0	100.0	3206
Colombia	13.8	48.2	37.5	0.4	100.0	2584
Dominican Rep.	53.7	14.2	32.1	0.0	100.0	4066
El Salvador	29.3	70.4	NR	0.0	100.0	3194
Guatemala	31.5	52.8	15.7	0.0	100.0	4184
Peru	11.5	36.0	52.5	0.0	100.0	2814
Trinidad & Tobago	7.8	72.6	18.9	0.7	100.0	1870

NR=Not recorded.

interviewer, and for whom the mother did not have a card. Missing values were most common in Mali (2.1 percent), Togo (1.2 percent), Ghana (0.8 percent), and Trinidad and Tobago (0.7 percent), and were found in less than 0.5 percent of children in all other surveys. The proportion of children with no card at all varies considerably between the countries, from 3 percent in Botswana to more than two-thirds of the under-five children in Mali. Striking, however, is the large proportion of children for whom the mother said she had a card, but did not show it to the interviewer. Reasons for this discrepancy could be because the:

- Card is kept somewhere else, for example, a family has more than one residence or health workers keep child health cards;
- Card could not be found in the house;
- Mother reluctant to search for the card; and
- Interviewer does not insist on seeing the card.

Generally, it can be assumed that the lower the proportion of reported cards that were seen by the interviewer, the poorer the quality of the data from this questionnaire section. Figure 4.1 shows that more than 70 percent of the cards reported were actually seen by the interviewer in seven countries, which indicates good data quality. In four countries 60 to 70 percent of the cards were presented, and in five, the range dropped to 50-60 percent, which may indicate poorer interview quality.

In seven surveys less than half of the reported cards were presented. The proportions of cards seen among children whose mother said they had a card are particularly low in Bolivia (27 percent), the Dominican Republic (31 percent), Ondo State, Nigeria (35 percent), Mali (39 percent), Peru (41 percent), and Senegal (49 percent).

The association between the age of the child and card presentation can be examined in Table 4.3 and Figure 4.2. The proportion of children with no cards is highest among children under one year: on average 34 percent of the infants have no card (mean for 23 countries; Brazil and El Salvador not included). Presumably, this is associated with a large proportion of children who have not yet made their first vaccination visit. At ages 12-23 and 24-35 months 23 percent of children have no card, and at 36-59 months, 26 percent have no card. Missing values are more common in the age group 36-59 months (0.8 percent) than among younger children (0.1-0.2 percent). The problem of not presenting a reported health card is much more prominent for older children: 74 percent of the mothers who said they had a card for an infant showed it to the interviewer, and this percentage declines to 67 percent at 12-23 months, 60 percent at 24-35 months, and 51 percent at 36-59 months. This may indicate that genuine inability to find the card is the chief reason for failure to present it, since the time elapsed from the issuing date is related to the cumulative probability of losing the card.

Figure 4.1 Proportion of cards seen among children under 5 years with cards, Demographic and Health Surveys, 1986-1989

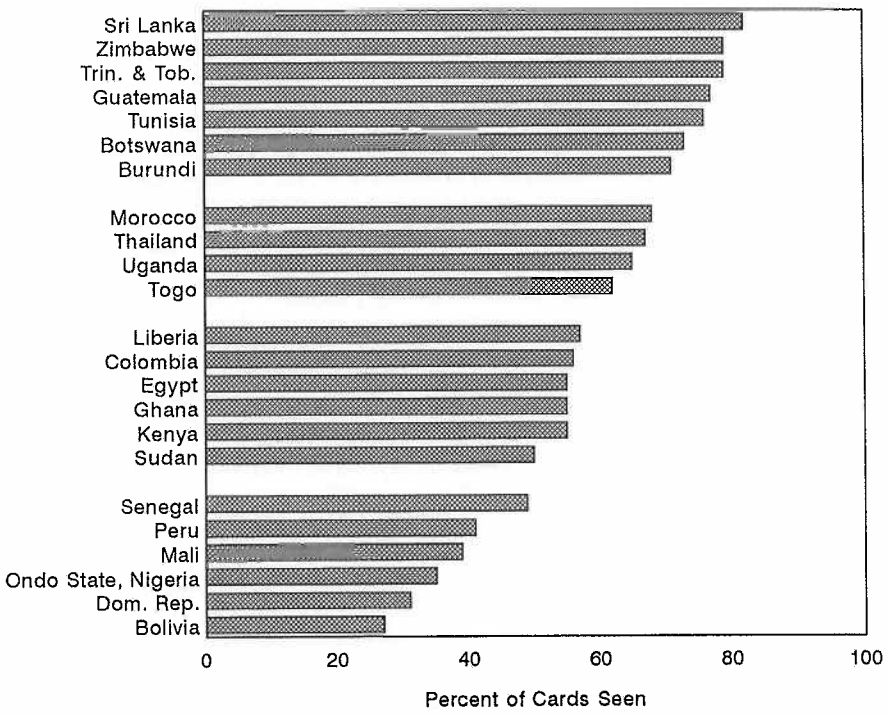
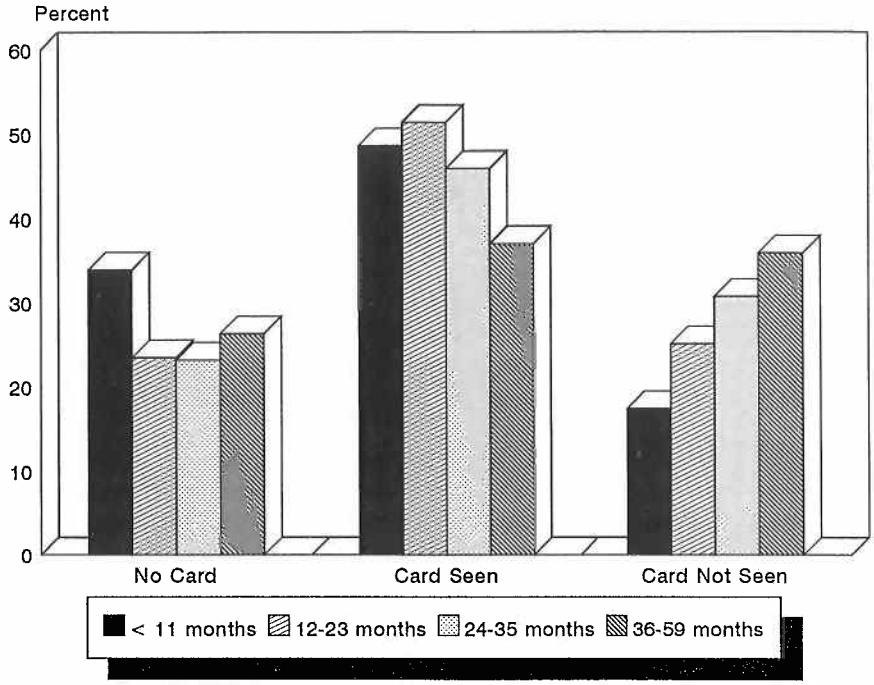


Table 4.3 Percentages of children with no card, card seen by the interviewer, and card not seen by the interviewer, by the child's age, Demographic and Health Surveys, 1985-1990

	<11 Months						12-23 Months					
	No Card	Card Seen	Not Seen	Miss-ing	Total	Number of Children	No Card	Card Seen	Not Seen	Miss-ing	Total	Number of Children
SUB-SAHARAN AFRICA												
Botswana	2.7	88.0	9.2	0.1	100.0	674	2.8	74.2	23.0	0.0	100.0	615
Burundi	38.3	51.9	9.7	0.0	100.0	767	25.4	63.8	10.8	0.0	100.0	663
Ghana	53.9	34.2	11.9	0.0	100.0	737	38.0	40.3	21.6	0.1	100.0	782
Kenya	12.8	60.9	26.3	0.0	100.0	1308	4.5	61.0	34.4	0.1	100.0	1315
Liberia	44.2	39.8	15.9	0.1	100.0	1118	32.4	43.0	24.6	0.0	100.0	817
Mali	77.0	12.4	10.5	0.1	100.0	729	69.2	12.0	18.8	0.0	100.0	554
Ondo State,Nigeria	34.5	39.4	25.9	0.2	100.0	629	26.8	36.9	36.3	0.0	100.0	590
Senegal	62.5	22.2	15.2	0.0	100.0	774	48.8	31.2	19.8	0.1	100.0	791
Togo	17.9	56.2	25.1	0.9	100.0	582	8.6	66.0	25.1	0.4	100.0	570
Uganda	53.3	36.9	9.8	0.0	100.0	972	31.6	49.3	19.0	0.0	100.0	946
Zimbabwe	7.2	84.9	7.9	0.0	100.0	569	5.1	77.6	17.3	0.0	100.0	629
NORTH AFRICA												
Egypt	9.0	57.7	33.1	0.1	100.0	1526	1.4	60.5	38.0	0.1	100.0	1594
Morocco	33.1	56.3	10.6	0.0	100.0	1126	34.2	50.5	15.3	0.0	100.0	1101
Sudan	43.6	39.0	17.4	0.1	100.0	1216	23.6	46.2	30.3	0.0	100.0	1150
Tunisia	11.1	75.2	13.7	0.0	100.0	812	5.5	77.0	17.6	0.0	100.0	820
ASIA												
Sri Lanka	7.2	82.8	9.8	0.1	100.0	737	3.2	82.1	14.7	0.0	100.0	774
Thailand	44.2	44.7	10.9	0.2	100.0	627	47.3	36.0	16.4	0.4	100.0	759
LATIN AMERICA/CARIBBEAN												
Bolivia	45.6	19.3	35.0	0.0	100.0	1055	24.2	23.1	52.6	0.2	100.0	1110
Brazil	41.1	58.9	0.0	0.0	100.0	607	26.2	73.8	0.0	0.0	100.0	578
Colombia	21.3	55.5	23.0	0.2	100.0	459	11.2	54.9	33.6	0.3	100.0	556
Dominican Rep.	62.4	16.0	21.6	0.0	100.0	813	53.0	17.8	29.3	0.0	100.0	864
El Salvador	33.1	66.7	0.0	0.2	100.0	677	24.5	75.3	0.0	0.2	100.0	604
Guatemala	48.4	43.1	8.5	0.0	100.0	879	29.0	55.5	15.4	0.0	100.0	823
Peru	22.1	39.7	38.2	0.0	100.0	544	8.4	43.0	48.7	0.0	100.0	526
Trinidad & Tobago	28.1	61.1	10.5	0.3	100.0	334	6.6	79.5	13.9	0.0	100.0	380

	24-35 Months						36-59 Months					
	No Card	Card Seen	Not Seen	Miss-ing	Total	Number of Children	No Card	Card Seen	Not Seen	Miss-ing	Total	Number of Children
SUB-SAHARAN AFRICA												
Botswana	1.8	69.6	28.2	0.3	100.0	580	4.3	60.1	35.2	0.5	100.0	1162
Burundi	27.5	50.9	21.6	0.0	100.0	768	41.2	31.4	26.8	0.6	100.0	1257
Ghana	30.5	39.7	29.2	0.7	100.0	761	34.4	25.1	38.7	1.8	100.0	1366
Kenya	6.4	49.6	43.7	0.2	100.0	1380	7.4	40.5	51.4	0.7	100.0	2509
Liberia	36.3	35.9	27.8	0.0	100.0	760	41.5	25.0	32.6	0.9	100.0	1532
Mali	65.8	13.1	20.0	1.1	100.0	516	63.5	10.1	21.4	5.0	100.0	1058
Ondo State,Nigeria	23.8	24.8	51.5	0.0	100.0	513	32.7	10.7	56.5	0.2	100.0	1254
Senegal	47.1	25.4	27.3	0.1	100.0	700	49.7	19.3	30.7	0.4	100.0	1412
Togo	9.0	53.2	37.1	0.7	100.0	558	15.9	43.1	38.8	2.2	100.0	1058
Uganda	23.9	50.2	25.9	0.0	100.0	838	25.0	42.0	32.8	0.1	100.0	1573
Zimbabwe	6.3	74.9	18.5	0.3	100.0	670	8.3	64.2	26.9	0.6	100.0	1272
NORTH AFRICA												
Egypt	1.6	54.8	43.6	0.0	100.0	1604	1.7	46.8	51.2	0.3	100.0	3189
Morocco	39.1	38.7	22.1	0.2	100.0	1070	42.2	31.3	26.1	0.4	100.0	2265
Sudan	25.9	33.0	41.0	0.2	100.0	1198	29.9	27.1	42.7	0.3	100.0	2393
Tunisia	7.5	71.0	21.4	0.0	100.0	863	8.2	63.9	28.0	0.0	100.0	1717
ASIA												
Sri Lanka	4.5	78.6	16.7	0.3	100.0	775	8.1	69.5	21.9	0.5	100.0	1575
Thailand	56.2	30.9	12.7	0.2	100.0	689	65.1	18.2	16.2	0.5	100.0	1424
LATIN AMERICA/CARIBBEAN												
Bolivia	21.9	23.1	55.0	0.0	100.0	1017	22.2	15.7	61.9	0.2	100.0	1980
Brazil	29.9	70.1	0.0	0.0	100.0	615	36.7	63.3	0.0	0.0	100.0	1407
Colombia	10.7	50.0	39.1	0.2	100.0	508	13.5	40.7	45.1	0.6	100.0	1061
Dominican Rep.	50.6	15.5	33.9	0.0	100.0	771	51.2	10.9	38.0	0.0	100.0	1618
El Salvador	26.9	72.9	0.0	0.2	100.0	652	30.8	68.7	0.0	0.5	100.0	1260
Guatemala	25.0	57.7	17.4	0.0	100.0	841	27.0	54.2	18.7	0.1	100.0	1641
Peru	9.0	36.6	54.4	0.0	100.0	566	9.3	30.8	59.9	0.0	100.0	1178
Trinidad & Tobago	2.6	78.9	18.5	0.0	100.0	379	2.1	71.0	25.2	1.7	100.0	777

Figure 4.2 Mean percent of children with cards by age of the child for 23 DHS surveys, 1986-1989



Note: Brazil and El Salvador not included

The health section of the DHS questionnaire is structured so that questions are first asked for the lastborn child, followed by the next-to-last child, second-to-last, third-to-last, etc. In this report this order will be referred to as the relative birth order, i.e., the place of the child in the health section of the questionnaire, starting with the last birth. It is important to know whether the information given for the most recent child is more accurate than for the other children under five years. To be able to compare the responses between children with different relative birth orders, a control for the age of the child must be made, since children with higher relative birth orders are on average older and since card rates and coverages are lower for older children. Therefore, the focus will be on children three to four years.

Table 4.4 shows the percent of children with no card, the percent with missing values, and the proportion of cards not seen among children whose mothers said they had a card for the child. The results for last-born children, next-to-last born, and second-to-last born or earlier within the five-year recall period can be compared. If data quality deteriorates within the health section, one would expect an increase in the percentage with no card, the proportion of missing values, and the proportion of cards not seen. There is an increase in the proportion of children with no cards in 13 countries and the mean for 25 countries increases from 25.0 percent for last-born children to 27.6 percent for next-to-last-born children and to 29.5 percent for second-to-last-born children or higher. This may indicate poorer data quality, but it could also be argued that last-born children are typical of mothers with only one child under five years of age as opposed to children with higher relative birth order who have at least one succeeding birth within the last five-year period. Thus, the decline with increasing index number may reflect genuinely lower use among high-fertility families and, therefore, there is no clear evidence of poorer data quality for children born next to last or second to last.

Missing values are more common for children with higher relative birth orders in most countries. The mean for 25 countries increases from 0.3 percent for the last-born child to 0.6 percent for next-to-last-born child to 2.0 percent for children born second-to-last or before. Some countries have marked increases, e.g., Burundi, Ghana, Thailand, Togo, and Trinidad and Tobago. Finally, the last three columns in Table 4.4 show the proportion where the card was not seen among children whose mothers reported having received a card. Except for Peru and Sudan, the proportion of cards not seen does not increase with the relative birth order of the child; it is even slightly higher among last-born children. The lack of difference between the children may reflect the habit of keeping all the health documents together in the same place. If a mother is asked to show the health card for the first (youngest) child, she may also bring the health cards for the other children.

A multivariate analysis was also carried out to assess factors influencing the occurrence of missing values for the question on child health cards. The analysis was limited to 13 surveys with at least 10 missing values for this question (unweighted data). The odds ratios for missing values, resulting from a logistic regressions analysis, are shown in Table 4.5.

Table 4.4 Data for last-born (1), next-to-last-born (2), and second-to-last-born or before (3+) children 36-59 months in the health section: Percent with no card, with missing values, and for whom mother said there was a card but it was not presented, Demographic and Health Surveys, 1985-1990

	No Card			Missing			Cards Not Presented			Number of Children		
	1	2	3+	1	2	3+	1	2	3+	1	2	3+
SUB-SAHARAN AFRICA												
Botswana	4.9	3.2	8.3	0.3	0.7	0.0	43.8	29.8	40.4	554	549	59
Burundi	43.8	39.3	47.0	0.4	0.2	3.4	39.7	48.3	43.8	272	837	149
Ghana	32.1	34.8	41.8	0.7	1.7	7.1	60.1	61.2	58.0	455	813	98
Kenya	4.3	8.3	9.4	0.2	0.5	2.0	56.7	55.0	57.8	667	1407	435
Liberia	37.1	42.2	47.5	0.4	0.7	2.4	63.2	52.2	57.4	464	830	239
Mali	65.4	65.3	53.1	0.6	3.0	1.2	73.1	68.1	54.8	295	605	159
Ondo State,Nigeria	32.1	33.0	33.7	0.0	0.1	1.1	88.8	80.6	86.2	471	694	89
Senegal	50.8	50.0	44.6	0.0	0.3	1.5	61.0	61.6	61.4	380	902	130
Togo	14.3	17.5	8.7	0.8	2.4	7.2	53.0	44.6	43.1	356	633	69
Uganda	22.7	25.2	27.5	0.2	0.0	0.3	52.5	40.3	44.5	357	927	289
Zimbabwe	6.6	9.1	12.1	0.4	0.4	3.3	33.3	25.3	41.6	487	694	91
NORTH AFRICA												
Egypt	1.9	1.5	1.8	0.2	0.2	0.9	57.7	50.5	45.8	102	1570	517
Morocco	31.6	45.6	54.1	0.1	0.3	1.5	46.1	44.7	47.3	760	1172	333
Sudan	28.5	30.3	31.4	0.1	0.2	0.6	57.6	60.9	69.7	684	1365	344
Tunisia	5.4	9.6	9.1	0.0	0.0	0.0	32.0	29.2	30.9	569	852	296
ASIA												
Sri Lanka	6.9	9.5	8.9	0.1	0.5	2.8	23.9	24.2	22.6	809	656	111
Thailand	63.1	68.4	68.2	0.3	0.6	3.2	48.2	45.8	35.2	879	489	56
LATIN AMERICA/CARIBBEAN												
Bolivia	18.9	23.6	26.1	0.0	0.2	1.0	80.5	78.9	80.4	746	969	265
Brazil	34.8	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	716	495	195
Colombia	13.1	12.2	19.8	0.3	0.4	2.7	53.4	52.2	50.2	507	425	130
Dominican Rep.	46.4	52.4	60.2	0.0	0.0	0.0	79.5	75.6	79.0	659	707	251
El Salvador	25.2	32.8	41.2	0.5	0.5	0.8	0.0	0.0	0.0	519	572	169
Guatemala	25.1	28.0	27.0	0.0	1.0	0.4	31.2	23.0	24.7	462	912	267
Peru	9.2	10.0	6.8	0.0	0.0	0.0	65.2	64.8	72.2	488	528	162
Trinidad & Tobago	1.3	2.0	4.9	1.0	0.8	5.9	28.8	22.8	26.4	381	294	102
Mean	25.0	27.6	29.5	0.3	0.6	2.0	49.2	45.6	46.9	502	765	200

Table 4.5 Odds ratios for having missing values on health card question by relative birth order and period of fieldwork[1], Demographic and Health Surveys, 1986-1989

	Relative Birth Order[2]		Period of Fieldwork[3]		Model Fit	
Country	Next to Last	Prior to Last Two	Middle	End	-2 Log Likelihood	Improvement Chi-square[4]
SUB-SAHARAN AFRICA						
Botswana	2.08	0.002	2.26	2.51	132.5	23.6 **
Ghana	5.13 **	19.63 ***	0.26 *	0.51	288.1	60.4 ***
Liberia	0.90	4.55 *	0.46	0.43	178.6	66.0 ***
Kenya	3.50	19.90 ***	0.98	1.44	251.9	41.7 ***
Mali	3.18 *	24.38 ***	0.26 ***	0.52	369.3	143.6 ***
NORTH AFRICA						
Togo	1.93	5.50 **	2.48 *	0.52	345.8	30.6 ***
Zimbabwe	0.55	3.54	0.55	0.64	109.1	26.1 **
ASIA						
Egypt	0.95	5.50 *	0.75	1.31	213.1	29.9 ***
Morocco	4.43	23.64 **	1.71	0.85	140.0	31.4 ***
Sri Lanka	6.93	33.64 **	0.11 *	0.34	112.8	26.5 **
LATIN AMERICA/CARIBBEAN						
Thailand	4.01	23.38 ***	1.27	1.95	204.4	21.3 *
Colombia	1.71	11.44 **	0.64	0.86	138.4	14.9
Trinidad & Tobago	1.81	8.34 **	0.54	0.43	131.8	33.4 ***

[1]Only surveys included with at least 10 missing values, unweighted.
[2]Reference category: Last birth
[3]Reference category: Beginning of fieldwork
[4]Compared to model with constant only; controlling for age of the child, mother's level of education, and residence.
* P < 0.05; ** P < 0.01; *** P < 0.001

All equations included relative birth order (as defined above), period of survey fieldwork, residence (urban or rural), mother's education (none or at least some), and age of the child. Residence, mother's education, and the child's age did not have significant effects in virtually all countries when relative birth order and period of fieldwork were included. Therefore, only the odds ratios for the latter are presented.

Relative birth order has a strong effect on the odds of missing values, especially if it concerns the second-to-last birth or before. The results support the findings of the bivariate analysis. The only exception among the 13 countries was Botswana. There is no evidence of an important effect of the period of fieldwork on the occurrence of missing values.

In sum, the analysis of data on card presence indicates that data quality does not deteriorate dramatically for the second and third child under five years. However, missing values appear to be somewhat more common among the latter, suggesting that interviewers may have become less attentive for the second and third children listed in the health section.

4.3 EVER IMMUNIZED

The question on whether a child with no card presented had ever been immunized was asked in 17 countries. In Senegal, the question was asked only for children age three months and older. Table 4.6 shows that DK responses and missing values together make up 2-3 percent of reports. In Liberia, 2.7 percent of the respondents said they did not know the vaccination status of the child; in Trinidad and Tobago this value was 1.5 percent. In Liberia, most of the DK responses were for children aged 24-59 months. Missing values were most common in Trinidad and Tobago (3.4 percent), Botswana (2.4 percent), Mali (2.3 percent), and Zimbabwe (2.3 percent).

The problem of DK responses and missing values is generally less pronounced at ages 12-23 months. Only in Botswana (3.1 percent), Trinidad and Tobago (1.3 percent), and Kenya (1.2 percent) were more than 1 percent of the data missing.

Table 4.6 Proportion of children under five years and 12-23 months with "don't know" responses or missing values for question on whether the child has ever been immunized, if no card was presented, Demographic and Health Surveys, 1986-1990

	Under 5 Years			12-23 Months
	Don't Know	Missing	Total	Total
SUB-SAHARAN AFRICA				
Botswana	0.8	2.4	3.2	3.1
Burundi	0.2	0.8	1.0	0.5
Ghana	0.2	1.3	1.5	0.4
Kenya	0.2	1.3	1.5	1.2
Liberia	2.7	1.0	3.7	0.6
Mali	0.4	2.3	2.7	0.0
Ondo State, Nigeria	0.1	0.2	0.3	0.3
Senegal[1]	0.9	0.3	1.2	0.4
Togo	0.1	1.1	1.2	0.5
Uganda	0.6	0.5	1.1	0.3
Zimbabwe	0.8	2.3	3.1	0.0
NORTH AFRICA				
Egypt	NA	NA		
Morocco	NA	NA		
Sudan	NA	NA		
Tunisia	NA	NA		
ASIA				
Sri Lanka	0.3	1.1	1.4	0.0
Thailand	0.9	0.5	1.4	0.8
LATIN AMERICA/CARIBBEAN				
Bolivia	NA	NA		
Brazil	NA	NA		
Colombia	0.1	0.9	1.0	0.6
Dominican Republic	NA	NA		
Guatemala	NA	NA		
Mexico	0.0	0.2	0.2	0.2
Peru	0.2	0.1	0.3	0.0
Trinidad & Tobago	1.5	3.4	4.9	1.3

NA=Not applicable
[1]The lower age range for children in Senegal was 3 months, not birth.

4.4 VACCINATION STATUS BY PRESENCE OF A CARD

How accurate is the information about the presence of a child health card as reported by the mother? The accuracy can partly be evaluated by analyzing data on cards presented and data on ever-vaccinated status. In cases where a mother responded "yes" to having a card but could not present it, a certain (but unknown) number of children will never have been vaccinated and the reported (but not seen) health card would have had no entries. This fraction should resemble the fraction of children for whom a card was presented, but which had no entries. Thus, a large difference in *percent ever vaccinated* between children with and without a shown card among all children with a reported card would probably reflect overreporting of card possession (or percent ever vaccinated) by the mothers who could not produce it.

Table 4.7 shows that the percentage of children 12-35 months ever immunized does not differ much between the two groups in two-thirds of the surveys: in 14 of the surveys with data available the difference is less than 2 percent. Yet, in all but four surveys, the percentage is smaller for *not presented.* In seven surveys, six in sub-Saharan Africa (Botswana, Burundi, Ghana, Liberia, Senegal, and Togo) and Morocco, the proportion ever vaccinated is more than 2 percent lower among those with no card presented than those with card presented. In some cases, the mother might have had an empty card with no vaccinations on it, but did not show this card to the interviewer. Underreporting of *ever received a vaccination* is also possible. In general, however, Table 4.7 can be considered as evidence of minor inconsistencies in mother's reporting of card possession or vaccination status of her children in the seven surveys mentioned above.

Table 4.7 Proportion of children 12-35 months ever vaccinated, by presentation status of cards[1], Demographic and Health Surveys, 1986-1990

	Presented[2]		Not presented[3]	
	Percent	Number of Children	Percent	Number of Children
SUB-SAHARAN AFRICA				
Botswana	99.6	860	94.0	299
Burundi	99.1	814	95.0	234
Ghana	98.2	617	90.8	390
Kenya	99.6	1487	98.1	1048
Liberia	96.8	624	92.0	409
Mali	100.0	134	83.3	207
Ondo State, Nigeria	100.0	345	99.2	477
Senegal	96.9	425	85.0	347
Togo	99.6	673	98.6	350
Uganda	99.9	887	97.3	396
Zimbabwe	99.4	990	98.7	233
NORTH AFRICA				
Egypt	86.6	1842	87.8	1288
Morocco	99.9	970	95.3	404
Sudan	99.6	926	100.0	830
Tunisia	100.0	1244	100.0	329
ASIA				
Sri Lanka	99.7	1245	98.5	243
Thailand	99.7	486	99.2	211
LATIN AMERICA/CARIBBEAN				
Bolivia	98.8	491	98.5	1143
Colombia	100.0	560	99.6	383
Guatemala	100.0	942	99.3	272
Peru	98.8	433	100.0	564
Trinidad & Tobago	99.3	601	98.4	123

[1]Computations were not possible for Brazil, Dominican Republic, Ecuador, El Salvador, and Mexico (see Table 4.1)
[2]Percentage with at least one vaccination recorded on presented card
[3]Percentage having mother respond "yes" to question on whether child had ever been vaccinated

4.5 COPYING OF CARD INFORMATION

The accuracy of copying the dates of specific vaccinations can be evaluated by looking at the frequency of impossible or highly unlikely dates. Of course, it is possible that the health workers made errors in recording the vaccination dates on the child health cards, and this type of error cannot be distinguished from errors made by the interviewers. An additional problem in the evaluation of data quality is created by the different editing procedures used in the various surveys. For example, according to the DHS guidelines, a 97 code is to be assigned during machine editing when inconsistencies appear between (a) the recorded dates of vaccination and the recorded birth date of the child or (b) the sequence of dates of the respective vaccinations (e.g., third dose of DPT given before the first dose of DPT). However, in many instances the vaccination data were used to edit the date on the spot, e.g., changing the birth date or the dates of specific vaccination dates.

As Table 4.8 shows, missing and inconsistent values were recorded in a limited number of surveys. However, Kenya had more than 5 percent of the vaccination dates either inconsistent or missing.

Measles vaccination is recommended at 9 months of age and it is generally unlikely that it is given to children younger than 6 months. In special circumstances, such as measles outbreaks, very young children are sometimes immunized, but in general less than 1 percent of the measles vaccinations should have been given to children under 6 months of age. Similarly, the second dose of DPT is recommended at 10 weeks of age and giving DPT2 doses during the first month of life is not very probable. The third dose of DPT is recommended at 14 weeks of age and DPT3 vaccinations reported during the first two months of life point to inconsistencies between birth dates and vaccination dates. It is noted that errors in the age at vaccination do not necessarily indicate something is wrong with the

Table 4.8 Percentages of vaccinations given too early using card information only: Measles before 6 months, DPT2 before 1 month, and DPT3 before 2 months of age (percentages of all vaccinations with dates); percentages within zero or negative intervals between DPT doses, Demographic and Health Surveys, 1986-1990

	Measles			DPT2			DPT3			Intervals between DPT Doses	
	Missing/ Incons.[1]	< 6 Months	Number of Children	Missing/ Incons.[1]	< 1 Month	Number of Children	Missing/ Incons.[1]	< 2 Months	Number of Children	DPT2 ≤ DPT1	DPT3 ≤ DPT2
SUB-SAHARAN AFRICA											
Botswana		0.9	1551		0.1	1933		0.0	1811	1.2	0.8
Burundi		4.3	1023		0.0	1241		0.0	1039	0.0	0.0
Ghana		5.5	760		0.0	840		0.0	671	0.1	0.2
Kenya	5.7	4.6	2065	6.6	0.3	2823	6.9	0.3	2565	0.7	0.3
Liberia		8.1	776		0.0	564		0.0	338	0.0	0.8
Mali		2.4	207		0.0	130		0.0	86	0.0	0.0
Ondo State, Nigeria		0.0	372		0.4	564		0.2	435	0.2	0.0
Senegal		5.4	497		0.0	484		0.0	278	0.0	0.0
Togo											
Uganda	0.0	4.5	1311	0.1	0.0	1387	0.4	0.0	1045	0.1	0.3
Zimbabwe		2.2	1761		0.0	1983		0.0	1845	0.2	0.2
NORTH AFRICA											
Egypt		2.9	1831		0.3	2212		0.2	1806	4.9	4.7
Morocco		2.4	1444		0.3	1863		0.1	1662	0.8	0.5
Sudan	1.7	4.5	1365	3.3	0.3	1711	4.3	0.3	1435	0.5	0.9
Tunisia		3.3	2269		0.0	2651		0.1	2456	1.3	2.2
ASIA											
Sri Lanka		0.2	1409	0.0	0.0	2561		0.0	2362	0.0	0.0
Thailand		0.5	398		0.0	870		0.0	748	2.6	3.5
LATIN AMERICA/CARIBBEAN											
Bolivia		5.4	661		0.2	684		0.3	521	1.1	0.5
Brazil		2.9	1588		0.1	1795		0.0	1599	0.0	0.0
Colombia		2.8	863		0.0	1045		0.2	932	0.0	0.0
Dominican Rep.	0.0	6.3	107	1.5	0.0	357	1.2	0.0	215	4.5	5.3
Guatemala	0.0	2.8	1584	0.0	0.1	1649	0.0	0.0	1283	0.7	0.5
Peru	1.4	1.3	706	1.5	0.1	806	0.9	0.3	657	1.8	2.4
Trinidad & Tobago	0.6	1.8	505	1.3	0.1	1255	1.0	0.1	1085	0.5	0.2

[1]Percentages are only shown for surveys where codes for missing or inconsistent values were used at least once.

vaccination date. The birth date of the child could be the cause of the inconsistency.

Measles vaccination dates rarely indicated a vaccination prior to 6 months of age in Botswana; Ondo State, Nigeria; Sri Lanka; and Thailand (less than 1 percent of children with measles vaccination received it before 6 months). At the other extreme, in several surveys more than 5 percent of the children received measles vaccinations before 6 months, including Liberia (8.1 percent), Dominican Republic (6.3 percent), Ghana, Bolivia, and Senegal. Kenya has 5.7 percent missing and inconsistent dates and an additional 4.6 percent of children received vaccination before 6 months of age.

Data on the ages at which DPT2 and DPT3 were given suggest that copying errors are not very common, since no country has more than 0.5 percent given at improbably early ages. However, Kenya and Sudan do have 7 and 4 percent missing and inconsistent values, respectively.

Greater than 1 percent of children have negative or zero intervals between the dates for DPT2 and DPT3 doses in five countries: Dominican Republic (5.3 percent), Egypt (4.7 percent), Thailand (3.5), Peru (2.4), and Tunisia (2.2).

4.6 RECALL COVERAGE

In addition to copying card information, mothers in eight surveys were asked to recall specific vaccinations given to their child(ren), if no card was presented to the interviewer. Mother's recall of vaccinations is very important to be able to estimate vaccination coverage among all children with or without cards. In Table 4.9, recall data and card data can be compared to obtain an idea of possible under- or overreporting of vaccinations by mothers. In general, coverage is expected to be somewhat lower among children for whom no card was presented to the interviewer, and the discrepancy is expected to be larger for multiple dose vaccines. The recall coverage is de-

Table 4.9 Health card coverage and recall coverage among children 12-23 months: Percent of children with card, without a card but ever vaccinated, and no card and never vaccinated; ratio (x 100) of health card coverage and recall coverage for specific vaccines and full immunization, Demographic and Health Surveys, 1986-1990

Country	Number of children	With Card	No Card but Imm.	No Card no Imm.	Total	Type of Immunization								
						BCG	DPT1	DPT2	DPT3	OPV1	OPV2	OPV3	MSL	Full
Morocco	1101	50.5	35.0	14.5	100.0	99.5	89.0	82.8	78.5	89.0	82.8	78.5	74.1	75.5
Sudan	1150	46.2	32.9	21.0	100.0	100.4	96.0	96.9	94.1	94.7	97.1	95.9	104.9	102.3
Tunisia	820	77.0	20.5	2.6	100.0	102.4	95.4	96.2	93.1	95.7	96.2	93.4	78.4	80.6
Sri Lanka	774	82.1	17.2	0.7	100.0	99.7	96.4	94.0	86.0	97.1	94.0	86.3	87.7	79.2
Bolivia	1110	23.1	61.7	15.3	100.0	105.4	91.4	73.9	50.2	99.9	87.8	68.3	91.8	54.2
Brazil	578	73.8	21.1	5.1	100.0	84.6	66.0	61.0	59.2	82.6	78.3	68.0	91.8	55.0
Guatemala	823	55.5	25.8	18.7	100.0	116.5	91.1	84.2	69.9	95.7	87.2	74.3	87.2	74.5
Trinidad	380	79.5	14.5	6.1	100.0	NA	99.5	98.2	80.8	101.0	100.9	73.6	NA	47.8

NA=Not applicable

fined as the proportion of children who received a specific vaccination among all children who have no card but had at least one vaccination reported by the respondent. In two surveys (Sri Lanka and Trinidad and Tobago) a separate question on whether the child had ever been immunized was asked before asking about specific vaccinations. In the other surveys, only questions about the specific vaccinations were posed.

Except for Sudan, recall coverage is indeed lower than card coverage in all eight surveys. The differences are greatest for the third doses of DPT and for polio vaccinations. For example, polio3 recall coverage is less than 80 percent of polio3 card coverage in 5 of the 8 surveys.

Recall coverage in Sudan is almost as high as card coverage and is even higher for measles vaccination. This may be real, if not being able to present a card has no relationship with coverage levels, an unlikely conclusion given the results from the other countries. A more realistic explanation, however, is that mothers whose children did receive at least some vaccinations tend to overreport the number, perhaps because they confuse vaccinations with curative injections.

4.7 COMPARISON WITH OTHER DATA SOURCES

Vaccination coverage rates are usually derived from either special coverage surveys or routine data from health facilities where vaccinations are given.[1] The coverage surveys are conducted using a standard survey methodology recommended by the Expanded Programme on Immunization (EPI) of the World Health Organization (WHO) (Henderson and Sundaresan, 1982). The survey sample consists of 30 clusters selected with probability proportional to population size. The first household in each cluster is randomly chosen and, to reduce survey costs, all subsequent households are selected from neighboring households until at least seven children in a selected age group are identified. With this method, the level of vaccination coverage can be estimated with a precision of about 10 percent (Lemeshow et al., 1985).

The EPI cluster sample coverage surveys are carried out in many countries. However, two concerns have been raised regarding the reliability of the resulting coverage estimates: the sample may be biased by overrepresentation of households located near health facilities, and interviews are often conducted by health workers, which may introduce an additional bias.

National coverage estimates can also be based on routinely reported data from the immunizing clinics. Data from these health information systems, however, are rarely complete and assumptions have to be made to estimate the coverage. In addition, the denominator (number of children eligible for vaccination) often has to be estimated from other sources, such as population projections with census data. It is known that censuses usually undercount young children.

The DHS surveys can be compared to official estimates of vaccination coverage based on either of the two methods if the period of the DHS survey coincides with the reference period for estimates from other sources. Since the focus of most EPI cluster coverage surveys is on children 12-23 months of age, the comparison will be limited to this age group. As in EPI cluster sample surveys, information on vaccinations given to the child is copied from the child's health card if it is presented. In the EPI surveys, if no health card is presented, the mother is usually asked to recall specific vaccinations.[2]

[1] This section is based on Boerma and Van Ginneken (1991).

[2] In some DHS surveys, data on specific vaccinations were limited to children for whom a health card was presented to the interviewer. For children without a health card, the mother was asked whether the child had ever been vaccinated, but no data on specific vaccinations were asked. The procedure used to obtain coverage estimates for the individual vaccines is outlined in Boerma et al. (1990). This procedure was used for Botswana, Burundi, Egypt, Kenya, Uganda, and Zimbabwe. In the other six DHS surveys in Table 4.7, mothers were asked to recall specific vaccinations and this information was used with the card data to obtain coverage estimates.

Table 4.10 presents coverage for BCG, three doses of DPT and oral polio (OPV), and measles vaccinations for 12 countries covered by DHS reports. The coverage estimates from six countries with EPI cluster sample surveys are within an acceptable range of the estimates made from the nationally representative samples of DHS surveys (Botswana, Kenya, Zimbabwe, Sudan, Ghana, and Nigeria). Data based on facility reports are much less consistent with DHS results. In Tunisia and Uganda, coverage estimates based on data reported by the health facilities are in line with the estimates provided by the DHS for the same period. In Bolivia, the reported coverage for 1988 appears to be much lower than the coverage found in the DHS survey. In four other countries (Egypt, Ghana, Nigeria, and Paraguay) DHS coverage rates are lower than vaccination coverage rates based on health information system reports.

In sum, DHS estimates of vaccination coverage are generally in the same range as coverage estimates based on the cluster

Table 4.10 Comparison of DHS and WHO data on immunization coverage among children 12-23 months (percentages)

Country	Data Source[1]	BCG	DPT3	OPV3	Measles	Number of Children	Remarks
Botswana	DHS Aug - Dec 1988	95	88	86	87	615	Surveys in agreement with DHS
	Survey 1987	99	86	88	91	425	
	Survey 1990	98	92	89	87	NA	
Kenya	DHS Dec 1988 - May 1989	93	82	82	72	1315	Large survey agrees well with DHS
	Survey 1987	86	75	75	60	2451	
Zimbabwe	DHS Sep 1988 - Jan 1989	94	86	86	79	630	Survey estimates close to DHS
	Survey 1988	97	79	78	83	NA	
Sudan (Northern)	DHS Nov 1989 - Jan 1990	76	60	61	61	1150	Survey in line with DHS, 1990
	Survey early 1989	67	53	53	57	1260	reported data appear over-
	Reported data 1990	94	81	81	71	NA	estimate
Ghana	DHS Feb - May 1988	69	42	41	51	782	Survey data agree with DHS, but
	Survey 1987	71	37	34	40	209	reported data overestimate BCG
	Reported data 1988	94	45	44	67	NA	and measles
Nigeria	DHS Apr - Oct 1990	63	36	36	48	1356	Survey 1989 in agreement with
	Survey 1989	58	44	44	46	NA	DHS, but reported data for 1990
	Reported data 1990	96	57	57	54	NA	are overestimation
Burundi	DHS Apr - Jul 1987	77	55	57	59	663	Reported data are not consistent
	Reported data 1987	84	69	45	55	NA	with high DPT3 and low OPV3
	Survey data 1989	53	47	49	39	NA	
Bolivia	DHS Feb-Jul 1988	55	28	38	58	1108	Reported data appear to under-
	Reported data 1987-88	27	39	40	44	NA	estimate coverage, although
	Reported data 1989	70	40	50	70	NA	coverage may be increasing
Paraguay	DHS Apr - May 1990	66	52	75[2]	57	815	DHS in line with coverage year
	Reported data 1990	90	78	76[2]	69	NA	before, but 1990 reports over-
	Reported data 1989	58	68	72[2]	59	NA	estimate coverage considerably
Egypt	DHS Oct 1988 - Jan 1989	70	66	66	76	1593	Reported data appear serious over-
	Reported data 1988	80	87	87	84	NA	estimates, but DHS estimates also
	Reported data 1989	83	90	90	93	NA	difficult (see Boerma et al., 1990)
Tunisia	DHS Jun - Oct 1988	95	88	88	78	759	Reported data in agreement with DHS
	Reported data 1988	85	91	91	83	NA	
Uganda	DHS Sep 1988 - Jan 1989	70	38	38	49	946	Reported data in line with DHS
	Reported data 1988	77	40	41	49	NA	

[1]Reported data refers to information reported by facilities
[2]OPV2
NA = Not applicable
Sources: WHO (1989, 1990), Boerma et al. (1990), and DHS country reports.

sample coverage surveys, while reported data from health facilities often differ considerably from DHS estimates. The latter situation is most likely due to inaccuracy in the estimates based on routine reports.

4.8 CONCLUSIONS AND IMPLICATIONS

In general, DHS data appear to be a useful source of information on child vaccination. For most of the surveys in the period 1986-1990, data on specific vaccinations were not collected from the mother if no card was presented, which complicated estimation of national coverage levels. [This topic is addressed elsewhere (Boerma et al., 1990).] The accuracy of mother's recall of vaccinations is difficult to assess. Data from 7 of the 8 surveys suggest that coverage should be somewhat lower among children with at least some vaccinations, but no card seen, than among children with cards presented to the interviewer. In the Sudan DHS, there is some evidence that mothers tend to overreport vaccinations.

A major problem is the low percentage of children for whom a card could not be presented, even though the mother said she had one. In seven countries, less than half of the cards reported were actually seen, and in only 7 of 22 surveys were more than 70 percent of the cards actually presented to the interviewer. Not showing the card is more common for older children, but there appears to be no relationship between the relative birth order of the child in the health section and card presentation rates. Missing values were slightly more common for children who were not the last birth, indicating poorer interviewer performance, but the size of the absolute differences were small in all surveys.

In the DHS-II core questionnaire, information on specific vaccinations is collected from the mother if no card is presented. Further, if the card did not show all vaccinations the mother is asked whether the child had received any additional vaccinations. A final addition is that, if the mother had no card, she is asked whether she ever had a health card for her child.

References

Boerma, J.T., A.E. Sommerfelt, S.O. Rutstein, and G. Rojas. 1990. Immunization: Levels, Trends and Differentials in the Demographic and Health Surveys. In *DHS Comparative Studies No. 1.* Columbia, Maryland: Institute for Resource Development.

Boerma, J.T. and J.K. Van Ginneken. 1991. A Comparison of Substantive Results of Epidemiological and Demographic Survey Methods. Paper presented at seminar on Measurement of Maternal and Child Mortality, Morbidity, and Health Care: Interdisciplinary Approaches. IUSSP. Cairo, Egypt, 4-7 November 1991.

Henderson, R.H. and T. Sundaresan. 1982. Cluster sampling to assess immunization coverage: A review of experience with a simplified sampling method. *Bulletin of the World Health Organization* 60(2)53-60.

Lemeshow, S., A.G. Tserkovnyi, J.L. Tulloch, S.K. Dowd, S.K. Lwanga and J. Keja. 1985. A computer simulation of the EPI survey strategy. *International Journal of Epidemiology* 14(3): 473-481.

World Health Organization. 1989. EPI Information System. Geneva.

World Health Organization. 1990. EPI Information System. Geneva.

CHAPTER 5

The Quality of Data on Child Morbidity and Treatment in DHS-I Surveys

J. TIES BOERMA
JEROEN K. VAN GINNEKEN

Acknowledgments

We wish to acknowledge Roy Miller and Shea Rutstein for their comments on this paper.

Diarrhea and respiratory infections are among the leading causes of death in childhood in developing countries. Therefore, data on the prevalence of these illnesses and on the health-treatment seeking behavior during episodes of illness are important for health programs. In the first phase of the Demographic and Health Surveys project (DHS-I, 1984-1990), data on morbidity and treatment patterns were collected for all living children under five years of age. Most surveys included a question on diarrhea prevalence, and about half of the surveys collected information on respiratory symptoms (cough, difficult breathing) and fever.

Measuring disease prevalence (or incidence) in cross-sectional surveys is difficult. Seasonality fluctuations and recall problems affect estimates of disease occurrence. In DHS, the primary objective of the section on morbidity was to assess treatment patterns. Yet, this evaluation of the quality of morbidity and treatment patterns focuses on prevalence data. Methods to evaluate the quality of treatment data are not readily available, and there are more opportunities to assess the quality of morbidity reporting. However, the quality of treatment data depends to a large extent on the quality of the morbidity data.

The first part of this chapter is a review of the available DHS information on diarrhea. The questions on the prevalence of diarrhea are reviewed, followed by an assessment of the effect of child fostering on morbidity reporting. The issue of over- or underreporting of diarrhea within a two-week recall period is addressed by examining the ratio of diarrhea in the last 24 hours versus diarrhea terminated within a two-week recall period. In addition, the quality of reporting is evaluated by comparing diarrhea prevalence rates with treatment rates. In some surveys, a question on the duration of diarrhea was included. The amount of heaping at one week is used to assess the quality of these data. Evaluating the quality of diarrhea treatment data cannot be done in detail since no methods are available. The questions asked differ from survey to survey, and the effects of their variability on treatment rates are assessed. In addition, proportions with missing values will be taken into account.

In the second part of this chapter, the quality of the data on fever and respiratory symptoms is evaluated. The approach is similar to the one taken for diarrhea, but less extensive, since fewer surveys included these topics and, if included, fewer questions were asked on fever and respiratory symptoms.

5.2 DIARRHEA

5.2.1 Questions on Diarrhea Occurrence

The prevalence of diarrhea was determined by first asking the mothers of all living children under the age of 5 years whether the child had had diarrhea in the last 24 hours (Table 5.1). If the answer was negative, the interviewer then asked whether the child had had diarrhea during the last 2 weeks. No diarrhea data were collected in Indonesia and in seven countries different questions were asked. For example, the surveys in Mexico, Ondo State (Nigeria), and Senegal only asked about diarrhea in the last two weeks, in Liberia and Ecuador, the last four weeks, and in Egypt, one week. In Bolivia, if the child had no diarrhea in the last 24 hours, the mother was asked when the child had diarrhea last.

In most surveys the judgement concerning what is an episode of diarrhea was made by the respondent. However, in Zimbabwe, a definition was provided to the respondent, i.e., at least three stools a day, and in Ondo State, Nigeria the number of stools on the worst day of the episode was asked. Mother's perception of whether the diarrhea was mild or severe was used in Egypt and Uganda. In Bolivia, Egypt, and Sudan the question was asked whether there was blood in the stools, which would distinguish certain types of nonviral diarrhea (e.g., shigellosis) from the acute, watery diarrhea.

In nine surveys, questions were asked about the duration of the episode of diarrhea in the last two weeks. Such data are more meaningful if a distinction is made between duration of episodes that are still continuing (duration-to-date) and duration of terminated episodes (completed duration). It was not possible to make this distinction in Ondo State, Nigeria, since there was no question on the presence of diarrhea in the last 24 hours. In Botswana, Kenya, Sudan, and Uganda, data were only collected for duration-to-date for current episodes ("How many days ago did it start?"). In Bolivia, Egypt, and Guatemala, if diarrhea had stopped during the two weeks before the survey mothers were also asked how many days the episode had lasted (in Egypt the recall period was one week).

5.2.2 Don't Know Responses Due to Child Fostering

Table 5.2 presents the percentages of children under five years with missing responses and of mothers who did not know whether they had had diarrhea in the last two weeks. Missing values are observed for less than 1 percent of the children in all but two countries: Mali (2 percent) and Trinidad and Tobago (2 percent).

There is considerable variation in the percentage of don't know responses. They are rare in Egypt, Guatemala, Mexico, Morocco, Sri Lanka, Sudan, and Tunisia (less than 1 percent), but in seven countries they accounted for 3 or more percent of the mothers. This problem is particularly common in Botswana (12 percent), Liberia (9 percent), Uganda (8 percent), Bolivia (8 percent), and Zimbabwe (7 percent).

Table 5.1 Questions asked concerning diarrhea occurrence in children under five years of age, Demographic and Health Surveys, 1985-1990

Country	Diarrhea in last 24 Hours	Diarrhea in last 2 Weeks	Duration of Episode	Severity/Type of Diarrhea
SUB-SAHARAN AFRICA				
Botswana	yes	yes	yes	
Burundi	yes	yes	no	
Ghana	yes	yes	no	
Kenya	yes	yes	yes	
Liberia	no	4 wks	no	
Mali	yes	yes	no	
Ondo State, Nigeria	no	yes	yes	N of stools
Senegal	no	yes	no	
Togo	yes	yes	no	
Uganda	yes	yes	yes	Mild or severe
Zimbabwe	yes	yes	no	Defined as at least 3 stools/day
NORTH AFRICA				
Egypt	yes	1 wk	yes	Mild or severe; blood in stool, etc.
Morocco	yes	yes	no	
Sudan	yes	yes	yes	Blood in stool
Tunisia	yes	yes	yes	
ASIA				
Indonesia	no	no	no	
Sri Lanka	yes	yes	no	
Thailand	yes	yes	no	
LATIN AMERICA/CARIBBEAN				
Bolivia	yes	yes[1]	yes	Blood in stool
Brazil	yes	yes	no	
Colombia	yes	yes	no	
Dominican Republic	yes	yes	no	
Ecuador	no	yes[2]	no	
El Salvador	no	yes	no	
Guatemala	yes	yes	yes	
Mexico	no	yes	no	
Peru	yes	yes, 15 days	no	
Trinidad & Tobago	yes	yes	no	

[1] "When was last diarrhea episode?"
[2] Last births only.

Table 5.2 Percent of children under five years with missing or don't know (DK) responses for diarrhea in last two weeks and percent with don't know responses, by fostering status, Demographic and Health Surveys, 1985-1990

Country	Diarrhea in last 2 Weeks		Percent Usually Not with Mother	Percent DK		Number of Children
	DK	Missing		If with Mother	If Not with Mother	
SUB-SAHARAN AFRICA						
Botswana	11.8	0.7	15.4	1.0	71.2	3069
Burundi	1.2	0.3	0.8	0.6	67.7	3502
Ghana	2.3	0.8	4.2	0.3	48.7	3690
Kenya	1.0	0.8	2.4	0.5	22.2	6589
Liberia	8.6	0.4	11.3	0.7	70.3	4307
Mali	2.1	2.1	3.3	0.2	58.2	2905
Ondo State, Nigeria	1.9	0.0	4.0	0.0	45.1	3018
Senegal	4.7	0.1	5.7	0.9	66.7	3708
Togo	2.0	0.9	3.2	0.3	55.6	2803
Uganda	7.8	0.1	7.8	1.4	83.7	4373
Zimbabwe	7.0	0.4	6.8	1.2	87.0	3164
NORTH AFRICA						
Egypt	0.0	0.3	0.2	0.0	0.0	8009
Morocco	0.4	0.6	0.9	0.3	10.2	5602
Sudan	0.9	0.4	0.7	0.7	22.0	6062
Tunisia	0.1	0.0	0.2	0.1	0.0	4250
ASIA						
Sri Lanka	0.4	0.7	1.2	0.3	7.4	3877
Thailand	2.0	0.4	2.7	0.3	62.2	3520
LATIN AMERICA/CARIBBEAN						
Bolivia	7.7	0.2	0.9	7.5	30.9	5205
Brazil	1.8	0.2	2.7	0.1	65.4	3224
Colombia	1.6	0.5	2.6	0.2	52.9	2616
Dominican Republic	3.9	0.6	7.6	0.8	41.9	4105
Ecuador	a	0.3				1796
El Salvador	a	0.3	b	b	b	3235
Guatemala	0.3	0.0	0.9	0.0	28.2	4230
Mexico	0.4	0.0	b	b	b	5316
Peru	1.3	0.0	1.3	0.7	45.9	2836
Trinidad & Tobago	1.0	1.7	3.5	0.4	15.9	1887

[a] No code for don't know.
[b] No data on fostering.

Child fostering is the most important reason for a lack of mother's knowledge about the health status of her child(ren), as becomes evident from the last three columns of Table 5.2. The majority of mothers whose children did not usually live with them did not know whether their child(ren) had had diarrhea. The percentage of "don't know" responses is low if the child usually lives with the mother. For example, in Botswana only about 1 percent of the mothers whose child usually stays with them did not know whether the child had diarrhea in the last two weeks before the survey, whereas if mother and child were not usually together 71 percent did not know.

The only exception is Bolivia, where 8 percent of the mothers did not know whether their child(ren) had had diarrhea in the last two weeks, even though the child usually stayed with them. In part, this may be due to the slightly different question asked in Bolivia, i.e., if the child did not have diarrhea in the last 24 hours, when was the last episode? This question replaced the more specific questions on diarrhea in the last two weeks. As a result, 24 percent of all mothers said their child had never been ill with diarrhea, and an additional 8 percent did not know when the last episode occurred. It seems that this type of open question does not lead to satisfactory data on diarrhea in the last two weeks before the interview.

5.2.3 Duration of Diarrheal Episodes

Data on the duration of diarrhea among children with diarrhea in the 24 hours before the survey were collected for eight sur-

Table 5.3 Percent missing values and don't know (DK) responses among children under five years of age with diarrhea in the last 24 hours, by number of days since onset of diarrhea, Demographic and Health Surveys, 1986-1990

Country	Missing	DK	0	1	2-5	6	7	8	9-12	13	14	15	16-20	>20	Total	Number of Children
Botswana	1.3	3.0	1.1	19.4	54.9	1.6	9.0	1.1	1.8	.5	4.3	.0	.5	1.6	100	128
Kenya	8.5	2.9	2.0	12.7	46.7	1.5	12.4	1.1	2.0	.3	4.6	.2	.3	2.5	100	441
Uganda	0.6	2.6	4.8	11.7	47.4	3.1	17.1	0.6	3.2	.4	5.5	.0	.6	2.3	100	614
Egypt	0.0	-	10.4	4.1	54.6	9.1	18.8	.3	.3	.0	.0	1.2	.9	.4	100	543
Sudan	1.1	1.5	1.8	9.0	59.3	2.7	10.1	.3	6.8	.1	.5	3.4	1.2	2.2	100	1096
Tunisia	0.0	-	.0	10.4	66.5	2.7	11.1	1.6	3.4	.0	.7	3.6	.0	.0	100	442
Bolivia	0.0	1.4	4.0	15.7	55.1	3.0	11.1	.6	2.3	.0	2.3	1.5	.5	2.7	100	807
Guatemala	0.0	-	2.1	14.3	52.4	2.3	4.4	9.0	4.4	.0	1.6	6.0	1.1	2.1	100	435

- Dash indicates no response category.

veys (Table 5.3). Duration data may be important to assess the extent to which chronic diarrhea is a problem.[1] Missing values are seen to present a problem in Kenya, with 9 percent missing. (Uganda is not included in Table 5.3, since the duration data were not included in the standard recode data file.) "Don't know" responses were given for an additional 3 percent of the children with current diarrhea in Kenya and Botswana. In three surveys (Egypt, Tunisia, and Guatemala) there was no coding category for "don't know."

Heaping at 7 days is common in all surveys except Guatemala, where it occurs at 8 days. Heaping at 7 days most likely occurs because many mothers responded that the diarrhea started 1 week ago. The percent using this response is moderate in most surveys, typically 9-12 percent. In Egypt, heaping is rather serious, with 19 percent of responses at 7 days, 9 percent at 6 days, and almost no cases starting more than one week ago.[2] In all surveys, except Egypt, there appears to be a deficit at 0 days, i.e., the day of the interview, which on the average is half a day. New cases of diarrhea might not have been recognized as such or might have been reported as having started one day ago.

The proportion of children having diarrhea for at least two weeks varies from 2 percent in Botswana to 9 percent in Guatemala. In all countries the proportion of children having diarrhea for at least three weeks is considerably lower and varies from none (Tunisia) to 3 percent in Bolivia.

[1] Chronic diarrhea usually is defined as diarrhea of at least two or three weeks duration.

[2] In two DHS surveys, Bolivia and Egypt, data on duration of ongoing episodes of diarrhea as well as ending date and duration of terminated episodes were collected. Daily prevalence and incidence of diarrhea can be calculaated (Boerma et al., 1991a). In Bolivia, incidence declined considerably if the recall period was longer than 2-3 days. In Egypt, there was a massive heap of cased starting seven days before the survey, which actually led to increasing prevalence of diarrhea within the one-week period with peaking at seven days before the survey and almost nothing thereafter. Such a pattern is very unlikely.

For mothers it is difficult to recall the exact termination of more distant episodes of diarrhea. In Bolivia and the experimental DHS surveys in Peru and the Dominican Republic, answers in weeks ago were recorded as such and not converted into days by the interviewer. A significant proportion of women responded in terms of 1 or 2 weeks ago. What respondents mean by 2 weeks ago may vary from culture to culture. Assuming that responses of "2 weeks ago" refer to the period 11-17 days before the survey (1.5-2.5 weeks), diarrhea prevalence in the last 2 weeks will be overestimated by about 2 to 7 per cent, if all 2-week responses are included in the 2-week recall period. Studies with 1-week recall periods will have similar problems.

5.2.4 Current and Terminated Diarrheal Episodes

The prevalence data can be used to evaluate the quality of the DHS data for diarrhea prevalence in both the last 24 hours and in the remainder of the last two weeks. The ratio of the proportions of children with diarrhea in the last 24 hours and in the period 2-14 days before the survey is a valuable indicator of data quality. In addition, as will be shown next, it is possible to use this ratio to estimate the duration of diarrhea. In a prospective study the 2-week prevalence (P_{14}) equals the sum of the point prevalence (existing cases) at the beginning of the period (P_1) and the incidence during the remainder of the period (I_{13}). For the retrospective data collected in DHS surveys, the diarrhea prevalence in the last 24 hours is equal to P_1 and the diarrhea cases that terminated 2-14 days before the survey are equal to I_{13}, if steady-state conditions prevail. Under these conditions (which implies constant prevalence and incidence during the last month or so), the number of new occurrences is equal to the number of terminated cases during the same period (Kleinbaum et al., 1982). The duration of a diarrheal episode (D) can be estimated from the relationship between prevalence (P) and incidence (I) as follows:

$$P = I * D / (1 + I * D)$$ (Rothman, 1986)

which leads to $P = I * D$ for rare conditions.

However, diarrhea is not a rare condition among children in many developing countries. Thus,

$D = P / I * (1 / (1-P))$, which for this study can be written as:

$$D = P_1 / (I_1 * (1-P_1))$$
$$= P_1 / ((I_{13}/13) * (1-P_1))$$
$$= 13 * P_1 / (I_{13} * (1-P_1)).$$

The ratio of diarrhea prevalence in the last 24 hours to diarrhea terminated at days 2-14 before the interview will be referred to as the CT ratio (Current/Terminated = P_1 / I_{13}).

The prevalence of diarrhea among children under five years for the two weeks preceding the survey varied from less than 10 percent in Trinidad and Tobago and Sri Lanka to well over 30 percent in Mali and Peru (Table 5.4). The CT ratio varied considerably between the countries, from 0.51 in Trinidad and Tobago to 1.65 in Guatemala. Mean durations reported by longitudinal studies of diarrhea in children are usually on the order of 5-6 days (Black et al., 1989, Snyder and Merson, 1982). These correspond to CT ratios of less than 0.50. Only two surveys (Sri Lanka and Trinidad and Tobago)are less than 0.60, which corresponds to a calculated duration of diarrheal episodes of about 7 days. Brazil, Botswana, Thailand, and Zimbabwe have calculated durations from 8 to 11 days. All other countries have calculated durations of 12 days or more, and Guatemala, Mali, Morocco, Sudan, and Uganda are even over 20 days. Therefore, most surveys show durations of diarrhea that are too long in comparison with the 5-6 days found in epidemiological studies.

Table 5.4 Diarrhea prevalence for the two weeks preceding the survey (last 24 hours, 2-14 days before survey, and total), ratio of diarrhea in last 24 hours to diarrhea 2-14 days ago (CT ratio), and indirect estimate of duration of diarrhea episodes (weighted data) among children 1-59 months of age, Demographic and Health Surveys, 1986-1990

	Percent with Diarrhea					
Country	Last 24 Hours	2-14 Days	Total Last 2 Weeks	CT Ratio	Estimated Duration (days)	Number of Children
SUB-SAHARAN AFRICA						
Botswana	4.8	6.5	11.3	0.74	10.1	2648
Burundi	8.4	9.2	17.6	0.91	13.0	3403
Ghana	13.9	13.1	27.0	1.06	16.0	3529
Kenya	6.8	6.2	13.0	1.10	15.3	6390
Mali	20.2	15.7	35.9	1.29	21.0	2736
Togo	14.6	15.7	30.3	0.93	14.2	2688
Uganda	15.4	11.0	26.4	1.40	21.5	3984
Zimbabwe	9.5	11.8	21.3	0.81	11.6	2906
NORTH AFRICA						
Morocco	17.7	11.4	29.1	1.55	24.5	5505
Sudan	18.5	12.1	30.6	1.53	24.4	5885
Tunisia	10.5	10.2	20.7	1.03	15.0	4208
ASIA						
Sri Lanka	2.2	3.8	6.0	0.58	7.7	3820
Thailand	6.3	9.8	16.1	0.64	8.9	3416
LATIN AMERICA/CARIBBEAN						
Bolivia	16.9	13.6	30.5	1.24	19.4	4753
Brazil	7.6	9.6	17.2	0.79	11.1	3141
Colombia	10.0	9.2	19.2	1.09	15.7	2527
Dominican Rep.	14.3	12.0	26.3	1.19	18.1	3878
Guatemala	10.4	6.3	16.7	1.65	24.0	4170
Peru	16.6	16.0	32.6	1.04	15.8	2778
Trinidad & Tobago	2.1	4.1	6.2	0.51	6.8	1819

Recall errors may vary by the educational characteristics of the respondent. For example, illiterate mothers may have been more likely to misinterpret (extend) the 24-hour recall period, including diarrhea episodes that ended more than 24 hours ago in their answers to the first survey question on diarrhea and resulting in a higher CT ratio. Underreporting may also be more common among illiterate mothers. Table 5.5 presents the CT ratio by mother's level of education for children 6-35 months. This age group was selected because the CT ratio tended to be higher for children under 6 months and lower for children 36-59 months, compared with children age 6-35 months. In 15 of 18 countries women with no education had higher CT ratios than women with primary education; in 11 of 15 surveys women with secondary education had lower CT ratios than women with no education. There is no consistent difference between primary and secondary education. The countries for which the inverse relationship between CT ratio and mother's level of education are most apparent are Dominican Republic, Guatemala, Kenya, Sudan, Togo, and Zimbabwe.

Table 5.5 CT Ratio by mother's level of education among children 6-35 months, Demographic and Health Surveys, 1986-1990

Country	None	Primary Schooling	Secondary Schooling or More
SUB-SAHARAN AFRICA			
Botswana	0.44	1.27	0.60
Burundi	0.91	0.72	-
Ghana	1.22	0.94	-
Kenya	1.47	1.07	0.75
Mali	1.37	1.48	-
Togo	1.11	0.94	0.63
Uganda	1.35	1.28	1.54
Zimbabwe	0.89	0.73	0.66
NORTH AFRICA			
Morocco	1.62	1.05	1.79
Sudan	1.78	1.28	1.13
Tunisia	1.02	1.36	0.48
ASIA			
Sri Lanka	0.68	0.38	0.63
Thailand	0.71	0.62	0.84
LATIN AMERICA/CARIBBEAN			
Bolivia	1.57	1.18	1.44
Brazil	0.95	0.77	0.86
Colombia	-	1.12	1.02
Dominican Rep.	3.17	1.30	0.95
Guatemala	1.78	1.43	0.60
Peru	1.57	1.07	1.10
Trinidad & Tobago	-	0.47	0.55

- Dash implies N < 100.

The high CT ratio might have been caused by serious underreporting of diarrhea cases that terminated 2-14 days before the interview. Additional evidence of omission of terminated cases of diarrhea was found in the Bolivia DHS survey: data on daily prevalence and incidence of diarrhea within the two-week recall period showed a rapid decline for the period more than 2-3 days before the interview (Boerma et al., 1991a). The decline in prevalence in the Bolivia DHS survey is larger than that observed in studies in Guatemala (Martorell et al., 1976), Bangladesh (Alam et al., 1989), and Ethiopia (Freij and Wall, 1977).

Another possible explanation for the high CT ratios is overreporting of current/recent diarrhea, as was also observed in Ethiopia (Freij and Wall, 1977). There may be a tendency to report diarrhea that ceased recently (but more than 24 hours ago) as diarrhea cases in the last 24 hours, perhaps because the mother was unsure if the diarrhea has ended or if she believed that treatment would be provided. Such a misstatement of occurrence of events is more likely if the reference period of 24 hours before the interview is not well understood by the respondent. This may be reflected by the fact that in about half of the countries the CT ratio was much higher for women without formal education. The relatively high proportion of diarrhea cases reported by these women in the last 24 hours might be due to difficulty in interpreting specific time periods. It is noted that part of the difference could be genuine: chronic diarrhea could very well be more common among children of illiterate mothers.

5.2.5 Diarrhea Case Management Questions

Table 5.6 provides a summary of the main questions on diarrhea case management. In 11 surveys the mother was specifically asked whether she continued breastfeeding during diarrhea. Questions concerning the amount of fluids and solids given to the child during the diarrhea episode were asked in 17 surveys (Peru only about solids). In 10 of these 17 surveys, it was specifically asked whether the mother increased or decreased the amount of fluids and solids. In seven surveys, no specific questions were asked, but the fluid and feeding practices were coding categories of a question on what the mother did to treat the diarrhea.

In all surveys except for Ecuador, questions were posed about the use of solutions of prepacked oral rehydration salts (ORS solution) and recommended home-made solutions (mostly a sugar- and salt-water solution). In Zimbabwe, only home solution use was included, since the national health policy does not promote ORS packet use. Three surveys did not ask about home solution. Specific questions on both ORS and home solutions were asked in five countries, while in nine surveys ORS but not home solution use was probed and included as a coding category in a general question on what was done to treat the diarrhea. In another eight surveys both ORS and home solution use were part of an open question. In addition, most surveys had coding categories for injection, antibiotics, other drugs, and traditional remedies.

Table 5.6 Questions on case management of diarrhea in children under five years of age, Demographic and Health Surveys, 1986-1990

Country	Breast-feeding Continued	Fluids More/ Less	Solids More/ Less	ORS[1]/Home Solution[2] Given	ORS/Home Solution Quantity	Taken Where	What Treatment[3]
SUB-SAHARAN AFRICA							
Botswana	yes	yes[4]	yes[4]	yes[5]	yes	yes[6]	yes
Burundi		yes[4]	yes[4]	yes[5]		yes[6]	yes
Ghana		yes[4]	yes[4]	yes[5]		yes[6]	yes
Kenya	yes	yes	yes	yes[4]	yes	yes	yes
Liberia				yes[4]			yes
Mali				yes[4]		yes[7]	yes
Ondo State, Nigeria		yes	yes	yes[4]		yes[7]	yes
Senegal				yes[4]		yes[7]	yes
Togo				yes[5]		yes[7]	yes
Uganda	yes	yes	yes	yes[4]	yes	yes	yes
Zimbabwe	yes			SSS[4]		yes	
NORTH AFRICA							
Egypt	yes	yes	yes	ORS[5]	yes	yes	yes
Morocco				yes[5]		yes	yes
Sudan	yes	yes	yes	yes[4]		yes	yes
Tunisia	yes	yes	yes	ORS[4]		yes	yes
ASIA							
Sri Lanka	yes	yes[4]	yes[4]	yes[5]		yes[6]	yes
Thailand		yes[4]	yes[4]	yes[5]		yes[6]	yes
LATIN AMERICA & CARIBBEAN							
Bolivia	yes	yes	yes	yes[4]		yes[7]	yes
Brazil				yes[5]		yes[6]	yes
Colombia		yes[4]	yes[4]	yes[5]		yes	yes
Dominican Rep		yes[4]	yes[4]	yes[5]			
Ecuador							
El Salvador				yes		yes	yes
Guatemala	yes	yes	yes	yes[4]	yes	yes	yes
Mexico				yes[4]			yes
Peru	yes		yes[4]	yes[4]		yes[6]	yes
Trinidad and Tobago		yes[4]	yes[4]	yes[5]		yes[6]	yes

[1]ORS = Prepackaged oral rehydration salts.
[2]Home-made solution from measured amounts of sugar, salt, and water and other recommended home fluids.
[3]Includes drug treatments, traditional remedies and others.
[4]The subject was part of an open question.
[5]ORS packets use was probed, but home-made solutions was part of an open question.
[6]Traditional health services use not included as coding category.
[7]Health facilities part of a question on what was done to treat the diarrhea.

In most surveys the mother was asked where she took her child with diarrhea. In six surveys there was no coding category for traditional medical practitioners. In five surveys, the utilization of health facilities was not asked specifically and there was only part of a general question on what was done to treat the diarrhea. Finally, almost all surveys included a question on the kind of treatment given, including use of drugs.

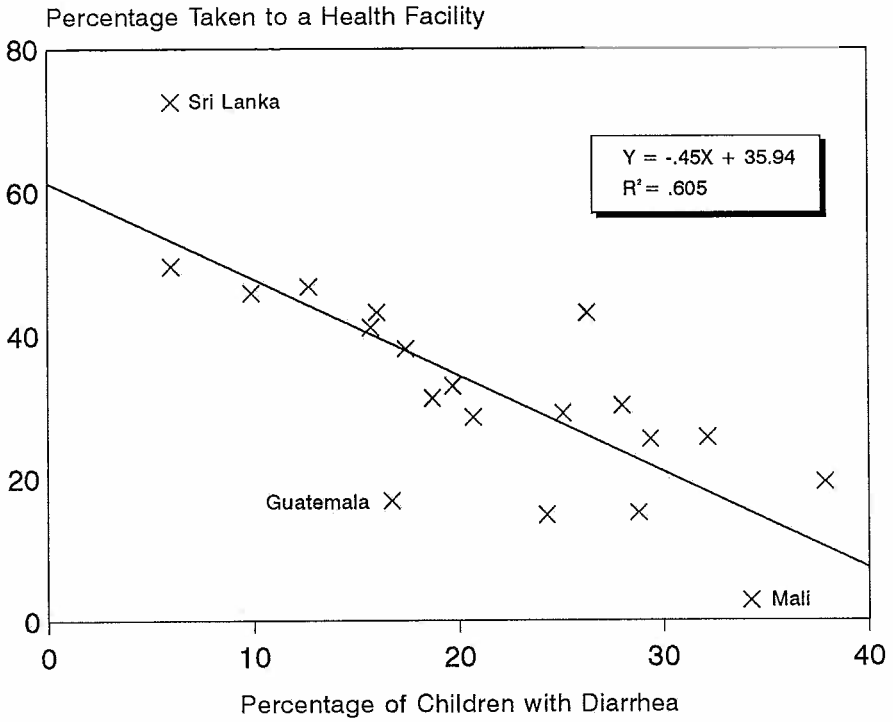
The way in which the question was asked impacts the results greatly, as was shown in Boerma et al. (1991b). In particular, the earlier DHS-I surveys differ from the later surveys. In DHS-II all diarrhea case management issues are asked for specifically.

Missing values and don't know responses are rare for the diarrhea case management questions (data not shown), and do not present a problem for the analysis.

5.2.6 Prevalence and Treatment

In Figure 5.1 the proportion of children with diarrhea taken to a medical facility is plotted against the level of diarrhea prevalence. There is a fairly consistent relationship between the two variables: the higher the level of diarrhea prevalence in a country, the lower the percentage visiting a medical facility ($R^2 = 0.46$, for 22 surveys).

Figure 5.1 Two-week diarrhea prevalence among all children 1-59 months by percentage taken to health facility among children with diarrhea, Demographic and Health Surveys, 1986-1989



Two explanations can be proposed. First, the relationship may be an effect of a common cause. A country with a poor overall development level has, for example, inadequate water supply and poor hygienic conditions for the majority of the population and diarrhea is very common. Similarly, retarded development has led to a poor health services infrastructure and thus services are not available to most sick children. The second, more tentative, explanation may be that there are different reporting tendencies, which vary between countries and cultures. In countries with high levels of diarrhea, larger numbers of less severe cases are reported, as suggested by the lower levels of medical services utilization. The DHS data certainly do not provide support to the hypothesis that in populations where diarrhea is very common, mothers are less likely to report mild episodes (in this case the decline of the regression line in Figure 5.1 would be much smaller). These observations also suggest that reporting of diarrhea may obscure results on treatment practices, which cannot be considered independent of the quality of morbidity reporting.

5.2.7 Treatment by Duration

The primary aim of the questions on diarrhea in the DHS surveys, however, is to assess treatment patterns. As in most other studies a recall period of two weeks was selected; this time is considered to offer the best balance between the quality of information that can be obtained on treatment (best for current or very recent illness) and the representativeness of that treatment information (possibly best for recent, but not current, episodes). In addition, sample size considerations play a role. Selection of a two-week recall period implies that treatment patterns are assessed jointly for a mixed group of sick children: diarrhea that has a) terminated, b) just started, and c) been present for a while and still continues. Elsewhere, DHS data have shown that there are no major differences in treatment patterns for children with terminated diarrhea and those with current diarrhea of at least two days duration (Boerma et al., 1991a). Both could be used to evaluate treatment practices. However, the treatment patterns for children with current diarrhea of less than 2 days duration differ and can be analyzed separately to assess home practices in the early stages of diarrhea. It should also be taken into account that there appears to be underreporting of diarrhea in the first 1-2 days of illness, as was shown for five DHS countries (Boerma et al., 1991a). This may be a recognition problem (by the mother), which has implications for health programs: if the diarrhea is not recognized as an illness it will not be treated as such.

5.2.8 External Comparison

An extensive comparison of data on diarrhea occurrence in demographic and epidemiological surveys has been done by Boerma and Van Ginneken (1992). Reviewing epidemiological surveys on diarrhea, the authors showed that a consistent definition of diarrhea was lacking. Different definitions were used in several epidemiological surveys, and this had considerable

impact on the resulting diarrhea incidence, prevalence, and duration. Moreover, epidemiological studies tend to concentrate on small populations, which are usually at a higher risk of diarrhea (e.g., urban poor). Therefore, comparing epidemiological and DHS survey data has to be done cautiously. In general, it was found that levels of diarrhea prevalence obtained in the DHS surveys are in the same (wide) range as prevalences reported in longitudinal epidemiological studies. Prevalence of diarrhea in the past 24 hours tends to be higher in DHS than in the epidemiological studies.

5.3 RESPIRATORY ILLNESS AND FEVER

Questions on the presence of respiratory symptoms and fever were not asked in all surveys. Respiratory symptoms were asked in 15 surveys, of which 10 are in sub-Saharan Africa (Table 5.7). There was considerable variability in the type of questions, which complicates comparability of results. The reference period was four weeks for most surveys and two weeks in Sudan and Togo. In Bolivia, the mother was asked whether the child had a cough in the last 24 hours. If not, she was asked when was the last time the child had had a cough and the response was recorded in days, weeks, or months ago. In Ecuador, the mother was only asked about the prevalence of a cough. In eight surveys, the prevalence of either (severe) cough *or* breathing difficulties was recorded, and in two surveys only breathing difficulties were asked for (Mali and Togo). In four countries (Bolivia, Egypt, Sudan, and Zimbabwe) it is possible to distinguish "cough only" from "cough with difficult breathing."

The main objective of these questions on the prevalence of respiratory symptoms is to assess treatment practices of children who have symptoms of acute lower respiratory infection (mostly pneumonia). Key symptoms of pneumonia are cough, rapid

Table 5.7 Questions asked on prevalence of respiratory symptoms and fever and related treatment practices, Demographic and Health Surveys, 1986-1990

Country	Respiratory Illness Symptoms in Last 4 Weeks	Where Taken	What Given	Fever in Last 4 Weeks	Where Taken	What Given
SUB-SAHARAN AFRICA						
Botswana	Severe cough or difficult or rapid breathing	yes	yes	yes	yes	yes
Burundi	Severe cough, rapid or difficult breathing	yes	yes	yes	yes	yes
Ghana	Severe cough or difficult or rapid breathing	yes	yes	yes	yes	yes
Kenya	Severe cough or difficult or rapid breathing	yes	yes	yes	yes	
Liberia	Cough or difficult breathing		yes	yes		yes
Mali	Difficult breathing	yes[a]	yes	yes	yes[a]	yes
Ondo State,Nigeria	Severe coughing and/or difficult breathing		yes	yes		yes
Senegal				b		
Togo	Difficult or rapid breathing; last 2 weeks		yes	yes[c]		yes
Uganda	Severe cough or difficult or rapid breathing	yes	yes	yes	yes	yes
Zimbabwe	Cough; fast/difficult breathing; noisy breathing; blocked/runny nose; sore throat; earache	yes	yes	yes	yes	yes
NORTH AFRICA						
Egypt	Cough; difficulty breathing during cough	yes				
Sudan	Cough; faster than normal breathing during cough	yes	yes	yes[c]	yes	yes
LATIN AMERICA/CARIBBEAN						
Bolivia	Cough; difficult breathing during cough; rapid breathing during cough	yes	yes			
Colombia	Severe cough or difficult or rapid breathing (only for last births)	yes	yes	yes	yes	yes
Ecuador	Cough (last births only)					

[a] The subject was part of an open question
[b] Survey included question on malaria during the last cold season (0-6 months before the survey)
[c] Reference period last two weeks

breathing, and fever, but all symptoms are not necessarily present, especially in young children. If the mother reports the presence of cough with difficult or rapid breathing, the child should be seen by a health worker to be evaluated for pneumonia (and treated). In some studies the presence of fever further enhanced the specificity of the diagnosis (e.g., Kalter et al., 1990).

The type of questions used strongly influenced the results on the prevalence of respiratory illness, and great variation can be observed (Boerma et al., 1991b). Questions on cough and difficult or rapid breathing were only asked separately for children in Bolivia, Egypt, Sudan, and Zimbabwe. In the DHS-II surveys separate questions are asked about cough, difficult breathing, and fever.

Twelve countries, in which malaria was considered a public health problem, included a question on the prevalence of *fever* in the last four weeks. In two others, Sudan and Togo, the reference period was two weeks. In Senegal, the survey did not include a question on fever, but mothers were asked whether the child had malaria during the last cold season (0-6 months before the survey).

If the child had had cough and/or breathing difficulties or fever in the last four weeks, a question on where the child had been taken for treatment and what treatment had been given was asked. The quality of the data on type of treatment received cannot be evaluated adequately, partly because of the great variation in the questions used between countries and partly because of the nature of the questions. The results depend entirely on the mother's ability to recall the type of medicines given to her child. In some instances the distinct features of the medicine, e.g., an ORS packet or an injection (although the mother may not know what medicine is given) allow a reasonable recall. It becomes much more difficult when the mother has to recall what kind of syrup or pills her child has received. Color and taste may help to distinguish whether the syrup is cough, antibiotic, or chloroquin, but in many cases the identity may remain unknown. Cross-sectional surveys are probably not the best way to collect such data, and health facility exit surveys may provide more reliable information about those who visited a health clinic. However, the question on where the sick child was taken provides important information, which can be collected in cross-sectional surveys that use a short recall period.

Missing values and don't know responses for the questions on prevalence of cough (or difficult breathing), fever, and diarrhea are shown in Table 5.8. Missing values do not present a problem and are consistent for the three symptoms. Regarding don't know responses, one may have anticipated higher levels for respiratory symptoms and fever, since the recall period for these symptoms was four weeks in most surveys, as opposed to two weeks for diarrhea. This does not turn out to be the case. In fact, don't know responses were somewhat less common for cough and fever than for diarrhea in most surveys, perhaps indicating that diarrhea occurrence is more difficult to assess for mothers. The difference is most marked for Bolivia, Botswana, Uganda, and Zimbabwe. It can also be speculated that some interviewers might have tended to avoid the larger number of additional diarrhea case management questions by using don't know.

Table 5.8 Don't know responses and missing values for respiratory symptoms, fever, and diarrhea among children under five years of age, Demographic and Health Surveys, 1986-1990

	Don't Know			Missing		
	Resp. Symptom	Fever	Diarrhea	Resp. Symptom	Fever	Diarrhea
SUB-SAHARAN AFRICA						
Botswana	8.6	8.6	11.8	0.5	0.5	0.7
Burundi	0.7	0.8	1.2	0.2	0.2	0.3
Ghana	2.0	2.1	2.3	0.8	0.8	0.8
Kenya	1.0	0.6	1.0	0.9	0.8	0.8
Liberia	8.5	8.9	8.6	0.3	0.3	0.4
Mali	2.5	1.9	2.1	1.9	1.9	2.1
Ondo	1.9	1.9	1.9	0.1	0.1	0.0
Togo	1.6	1.7	2.0	0.7	0.8	0.9
Uganda	5.9	6.3	7.8	0.0	0.0	0.1
Zimbabwe	5.8	5.9	7.0	0.5	0.8	0.4
NORTH AFRICA						
Egypt	0.6		0.3	0.2		0.3
Sudan	0.4	0.5	0.4	0.1	0.1	0.4
LATIN AMERICA/CARIBBEAN						
Bolivia	5.1		7.7			0.2
Colombia	0.7	0.7	0.5	0.2	0.2	0.5

As with diarrhea, don't know responses for respiratory symptoms and fever were common in countries with high levels of fostering: Bolivia, Botswana, Liberia, Uganda, and Zimbabwe. In Bolivia, an open question was asked about when the child was ill with a cough the last time, if there had been no coughing in the last 24 hours. In addition to 5 percent responding don't know, 20 percent of the mothers said the child never had been sick with coughing. Interestingly, the proportion of women responding don't know to the diarrhea question is considerably higher in Bolivia: 8 percent. This difference may be due to differential recall for diarrhea and cough by mothers, but interviewer's errors are certainly a possibility.

Boerma and Van Ginneken (1992) compared data on respiratory illness occurrence in longitudinal epidemiological and cross-sectional demographic surveys. Their results show that the DHS surveys do have considerably higher prevalence of cough with difficult breathing than the pneumonia incidence/prevalence figures reported in epidemiological studies. The current questions on the prevalence of cough with difficult breathing (possibly with fever) appear to be the best approach to make the diagnosis of possible pneumonia based on interviews in DHS-type surveys. However, the specificity of these symptoms is low, and the estimates of pneumonia prevalence based on interviews are too high.

Data on fever prevalence in DHS surveys cannot be compared with other surveys, since very few data are available on fever prevalence outside the DHS surveys. Furthermore, fever is a very nonspecific symptom that can occur in conjunction with many infectious diseases.

5.4 CONCLUSION AND IMPLICATIONS

Morbidity is difficult to measure in a survey because it is subject to the respondent's bias. In DHS-I surveys, diarrhea prevalence in the last two weeks appeared to be in an acceptable range, but morbidity in the last 24 hours was overreported. This may partly be due to the order in which the diarrhea questions were posed: the 24-hour question was asked before the more general question. In DHS II, the order of the questions was changed, with the more general question being asked first.

Regarding respiratory illness, there is more variation in the questions on the symptoms used in the various DHS surveys than with the questions on diarrhea. This variation is partly responsible for the considerable differences in morbidity levels found in these surveys. In the second phase of DHS more standardized questions on respiratory infections are asked (on cough and difficult/rapid breathing), and indeed appear to lead to more consistent results.

The analysis of morbidity data by mother's education and in relation to reported treatment patterns also suggested reporting biases by education and other variables. Possibly, questions on the severity of illness might give a less biased reporting of diarrhea and a more useful assessment of treatment patterns. Concerning diarrhea, a question on the number of stools on the worst day of the episode or even the mother's subjective classification of the severity may be useful. Most DHS-I surveys, however, did not include such questions.

The analysis of the morbidity data in 27 DHS surveys shows that there are very few missing values, and with a few exceptions, small percentages of "don't know" responses. Insofar as there are "don't know" replies, they frequently occur in cases where the child was not living with the mother. These cases should be excluded from the analysis of morbidity data. [Note: DHS country reports always use all children in the denominator, including missing values and don't know responses.]

In eight surveys questions were asked on the duration of diarrhea episodes. Our analysis of these data shows several irregularities in distributions of replies, in particular heaping on durations of seven days. This limits the accuracy of this type of information. The primary use of the duration data is in the analysis of treatment data. Children who had either very short episodes or diarrhea that has just started (e.g., one day ago) could be excluded from the analysis of treatment data. On the other hand, it was shown that the effects of excluding very short episodes on treatment data for all cases in the last two weeks are limited. In DHS-II surveys, all morbidity questions (diarrhea and cough/difficult breathing) included a question on duration of the episode.

The recall of treatment patterns shows very few "don't know" answers, even though one would expect that the mother, in several instances, would not know what type of treatment (medicine) was given by the health worker. The reliability of data on the type of drug may therefore be questioned, but no method is available to assess the quality of such responses in cross-sectional surveys. The best evaluation of treatment practices in health facilities is probably an exit survey at a health facility (interviewing the mothers immediately after leaving the health facility and examining their records), complemented by survey data on the proportion of children with diarrhea or other symptoms that use health facilities. In the DHS-II core questionnaire, questions are asked about whether help was sought during the child's illness, where it was sought, and what type of treatment was given. Since, unlike in DHS-I, these questions were asked in the same way in most DHS-II surveys, a more detailed evaluation may be done and the utility of the questions on the type of treatment recalled by the mother can be more critically assessed.

References

Alam, N., F.J. Henry, and M.M. Rahaman. 1989. Reporting errors in one-week diarrhea recall surveys: Experience from a prospective study in rural Bangladesh. *International Journal of Epidemiology* 18(3): 697-700.

Black, R.E., G. Lopez de Romana, K.H. Brown, N. Bravo, O.G. Balazar, and H. Creed-Kanashiro. 1989. Incidence and etiology of infantile diarrhoea and major routes of transmission in Huascar, Peru. *American Journal of Epidemiology* 129: 785-799.

Boerma, J.T. and J.K. Van Ginneken. 1992. Comparison of substantive results from demographic and epidemiological survey methods. In *Measurement of Maternal and Child Mortality, Morbidity and Health Care: Interdisciplinary Approaches*. Edited by J.T. Boerma. 27-60. Proceedings of IUSSP seminar, Cairo, Liege: Derouaux-Ordina Editions.

Boerma, J.T., R.E. Black, A.E. Sommerfelt, S.O. Rutstein, and G.T. Bicego. 1991a. Accuracy and completeness of mother's recall of diarrhoea occurrence in preschool children in Demographic and Health Surveys. *International Journal of Epidemiology* 20(4): 1073-1080.

Boerma, J.T., A.E. Sommerfelt, and S.O. Rutstein. 1991b. *Childhood Morbidity and Treatment Patterns in Demographic and Health Surveys*. DHS Comparative Studies No. 4. Columbia, Maryland: Institute for Resource Development.

Freij, L. and S. Wall. 1977. Exploring child health and its ecology: The Kirkos study in Addis Ababa. *Acta Paediatrica Scandinavica*, Supplement 267:1-180.

Kalter, H.D., R.H. Gray, R.E. Black, and S.A. Gultiano. 1990. Validation of post-mortem interviews to ascertain selected causes of death in children. *International Journal of Epidemiology* 19(2):380-386.

Kleinbaum, D.G., L.L. Kupper, and H. Morgenstern. 1982. *Epidemiologic Research: Principles and Quantitative Methods*. Belmont, California: Lifetime Learning Publications.

Martorell, R., J.P. Habicht, C. Yarbrough, A. Lechtig, and R.E. Klein. 1976. Underreporting in fortnightly recall morbidity surveys. *Environmental Child Health* 22(3):129-134.

Rothman, K.J. 1986. *Modern Epidemiology*. Boston/Toronto:Little, Brown and Company Publishers.

Snyder, J.D. and M.H. Merson. 1982. The magnitude of the global problem of acute diarrheal disease: A review of active surveillance data. *Bulletin of the World Health Organization* 60(4):605-613.

CHAPTER 6

Assessment of the Quality of Breastfeeding Data in DHS-I Surveys

J. TIES BOERMA
A. ELISABETH SOMMERFELT

DHS-I surveys collected information on various aspects of breastfeeding practices, such as duration, frequency and timing, supplementation with liquids and solids and the use of bottles for feeding. Information on the duration of breastfeeding is collected in two ways. First, the respondent is asked whether she was still breastfeeding her most recent child at the time of the survey (current status). Second, retrospective information on the duration of breastfeeding is collected for children who are no longer breastfed.

Based on evaluation of World Fertility Survey and other data, it has been known that reported durations of breastfeeding are subject to several types of errors, including number preference for "round" durations, such as multiples of six months, and overstatement, i.e., breastfeeding durations longer than interbirth intervals and greater than ages at death or current ages. Understatement is also likely to occur in retrospective duration reports but its extent is difficult to ascertain directly. Because of the substantial amount of error that has been documented, the DHS program has elected to utilize only the current status report of breastfeeding in the survey reports. Using only the proportions of children currently breastfeeding can be calculated (Lesthaeghe and Page, 1980). Additionally, using just the number of children currently breastfeeding and the average monthly number of births, a prevalence-incidence mean duration can be calculated (Mosley et al., 1982). Because of the recognized errors in duration recall, the latter current-status-based measure of duration was used for the DHS-I reports. For the DHS-II reports, all three current-status-based measures of duration were reported, the median duration being the preferred measure for reasons noted below.

If sufficiently accurate, retrospective information on duration of breastfeeding can be used to estimate the effects of breastfeeding on child health and survival. Recall data on breastfeeding are also increasingly used in rapid epidemiological methods, such as case control studies (Huttly et al., 1990). For both these reasons, it is useful to evaluate the quality of the recall duration data collected in the DHS-I surveys.

In the DHS-I surveys, data on the use of supplements for breastfed children in the 24 hours preceding the interview and on the frequency of daytime and nighttime breastfeeding were also collected.

Our evaluation of the quality of the breastfeeding data in DHS-I surveys conducted in the period 1986-1990 focuses primarily on breastfeeding duration data. First, the questions used to obtain information on breastfeeding and supplementary feeding will be reviewed. Then, the various methods of calculating breastfeeding indicators will be compared, focusing on measures based on both current status and retrospective data. The quality of the data obtained is analyzed by looking at the frequency of occurrence of missing and inconsistent values, heaping of responses, and overlap of lactation and gestation. In the final section, data on supplementary feeding and breastfeeding frequency are analyzed.

6.1 QUESTIONNAIRE

Information was obtained regarding breastfeeding behavior for all the respondent's children born in the five years preceding the survey. For each child the respondent was asked if the child was ever breastfed, and if so, for how long. The questionnaire structure assumed that only the lastborn child could still be breastfed at the time of the survey. The questions asked in each survey are summarized in Table 6.1.

For children who were still breastfed at the time of the survey, questions were asked about liquids and foods given during the 24 hours preceding the survey. The DHS-I core questionnaire asked about: water, juice, powdered milk, cow's or goat's milk, other liquids, and solid or mushy food. For the surveys in many countries these questions were modified so that specific foods and liquids commonly used for infants and young children were asked about. In most instances, these country-specific questions can easily be translated into one of the standard categories. However, occasionally this is not possible, e.g., in Uganda a combined question was asked on whether the child had been given "any other liquids, or solid or mushy food." In this case it is not possible to know whether the child received "other liquids" or "solid/mushy food" or both. Finally, for any breastfed child given anything to eat or drink (other than breastmilk) during the 24 hours before the interview, the mother was asked whether any of these had been given in a bottle with a nipple.

Although the DHS-I questionnaires inquired about the child's food intake during the 24 hours preceding the survey, the mother was not asked whether these foods and liquids were given regularly. Information was also *not* collected to determine if a child sometimes, though not every day, received anything other than breastmilk. Hence, an individual child cannot be classified with complete certainty as exclusively breastfed. Therefore, DHS data most likely present an underestimate of the proportion of infants receiving other foods and an overestimate of the proportion exclusively breastfed. If the child sometimes received ritual foods, e.g., honey or sugar water, but not in the last 24 hours before the interview, he or she should be classified as "almost exclusively" breastfed. In a few DHS-I surveys, mothers were asked to recall the age when breastfeeding was supplemented by other liquids or solids on a regular basis.

DHS-I countries for which the appropriate data were not available were excluded from these analyses. For example, in the Guatemala survey no questions were asked about foods and liquids given to the child nor about the use of a feeding

Table 6.1 Summary of feeding questions used in DHS-I

	Breastfeeding (for all births in the last 5 years)				Number of Breast-feed-ings	Supplements for Lastborn in Last 24 Hours						
	Ever	Why Never	Duration	Why Stop		Plain Water	Juice	Powdered Milk	Cow/Goat Milk	Other Liquid	Solid Mushy	Bottle
SUB-SAHARAN AFRICA												
Botswana	+	+	+	+	+	+	+	+	+	+	+	+
Burundi	+		+	+	+	+	+	+	+	+	+	+
Ghana	+		+	+	+	+	+	+	+	+	+	+
Kenya	+	+	+	+	+	+	+	+	+	+	+	+
Liberia	a				+	+	+	+	+	+	+	+
Mali	+		+		+	+	+	+	+	+	+	+
Ondo	+	+	+	+	+	+	+	+	+	+	+	+
Senegal	+	a	+	+	+	+	+	+	+	+	+	+
Togo	+		+		+	+	+	+	+	+	+	+
Uganda	+	+	+	+	+	+	+	+	+	b	b	+
Zimbabwe	+	+	+	+	+	+	+	+	+	+	+	+
NORTH AFRICA												
Egypt	+	+	+	+	+	+	+	+	+	+	+	+
Morocco	+		+	+	+	+	+	+	+	+	+	+
Sudan	+	+	+	+	+	+	+	+	+	+	+	+
Tunisia	+		+	+	+	+	+	+	+	+		+
ASIA												
Indonesia	+		+		+	+	+	+		b	b	+
Sri Lanka	+	+	+	+	+	+	+	+	+	+	+	+
Thailand	+		+		+	+	+	+	+	+	+	+
LATIN AMERICA/CARIBBEAN												
Bolivia	+	+	+	+	+	+	+	+	+	+	+	+
Brazil	a		a		+	+	+	+	+	+	+	+
Colombia	+		+		+	+	+	+	+	+	+	+
Dominican	+		+		+	+	+	+	+	+	+	+
Ecuador	+		+		+	+	+	+	+	+	+	+
Guatemala	+	+	+	a								
Mexico	+		+		+	+	+	+	+	+	+	+
Peru	+		+		+	+	+	+	+	+	+	+
Trinidad	+	+	+	+	+	+	+	+	+	+	+	+

[a] Asked for last birth only.
[b] Implies both supplements were not asked separately but were put together.

bottle. The feeding questions in the Egypt questionnaire differed from those asked elsewhere. In Liberia the "ever-breastfed" question was only asked in reference to the lastborn child and the duration of breastfeeding was not determined. Data from El Salvador were not included because of incomparability with those from the other countries. No question was asked about bottle feeding in Indonesia.

In a number of surveys questions were asked about the reasons for never breastfeeding and for termination of breastfeeding. In addition, the number of nighttime and daytime feedings were asked for currently breastfed children.

6.2 CURRENT STATUS VERSUS RETROSPECTIVE DATA

The importance of specifying how the median or mean duration of breastfeeding is calculated has been shown in several studies (Trussell et al., 1992; Sommerfelt et al., 1991). It does make a critical difference whether the estimate is based on current status data or retrospective life table data, whether only living children or also deceased children are included, whether never breastfed children are included, and whether the sample is based on the last birth only or on all births within a specified period of time.

Both measures based on current breastfeeding status and measures using retrospective information on age at weaning have advantages and disadvantages (Trussell et al., 1992). The main source of bias for current status information is the reporting of children's ages (or dates of birth); retrospective reports of breastfeeding duration have several problems. The marked heaping of breastfeeding duration data on multiples of six months in retrospective surveys has been noted in several studies (Ferry, 1981; Lesthaeghe and Page, 1980). Re-interview surveys in Malaysia (Haaga, 1988) and Brazil (Huttly et al., 1990) have found inconsistencies between the answers in sub-

sequent survey rounds. In Malaysia, ever breastfed and duration of breastfeeding results were fairly consistent between subsequent survey rounds, but supplementary feeding data were less accurate. In Brazil, where prolonged breastfeeding is rare, about 30 percent of the cases were considered misclassified in subsequent survey rounds (1 and 3 years after the baseline interview). Both studies pointed to the possibility of differential biases by socioeconomic status, which could either obscure or over-emphasize genuine breastfeeding differences. In Malaysia, respondents had a lower digit preference if they had at least secondary education. Rural residents gave less reliable answers, even after controlling for education. The possibility of digit preference also increased with the length of the recall period, but this effect was smaller than the effect of education and residence (and ethnicity). In Brazil, overreporting of breastfeeding durations was more common among women of higher socioeconomic status.

A disadvantage of current status measures is the larger sampling variability compared with measures based on retrospective data. For instance, the proportion not breastfeeding may be higher among four-month-old infants than among five-month-old infants. Often, there is no monotonic decrease in breastfeeding with increasing age when current status information is used. However, as Trussell et al. (1992, p. 290) put it: "The precise extent of trade-off between bias and variance has ... not been determined."

Trussell and colleagues (1992) recently completed an extensive analysis of DHS and WFS data on duration of breastfeeding. Comparing current status measures with retrospective life-table measures for 21 DHS surveys they found that current status measures exceeded retrospective life-table measures in virtually all surveys. The mean duration of breastfeeding for all 21 surveys combined was 16.5 months if based on current status and 15.7 months if based on retrospective life-table measures; the corresponding figures for the medians were 15.4 and 14.2 months, respectively. Trussell et al. (1992) concluded that there is a tendency for retrospective reports to be biased downward.

A third measure of breastfeeding duration is the prevalence/incidence mean. The procedure for computing this mean is borrowed from epidemiology. It requires less detailed data for calculation than the current status mean, but its accuracy depends on stronger assumptions than are required for the current status mean. In epidemiology, the mean duration of an illness can be estimated by dividing its prevalence by its incidence. In the present case, the "disease" is the condition of exclusive, full, or any breastfeeding. Prevalence is defined as the average number of births per month. This average is usually estimated by summing the number of births over the period 1-24 or 1-36 months preceding the survey to overcome problems of seasonality and possible reference period errors. The prevalence/incidence mean duration in months of breastfeeding is estimated by dividing the number of children breastfed at the time of the survey by the average number of births per month. This method has been used in several DHS-I survey reports to estimate duration of breastfeeding. For a detailed assessment of the advantages and disadvantages of the prevalence/incidence mean compared with other measures we refer to Grummer-Strawn and Trussell (1990).

The issue of sampling variability using current status information is also important for indicators of breastfeeding practices during the first year of life. These indicators aim to measure the extent of exclusive breastfeeding during the first 4-6 months of life and the introduction of appropriate and adequate complementary foods by the second half of infancy. In an extensive analysis of DHS-I data, Sommerfelt et al. (1991) show that single-month age groups cannot be used in DHS surveys because of sampling variation. They argue that 4-month intervals are the preferred age group for most DHS surveys with sample sizes in the range of 4,000 to 8,000 respondents. Thus, the prevalence of exclusive breastfeeding is assessed among children 0-3 months, and the prevalence of breastfeeding with complementary foods (solid and mushy foods) is evaluated among children 6-9 months.

6.3 MISSING AND INCONSISTENT VALUES

Table 6.2 includes the data on duration of breastfeeding by survival status of the child at the time of the survey for children born in the previous five years, as they appear in the standard recode data files. Missing values are a minor problem for living children; only Senegal and Mali exceed 2 percent, and it is less than 1 percent for most countries.

The maximum breastfeeding duration allowed during the data editing was the interval between the date of birth of the child and the date of the interview. Cases that exceeded this duration were coded inconsistent. Inconsistent durations, i.e., the reported duration was impossible given the interview date, was observed for less than 1 percent of all children in most countries, but was slightly more common in Kenya, Mali (3 percent), Morocco, and Ondo State, Nigeria. "Don't know" responses were coded in only a few surveys; these have been classified as missing values in Table 6.2.

The situation for dead children is quite different. First, mothers could report that they breastfed their child until death. In nine surveys, it was reported that at least half of the deceased children were breastfed until death, and in 17 surveys this was the case for more than 40 percent. Missing values are a problem. More than 10 percent of the breastfeeding duration data are missing in 7 surveys: Ecuador (21 percent), Peru, Sri Lanka, Thailand, Togo, Trinidad and Tobago, and Zimbabwe. Only in Brazil, Dominican Republic, Guatemala, Ondo State (Nigeria), and Tunisia do missing values occur for less than 2

Table 6.2 Duration of breastfeeding by survival status for children born in the five years preceding the survey, Demographic and Health Surveys, 1986-1990

Country	Living Children							Dead Children						
	Never Breastfed	Still Breastfed	Recall Duration	Incons.	Missing	Total	Number of Children	Never Breastfed	Until Death	Recall Duration	Incons.	Missing	Total	Number of Children
SUB-SAHARAN AFRICA														
Botswana	2.4	33.9	62.0	0.3	1.3	100	3069	35.1	42.7	13.5	2.0	6.7	100	146
Burundi	0.5	46.3	51.9	0.3	1.0	100	3502	13.3	64.5	15.7	0.5	6.0	100	385
Ghana	0.9	40.5	57.4	0.2	1.1	100	3690	22.2	46.2	23.8	2.0	5.8	100	446
Kenya	1.1	36.5	60.4	1.1	0.9	100	6589	20.0	54.9	12.3	4.6	8.2	100	538
Mali	0.3	44.4	49.5	3.3	2.5	100	2905	12.0	59.6	15.6	3.0	9.8	100	537
Ondo St.,Nigeria	0.2	32.9	65.0	1.8	0.1	100	3018	12.9	37.1	47.0	3.0	0.0	100	264
Senegal	0.9	37.0	60.0	0.0	2.2	100	3708	13.8	59.4	22.3	0.0	4.5	100	579
Togo	0.7	44.0	54.2	0.1	1.0	100	2803	21.5	54.1	11.8	1.8	10.9	100	331
Uganda	0.3	38.0	61.1	0.2	0.4	100	4373	14.0	61.9	20.1	1.6	2.4	100	676
Zimbabwe	0.2	31.9	67.4	0.2	0.3	100	3164	19.6	45.4	16.0	2.1	17.0	100	194
NORTH AFRICA														
Egypt	6.0	31.4	62.3	0.0	0.3	100	8009	30.9	55.8	11.1	0.0	2.2	100	723
Morocco	3.8	26.5	66.7	2.0	0.9	100	5602	24.0	43.0	24.0	2.4	6.6	100	500
Sudan	0.6	35.7	62.7	0.4	0.6	100	6062	24.4	47.6	21.3	1.9	4.8	100	582
Tunisia	3.8	27.1	69.1	0.0	0.0	100	4250	32.2	30.4	35.7	0.0	1.8	100	227
ASIA														
Indonesia	3.0	43.5	52.8	0.1	0.6	100	7593	13.7	59.7	18.9	0.0	7.6	100	650
Sri Lanka	1.3	38.9	59.0	0.1	0.8	100	3877	29.5	50.0	9.7	0.0	10.8	100	104
Thailand	4.4	29.0	66.1	0.0	0.5	100	3520	34.9	43.7	9.4	0.0	12.1	100	132
LATIN AMERICA/CARIBBEAN														
Bolivia	2.1	31.0	66.7	0.0	0.3	100	5209	18.7	48.9	28.4	0.5	3.5	100	571
Brazil	10.8	15.8	73.0	0.1	0.2	100	3224	43.8	22.4	26.6	6.1	1.1	100	257
Colombia	5.8	19.1	73.8	0.6	0.6	100	2616	40.5	27.6	26.2	0.0	5.7	100	87
Dominican	7.9	17.2	74.7	0.1	0.0	100	4105	45.1	16.4	30.1	8.4	0.0	100	337
Ecuador	5.3	26.5	66.7	0.0	1.5	100	2849	31.2	29.2	18.8	0.0	20.8	100	202
Guatemala	3.0	38.3	58.5	0.1	0.1	100	4230	31.0	45.6	20.9	1.3	1.3	100	397
Mexico	15.5	19.3	64.9	0.1	0.1	100	5316	43.7	0.0	52.3	0.6	3.5	100	295
Peru	4.9	29.5	64.7	0.0	0.9	100	2836	21.0	24.7	37.6	4.7	11.9	100	295
Trinidad & Tob.	9.8	17.3	71.7	0.1	1.1	100	1887	62.7	8.5	13.6	0.0	15.3	100	59

percent of the deceased children. Inconsistent durations are observed for more than 2 percent of the deceased children in 8 surveys; for Brazil and the Dominican Republic, the figure was more than 5 percent.

Table 6.3 presents the proportion of births in the last five years with missing values for the breastfeeding duration variable by relative birth order of the child. The latter has been classified into last birth, next-to-last birth, and second-to-last births and before, within the five years prior to the survey. In virtually all countries the proportion having missing values increases noticeably with increasing relative birth order.

Multivariate analysis of factors affecting the likelihood of a missing value was also conducted for selected countries (results not shown). The covariates included in the analysis were survival status of the child, relative birth order (last, next-to-last, and second-to-last and higher), period of the survey (beginning, middle, or end), residence (urban, rural), mother's level of education (none, primary, secondary or higher) and the child's age (0-11, 12-23, 24-35, and 36-59 months). The results confirmed the bivariate results on the problem of missing values for dead children and by relative birth order, while no other covariate exerted a consistent, significant, influence on the dependent variable.

6.4 HEAPING

The amount of heaping of the reported durations of breastfeeding on multiples of six months among children not breastfed at the time of the survey are summarized in Table 6.4. The overall heaping index is the sum of reported durations of 6, 12, 18, 24, 30, and 36 months divided by all children with reported durations (times 100), as was done for the World Fertility Survey (WFS) (Ferry, 1981). The median duration of breastfeeding has to be taken into account when interpreting the results since, if the median duration is short, such as in Brazil (median duration about 5 months), heaping is potentially less than in countries where the median is near 24 months.

Considering the fifteen countries with the highest median durations of breastfeeding, all surveys have a heaping index in the range of 40 to 60, meaning that 40-60 percent of durations

Table 6.3 Missing values for breastfeeding duration by relative birth order (percentages), Demographic and Health Surveys, 1986-1990

Country	Last	Next to Last	Second to Last or Before	All
SUB-SAHARAN AFRICA				
Botswana	0.8	2.5	9.8	1.5
Burundi	0.7	2.0	7.2	1.5
Ghana	0.6	2.3	10.3	1.5
Kenya	0.9	1.6	5.2	1.5
Liberia	0.3	-	-	
Mali	0.5	6.1	17.6	3.5
Ondo State, Nigeria	0.1	0.0	0.8	0.1
Senegal	0.7	4.5	9.9	2.4
Togo	0.5	3.3	11.1	1.8
Uganda	0.1	1.4	1.7	0.7
Zimbabwe	0.8	1.9	2.9	1.2
NORTH AFRICA				
Egypt	0.2	0.6	2.3	0.5
Morocco	0.5	1.6	4.6	1.2
Sudan	0.7	1.5	0.9	1.0
Tunisia	0.0	0.0	1.1	0.1
ASIA				
Indonesia	0.6	2.2	4.1	1.1
Sri Lanka	0.4	2.3	4.3	1.0
Thailand	0.3	2.5	9.3	0.9
LATIN AMERICA/CARIBBEAN				
Bolivia	0.3	0.6	3.6	0.6
Brazil	0.3	0.4	0.5	0.3
Colombia	0.2	1.6	4.3	0.8
Dominican Republic	0.0	0.0	0.0	0.0
Ecuador	0.9	2.4	8.1	1.8
Guatemala	0.0	0.1	0.8	0.1
Mexico	0.2	0.4	1.1	0.3
Peru	0.3	4.0	7.8	1.9
Trinidad & Tobago	0.7	2.3	8.1	1.5

were reported at multiples of six months. Among the countries with shorter durations of breastfeeding the heaping index is below 40, with the exception of Morocco and Tunisia. For the seven countries that can be compared directly, heaping was less in the DHS survey than in the WFS survey.

Table 6.4 also shows the amount of heaping for breastfeeding duration at 12, 18, and 24 months. The heaping at these three digits was assessed by considering the number of responses on the digit of interest in relation to the surrounding digits. For example, the number of responses at 12 months was multiplied by 5 and divided by the number of responses at 10-14 months. If there is no heaping at all, the measure equals 1. The measure equals 5 if all responses are heaped at 12 months and none at the four surrounding digits. Heaping is obvious in all countries and is more serious at longer durations. The number of responses at 12 months is about 3 times higher than expected. The lowest amount of heaping is observed in Senegal and Zimbabwe; the highest in Morocco and Mexico. Heaping is equally strong at 18 months, and more pronounced at 24 months than at 12 months. In most countries the number of responses at 24 months was at least four times higher than expected.

Is reporting of breastfeeding duration more heaped by women of lower socioeconomic classes? The overall heaping index is clearly higher for the lower education categories than for the higher education categories, especially in the Latin American countries (Table 6.5). However, these differences may be partly due to differences in duration of breastfeeding: women with less education breastfeed for longer periods and, since heaping is more pronounced at longer durations of breastfeeding, the heaping may be amplified. In Table 6.5, heaping at 12 and 24 months are shown separately. In most countries there is slightly more heaping among women with no education, but the differences are fairly small and considerable heaping occurs in all education groups.

Table 6.4 Heaping index at multiples of 6 for children with reported durations of breastfeeding (BF) (including never breastfed children), median duration of breastfeeding and heaping at 12, 18, and 24 months, Demographic and Health Surveys, 1986-1990

Country	Heaping Index[a]	Heaping Index[b]	Median Duration BF[c] (months)	Heaping at:[d] 12 months	18 months	24 months	Number of Children
SUB-SAHARAN AFRICA							
Botswana	48.6		17.7	3.1	2.6	4.2	2049
Burundi	52.1		24.1	3.0	1.8	4.1	1949
Ghana	57.3		21.1	3.1	3.1	4.3	2356
Kenya	42.0		19.5	3.4	2.5	4.6	4225
Mali	59.1		18.4	2.9	2.4	4.3	1595
Ondo State, Nigeria	54.2		17.3	3.0	3.8	4.5	2126
Senegal	54.8		18.9	2.1	3.2	4.0	2464
Togo	57.5		22.6	3.0	3.2	3.8	1650
Uganda	44.6		19.0	2.9	2.3	4.1	2913
Zimbabwe	40.2		18.8	2.0	2.4	3.4	2209
NORTH AFRICA							
Egypt	56.1		18.5	3.5	3.9	4.5	5772
Morocco	47.2		15.0	3.6	3.2	4.4	4193
Sudan	53.3		18.8	2.8	3.1	4.3	4106
Tunisia	42.5		14.9	3.2	3.4	4.5	3254
ASIA							
Indonesia	54.9	61.3	22.6	3.2	3.2	4.4	4455
Sri Lanka	50.1	59.9	20.2	3.3	3.8	4.3	2376
Thailand	38.0	52.9	14.8	2.9	2.7	4.7	2540
LATIN AMERICA/CARIBBEAN							
Bolivia	37.9		16.3	2.7	2.5	4.0	3850
Brazil	16.1		5.2	2.7	2.3	4.2	2883
Colombia	29.1	34.2	8.2	3.1	3.0	4.1	2141
Dominican Republic	20.4	32.8	7.2	2.8	2.6	3.9	3648
Ecuador	33.8		13.4	3.0	2.6	4.7	2153
Guatemala	52.6		20.3	3.4	3.5	4.5	2805
Mexico	29.8	38.6	7.8	3.6	3.4	4.6	4559
Peru	37.6	44.2	15.4	3.0	3.1	4.3	2147
Trinidad & Tobago	20.1		6.1	3.1	3.0	4.2	1582

[a] Heaping index = @Sum(6+12+18+24+30+36)/@sum(all 0-36).
[b] Data for WFS from Ferry (1981).
[c] Median duration based on current status data, including all children born in the three years before the survey (from Sommerfelt et al., 1991).
[d] Heaping at 12 months: 5 * N(12 months) / N(10,11,12,13,14). If no heaping at all, then measure equals 1; if all responses heaped, then measure is 5.

Table 6.5 Heaping at 12 and 24 months for breastfeeding durations by mother's level of education: The heaping index by mother's education relative to the overall level of education, and the extent of heaping at 12 and at 24 months, Demographic and Health Surveys, 1986-1990

Country	Heaping Index Ratio[1]			Heaping at 12 Months[2]			Heaping at 24 Months[2]			Number of Children
	None	Prim.	Sec. or Higher	None	Prim.	Sec. or Higher	None	Prim.	Sec. or Higher	
SUB-SAHARAN AFRICA										
Botswana	1.22	0.93	0.88	3.6	3.0	2.7	4.5	4.0	(4.1)	2049
Burundi	1.05	0.79	(0.76)	2.9	(2.9)	-	4.2	3.7	-	1949
Ghana	1.09	0.95	0.82	3.4	2.9	3.1	4.4	4.2	-	2356
Kenya	1.10	0.99	0.91	3.6	3.4	3.1	4.8	4.5	4.3	4225
Mali	1.02	0.90	-	3.0	2.7	-	4.3	4.2	-	1595
Ondo State, Nigeria	1.10	0.93	0.88	3.1	2.8	3.4	4.6	4.2	4.0	2126
Senegal	1.04	0.89	0.79	2.2	1.8	2.3	3.9	(4.5)	-	2464
Togo	1.00	0.97	1.06	3.1	3.0	(2.9)	3.7	4.0	(4.3)	1650
Uganda	1.06	0.96	0.96	3.1	2.7	2.7	4.1	4.1	4.5	2913
Zimbabwe	1.20	0.98	0.89	2.3	1.9	2.0	3.7	3.4	2.9	2209
NORTH AFRICA										
Egypt	1.11	0.96	0.73	3.7	3.4	3.1	4.5	4.4	4.2	5772
Morocco	1.09	0.69	0.42	3.6	3.2	(3.3)	4.4	-	-	4193
Sudan	1.01	1.04	0.89	2.8	2.8	2.7	4.2	4.4	4.4	4106
Tunisia	1.26	0.77	0.56	3.3	3.0	2.9	4.5	4.5	-	3254
ASIA										
Indonesia	0.99	1.05	0.84	3.5	3.3	2.9	4.2	4.5	4.6	4455
Sri Lanka	1.05	1.00	0.99	(3.2)	2.9	3.5	4.4	4.0	4.5	2376
Thailand	1.11	1.11	0.43	3.1	2.9	(2.0)	(4.9)	4.7	-	2540
LATIN AMERICA/CARIBBEAN										
Bolivia	1.23	1.03	0.79	2.7	2.7	2.7	4.2	3.8	4.4	3850
Brazil	1.57	0.90	0.97	(3.8)	2.5	(2.2)	-	4.2	-	2883
Colombia	1.33	1.10	0.76	(3.6)	3.0	3.0	-	4.1	4.2	2141
Dominican Republic	1.54	1.12	0.57	(2.4)	2.1	3.0	(4.8)	3.8	-	3648
Ecuador	1.14	1.03	0.87	3.5	3.0	2.8	-	4.8	(4.3)	2153
Guatemala	1.20	0.87	0.57	3.6	3.1	3.1	4.6	4.4	-	2805
Mexico	1.79	0.99	0.62	3.9	3.6	3.4	4.7	4.6	-	4559
Peru	1.30	1.13	0.73	3.2	3.1	2.8	(4.2)	4.5	(4.0)	2147
Trinidad & Tobago	-	1.11	0.90	-	3.1	3.2	-	(4.2)	(4.0)	1582

[1] Heaping index = @Sum(6+12+18+24+30+36)/@sum(all 0-36). The ratio puts heaping for all women at 1.0.

[2] Heaping at 12 months: 5 * N(12 months) / N(10,11,12,13,14). If no heaping at all, then measure equals 1; if all responses heaped, then measure is 5. Same for 24 months.

- N < 25

() 25 < N < 50

6.5 OVERLAP

Since data were collected for all births in the five years preceding the survey, it is possible to analyze the consistency of breastfeeding duration reports in relation to birth dates of subsequent children. The overlap of lactation and next gestation, or continuation of breastfeeding even after the birth of the next child, can only be analyzed for mothers with at least two births in the last five years. The analysis also included interval pairs in which the index child died.

Before assessing the overlap of lactation and gestation from retrospective reports, current status data are analyzed to assess the extent of lactation-gestation overlap in each country. Table 6.6 shows that overlap is common during the first trimester of pregnancy: more than 10 percent of the women are still breastfeeding in 16 countries. The proportion of pregnant women still nursing their child declines rapidly by the second trimester, but is continued by more than 10 percent in Guatemala (25 percent), Egypt, and Indonesia. During the last trimester of pregnancy continued breastfeeding is practiced by less than 5 percent of all women in virtually all countries, with the notable exception of Indonesia.

Table 6.6 Percent of pregnant women still lactating by trimester of pregnancy, from current status data, Demographic and Health Surveys, 1986-1990

Country	Pregnancy Trimester			All	Number of Pregnant Women
	First	Second	Third		
SUB-SAHARAN AFRICA					
Botswana	3.9	0.0	0.0	0.7	165
Burundi	18.8	3.5	0.0	4.9	313
Ghana	8.6	2.9	3.3	4.4	295
Kenya	22.2	4.8	4.3	7.9	459
Liberia	6.8	1.8	0.3	2.5	407
Mali	16.3	2.3	1.5	5.2	301
Ondo State, Nigeria	3.2	0.0	0.0	0.8	255
Senegal	5.4	1.7	1.6	2.5	393
Togo	14.1	7.8	2.4	8.0	251
Uganda	20.3	4.4	0.8	8.0	443
Zimbabwe	0.0	0.0	1.1	0.4	255
NORTH AFRICA					
Egypt	30.9	13.2	4.0	12.7	680
Morocco	9.9	2.4	2.3	4.4	472
Sudan	8.6	2.0	1.6	3.3	645
Tunisia	17.3	7.2	3.0	8.3	300
ASIA					
Indonesia	22.5	12.1	9.4	13.7	421
Sri Lanka	(33.3)	1.5	3.9	9.9	210
Thailand	(26.7)	8.5	(8.0)	12.9	154
LATIN AMERICA/CARIBBEAN					
Bolivia	17.5	1.5	0.3	4.2	432
Brazil	11.5	3.0	2.1	5.0	228
Colombia	(8.5)	5.1	1.5	4.7	181
Dominican Republic	2.8	1.1	1.8	1.8	315
Ecuador	12.7	0.0	1.3	3.7	215
Guatemala	31.0	25.3	4.5	17.9	386
Mexico	14.1	5.9	1.0	5.7	391
Peru	31.4	5.6	2.7	10.7	215
Trinidad & Tobago	-	3.8	(3.0)	3.8	106

Note: Includes only women pregnant at the time of the survey and with at least one living child born in the five years before the survey. Figures in () are based on 25-49 cases; * indicates less than 25 cases.

Table 6.7 presents the proportion of children with overlap of breastfeeding and gestation using retrospective data. A large proportion of children appears to be breastfed during the last trimester of the next pregnancy and, even worse, after the birth of the next child. For example, in Burundi more than 50 percent of the women are still breastfeeding during the new pregnancy: 17 percent terminate breastfeeding during the first trimester, 11 percent during the second trimester, 9 percent during the third trimester, and 13 percent after the birth of the next child. This kind of overlap is highly unlikely to occur on a large scale (as indicated by the analysis of the current status data), and points to either overreporting of breastfeeding durations or misreporting of birth dates. The birth date of the second, more recently born, child of the interval pair could be wrong: the age of this child is overestimated (away from the interview date). The birth date of the first child could also have been misplaced: the age of this could have been underestimated (towards the interview date). A combination of both biases is possible.

The overlap appears to be stronger for Burundi, Egypt, Indonesia, Kenya, Mali, and Thailand. Sri Lanka appears to have no overlap problem, while Brazil, Colombia, the Dominican Republic, Ecuador, and Senegal have less than 5 percent overlap beyond 6 months of gestation. It must be taken into account that the chance that reporting errors lead to overlap is potentially greater in populations where prolonged breastfeeding is common (or where birth intervals are short).

Table 6.7 Overlap of breastfeeding (index child) and gestation (next child) including the period after the next birth (percentages), from retrospective data, Demographic and Health Surveys, 1986-1990

	Termination of Breastfeeding (index child)						
	Before Pregnancy of Next Child	During Pregnancy of Next Child (months)			After Birth of Next Child	Total	Number of Children
Country		0-3	4-6	7-9			
SUB-SAHARAN AFRICA							
Botswana	74.3	13.6	5.1	2.9	4.1	100	809
Burundi	49.3	17.2	11.3	9.4	12.7	100	1473
Ghana	72.7	11.7	6.6	3.9	5.1	100	1280
Kenya	56.9	14.9	12.0	7.3	8.9	100	2709
Mali	62.8	13.6	9.1	9.0	5.5	100	1112
Ondo State,Nigeria	94.9	5.0	0.1	0.0	0.0	100	1017
Senegal	75.0	15.7	5.2	2.1	1.9	100	1501
Togo	70.5	12.5	6.6	4.1	6.3	100	946
Uganda	69.8	18.3	6.4	2.4	3.1	100	2015
Zimbabwe	72.9	16.3	5.9	2.9	2.1	100	1015
NORTH AFRICA							
Egypt	51.9	18.1	12.1	9.3	8.6	100	3237
Morocco	76.2	12.0	6.4	4.7	0.6	100	2150
Tunisia	65.7	14.0	7.5	6.2	6.6	100	1736
Sudan	63.4	15.7	8.6	5.2	7.0	100	2498
ASIA							
Sri Lanka	62.8	27.6	7.5	1.8	0.4	100	1074
Indonesia	65.0	13.5	8.0	7.0	6.6	100	2164
Thailand	64.0	12.9	8.8	7.1	7.2	100	730
LATIN AMERICA/CARIBBEAN							
Bolivia	72.0	14.0	7.4	3.1	3.4	100	2030
Brazil	82.1	10.0	4.1	2.4	1.4	100	1076
Colombia	77.4	13.3	5.1	3.5	0.7	100	787
Dominican Rep.	83.3	10.1	3.3	2.5	0.8	100	1526
Ecuador	74.0	16.4	5.8	3.6	0.2	100	964
Guatemala	64.2	14.6	9.0	5.7	6.5	100	1801
Mexico	76.1	10.0	6.2	3.6	4.0	100	1849
Peru	69.2	15.8	7.4	7.5	0.2	100	1028
Trinidad and Tobago	77.2	10.5	5.0	3.6	3.6	100	579

6.6 FREQUENCY OF FEEDING

Except for Guatemala, virtually all surveys included a question on the number of breastfeedings given to lastborn children, if the mother reported she was currently breastfeeding the child.

Missing values are found for more than 3 percent of the breastfed children in four surveys: Botswana, Dominican Republic, Egypt, and Trinidad and Tobago (Table 6.8). "Don't know" responses are rare in most countries. However, there are a few notable exceptions in sub-Saharan Africa, e.g., Burundi, Mali, Senegal, and Togo where over 5 percent of the women responded "don't know."

Table 6.8 Number of times child was breastfed during last day/night: Percent with missing values, percent of women responding "don't know" (DK), "on demand", and no feedings among breastfed children, Demographic and Health Surveys, 1986-1990

Country	Night Feedings				Day Feedings				Number of Children
	Missing	Don't Know	On Demand	None	Missing	Don't Know	On Demand	None	
SUB-SAHARAN AFRICA									
Botswana	2.1	0.0	34.2	0.6	4.3	0.0	-	0.4	1040
Burundi	0.1	9.3	41.2	0.2	0.1	9.1	53.2	0.3	1620
Ghana	0.3	0.0	73.0	0.1	0.4	0.0	82.6	0.1	1463
Kenya	1.0	0.0	64.5	0.7	1.2	0.0	67.3	2.7	2401
Liberia	0.0	0.7	74.9	0.3	0.0	0.0	86.0	0.4	1542
Mali	0.3	8.1	71.4	0.0	0.3	7.9	75.0	0.2	1282
Ondo State, Nigeria	0.1	0.0	75.7	0.1	0.2	0.0	81.8	0.2	977
Senegal	0.1	7.0	74.1	0.8	0.2	8.2	82.5	0.2	1373
Togo	0.1	6.7	45.2	0.6	0.2	9.3	53.3	0.7	1210
Uganda	0.4	0.0	52.7	0.3	0.4	0.0	74.5	1.0	1663
Zimbabwe	1.3	0.0	74.7	0.0	1.5	0.0	73.0	0.4	998
NORTH AFRICA									
Egypt	3.5	0.0	-	0.2	3.3	0.0	-	0.4	2513
Morocco	0.8	0.2	72.0	0.8	1.0	0.1	82.6	0.2	1485
Sudan	0.7	0.0	58.5	0.4	0.7	0.0	66.9	0.3	2159
Tunisia	0.0	0.0	63.7	1.2	0.0	0.0	66.4	0.3	1150
ASIA									
Indonesia	1.0	0.0	25.5	0.3	0.9	0.0	45.5	1.5	3296
Sri Lanka	0.9	0.1	35.1	0.7	0.9	0.0	32.4	5.0	1508
Thailand	0.7	0.1	13.9	1.0	0.6	0.0	33.1	3.3	1017
LATIN AMERICA/CARIBBEAN									
Bolivia	0.0	0.4	-	0.7	0.0	0.4	-	1.2	1613
Brazil	0.6	0.0	18.8	2.1	0.4	0.0	26.0	6.6	510
Colombia	0.8	0.0	25.3	2.8	0.8	0.0	30.7	5.5	501
Dominican Republic	3.6	0.0	36.5	1.6	3.6	0.0	34.2	4.1	707
Ecuador	0.0	0.0	28.1	2.3	0.0	0.0	34.0	2.8	755
Guatemala[1]									1621
Mexico	0.4	0.0	-	2.0	0.6	0.0	-	4.6	1025
Peru	1.0	0.0	32.4	2.5	0.8	0.0	41.5	1.8	836
Trinidad & Tobago	3.7	0.0	23.5	2.1	3.1	0.0	36.4	11.0	327

- Implies no on demand category.
[1] Questions not asked.

"On demand," a common response in many surveys, was recorded for more than half of the children in 11 countries for nighttime feeding and in 13 countries for daytime feeding. All these countries are in Africa. In Botswana, there was a code for "as often as the child wants" for nighttime feedings; this was used for 34 percent of the children, but no code was used for on demand feeding during daytime. Egypt had no code for "on demand" and only numerical responses were allowed.

One might hypothesize that the responses "on demand" or "as often as the child wanted to" would be used more often for very young infants who nurse more frequently since the mother might not remember the exact number of feedings. On the other hand, these responses could also be used for the older child who no longer nurses frequently, and who may be put to the breast only when demanding to (e.g., as seen in "comfort nursing"). In order to determine whether the "on demand" category was used more frequently for children of certain age groups, the responses to the questions about nursing frequency were analyzed according to the child's current age (data not shown). In most countries, there were essentially no differences by age group in the proportion who responded "on demand" either for nighttime or daytime feeding. In a few countries this response code was used somewhat less frequently for children 24 months and older (Mali, Zimbabwe, Thailand, and Ecuador).

Differences in the proportion who used the "on demand" category might also be related to the literacy level, and hence might vary according to certain background characteristics of the respondent. As expected, rural women generally used the "on demand" category more frequently than urban women both for daytime and nighttime feedings (data not shown). Only in Brazil and Mali was this category used by a higher proportion of urban than rural mothers. Further, the "on demand" category was generally used more often among women without education (data not shown). It should be pointed out that even though these differences by background characteristics are demonstrated, a substantial number of women still used the "on demand" response in all population subgroups examined.

In general, the meaning of "on demand" feeding may vary considerably between cultures and between individuals. Therefore, the large proportion of answers coded as "on demand" presents a problem for the analysis of the effects of feeding patterns on postpartum amenorrhea and fertility (Rutstein, 1991).

6.7 SUPPLEMENTARY FEEDING

The questions on supplementary feedings (liquids and solid foods) in the last 24 hours were asked for the lastborn child, who was currently breastfeeding. Table 6.9 shows the percentage of children for whom there were missing values for supplementary feeding variables, including country-specific variables. Both the percentage of children with a missing value for any (i.e., one or more) of the feeding variables and the percentage with missing values for all these variables are given. The omission of all supplementary foods was rare in most surveys and exceeded one percent in only three surveys (Botswana, Ghana, and Trinidad and Tobago). In half the countries, less than 2 percent of the children had at least one supplementary variable missing. In Kenya, however, where 11 percent of the children had missing values for at least one of the supplemental feeding variables, only 1 percent had missing values for all variables. In Indonesia, Peru, and Trinidad and Tobago, 5 to 6 percent of the children had missing values for one or more of the variables. This makes the classification of feeding practices into conventional categories (exclusive, full, with liquids, with solids) more difficult and in several cases impossible to do. Table 6.9 also demonstrates that missing values were more common among older children.

Missing values were also examined by place of residence (urban or rural) and mother's level of education (data not shown). There were only minor differences by residence, and no consistent pattern was seen. Differences were also generally small by the mother's level of education, although in almost all surveys the lowest proportion of missing values was seen among mothers with no education.

6.8 CONCLUSIONS

Reporting the duration of breastfeeding has several problems. First, in virtually all surveys, missing values are more common for dead children. Additionally, they are more common for children with higher relative birth order in the DHS questionnaire (i.e., next-to-last birth, but more so second-to-last births and before) in many surveys. Second, heaping at multiples of six is pronounced in virtually all surveys and the amount of heaping varies by background characteristics such as mother's education. If heaping is a good indicator of the quality of data then reports of mothers with no education or low levels of education are less accurate than the reported durations reported by mothers with higher levels of education. One of the reasons for this difference by education, however, is that women with no education have to report on longer durations of breastfeeding, which makes their responses more likely to be heaped on multiples of six months.

Third, the analysis of overlap between pregnancy and lactation from the retrospective reports by the mother indicates considerable inaccuracies in either breastfeeding duration or birth dates or both. Reports of the duration of breastfeeding may be over- or underestimates, but overlap is clearly associated with overreporting of breastfeeding durations. On the other hand, Trussell et al. (1992), using DHS and WFS data, found that current status measures were consistently lower than retro-

spective life-table measures and concluded that there is a tendency for retrospective reports in DHS to be biased downward. This conclusion is not necessarily inconsistent with our findings of unlikely proportion of overlap, probably due to overreporting of breastfeeding duration. Both overreporting and underreporting may occur, and the analysis by Trussell et al. suggests that underreporting is more common than overreporting. The analysis of overlap between pregnancy and lactation cannot detect underreporting of duration, but it can detect overreporting.

An alternative explanation for the large extent of overlap of breastfeeding and pregnancy could be that the ages of the children are systematically incorrect. The errors in age reporting would have to lead to a shortening of the birth interval: the more distant birth date would have to be pulled towards the interview date (age underestimated), the more recent birth date would be pushed away from the interview date, or a combination of these biases could occur. There is evidence of displacement of birth dates of young children in birth histories (Becker, 1984; Grummer-Strawn and Trussell, 1990), which is analyzed elsewhere in this Report (see Bicego and Boerma, Chapter 2). The displacement of births appears to be pronounced in several surveys, particularly in Africa. Generally, there is a displacement of births into the first year of life, which may affect breastfeeding duration estimates based on current status: an underestimate of the mean duration of breastfeeding is the result. Clearly, the displacement of birth

Table 6.9 Missing values for supplemental foods and liquids: Percent with missing values for all the supplemental feeding variables and percent with missing values for one or more of the supplemental feeding variables among last-born children being breastfed at the time of the survey, Demographic and Health Surveys, 1985-1990

	Children 0-59 Months		Percent with Missing Values in Each Age Group[1]			
Country	Percent with Missing Values for All Variables	Percent with Missing Values for at least One Variable	0-11 Months	12-23 Months	24-59 Months	Number of Children
SUB-SAHARAN AFRICA						
Botswana	1.8	3.9	2.3	4.4	(24.9)	1040
Burundi	0.1	0.1	0.0	0.0	0.9	1620
Ghana	1.1	1.8	1.7	1.0	5.7	1455
Kenya	0.3	11.2	8.7	13.8	16.7	2400
Liberia	0.3	0.6	0.3	1.0	2.5	1542
Mali	0.0	0.7	0.9	0.2	0.8	1282
Ondo State, Nigeria	0.0	2.3	2.1	2.5	(3.2)	976
Senegal	0.0	3.1	2.5	3.0	11.5	1373
Togo	0.0	1.7	1.2	2.1	2.3	1210
Uganda	0.4	1.2	0.7	0.9	10.9	1663
Zimbabwe	0.0	1.6	1.9	1.0	(2.7)	997
NORTH AFRICA						
Morocco	0.7	1.3	0.7	1.3	13.5	1485
Sudan	0.6	1.3	0.7	1.4	5.8	2159
Tunisia	0.0	0.0	0.0	0.0	0.0	1150
ASIA						
Indonesia	0.6	6.3	4.6	6.3	9.0	3296
SriLanka	0.9	1.2	0.5	1.4	2.0	1506
Thailand	0.6	1.3	1.2	0.9	2.4	1017
LATIN AMERICA/CARIBBEAN						
Bolivia	0.0	0.0	0.0	0.0	0.0	1613
Brazil	0.0	0.0	0.0	0.0	0.0	510
Colombia	0.6	3.1	3.6	3.0	(0.0)	501
Dominican	0.0	3.6	1.1	4.2	(35.5)	707
Ecuador	0.0	0.0	0.0	0.0	(0.0)	755
Mexico	0.0	0.0	0.0	0.0	0.0	1025
Peru	0.7	6.1	4.7	6.2	11.7	836
Trinidad and Tobago	3.1	4.6	3.6	2.5	11.3	327

Note: Figures shown in () are based on 25-49 cases.
[1] In this portion of the table, "missing values" refers to missing values for one or more of the supplemental feeding variables (i.e., for at least one variable).

dates may contribute to the problem of high overlap of gestation and lactation. However, it is obvious that reported data on duration of breastfeeding have multiple data quality problems, which need to be taken into account, especially when studying trends and differentials in breastfeeding duration and assessing the effect of breastfeeding on mortality. The quality of current status data on breastfeeding and supplementary feeding cannot be evaluated thoroughly, since only a limited number of questions were asked, and consistency could not be checked. The method used, i.e., recall in last 24 hours, may lead to an underestimation of the proportion of children receiving supplements, although the magnitude of this bias is not known. It also must be kept in mind that the usefulness of current status data depends on the quality of age reporting, and several deficiencies in the DHS data concerning the accuracy of birth dates have been noted. Data on the number of breastfeedings during day and night time indicate a very large proportion responding "on demand." Since the meaning of "on demand" varies greatly between populations and individuals, the DHS-II questionnaire was adapted to make the respondent specify her intended meaning.

Other changes made in DHS-II include:

- Adding a question about how soon after birth the newborn was put on the breast, to measure breastfeeding practices during the first days of life and the proportion of children given the opportunity to receive colostrum.

- Asking the mother about the age (in months) at which she started to give supplements on a regular basis. These supplements are infant formulae and/or milk other than breast milk, plain water, other liquids, and any solid or mushy food. The recall of supplementary feeding includes all births (still alive or dead) in the five years prior to the survey. The data will be evaluated thoroughly at the completion of DHS-II, given the multiple problems associated with recall of breastfeeding durations identified in this paper.

- Including all children in the question on use of a bottle the day or night before the interview, and not just breastfed children as in DHS-I.

DHS-II first country reports present median duration of breastfeeding based on current status information. Children who are never breastfed are included, as are nonsurviving children. The summary measures are birth-based rather than woman-based. The reports also present the prevalence-incidence mean, which was used in several DHS-I reports.

References

Becker, S. 1984. A response bias in the reporting of month of birth in pregnancy history surveys. IPD Working Paper 1984 - 85, Brussels, Belgium: Vrije Universiteit Brussel, Inter-university Programme in Demography.

Ferry, B. 1981. *Breastfeeding*. WFS Comparative Studies 13. Voorburg, the Netherlands: International Statistical Institute.

Grummer-Strawn, L. and T.J. Trussell. 1990. Computing the mean duration of breastfeeding from current-status data. Princeton, New Jersey: Office of Population Research, Princeton University.

Haaga, J.G. 1988. Reliability of retrospective survey data on infant feeding. *Demography* 25(2): 307-314.

Huttly, S.R.A., F.C. Barros, C.G. Victora, J.U. Beria, and J.P. Vaughan. 1990. Do mothers overestimate breast feeding duration? An example of recall bias from a study in southern Brazil. *American Journal of Epidemiology* 132(3): 572-575.

Lesthaeghe, R.J. and H.J. Page. 1980. The post-partum non-susceptible period: Development and application of model schedules. *Population Studies* 34(1): 143-169.

Mosley, W. Henry, Linda H. Werner, and Stan Becker. 1982. *The Dynamics of Birth Spacing and Marital Fertility in Kenya.* WFS Scientific Reports No. 30. Voorburg, the Netherlands: International Statistical Institute.

Rutstein, S.O. 1991. The impact of breastfeeding on fertility. In *Proceedings of the DHS World Conference*. Vol. 2, pp. 897-924. Columbia, Maryland: Institute for Resource Development/Macro International Inc.

Sommerfelt, A.E., J.T. Boerma, and S.O. Rutstein. 1991. Breastfeeding indicators: Learning from the DHS experience. Document prepared for UNICEF.

Trussell, T.J., L. Grummer-Strawn, G. Rodriguez, and M. Van Landingham. 1992. Trends and differentials in breastfeeding behavior: Evidence from the WFS and DHS. *Population Studies* 46: 285-308.

CHAPTER 7

Anthropometric Status of Young Children in DHS-I Surveys: An Assessment of Data Quality

A. ELISABETH SOMMERFELT
J. TIES BOERMA

Acknowledgments

We wish to acknowledge Beverley Carlson, Penelope Nestel, and John Mason for comments given on earlier drafts of this paper.

Anthropometry provides an objective assessment of children's health and nutritional status. When interpreting such information, it is important to know whether the children in the sample are representative of the population of children from which the sample was drawn, and whether the recorded measurements correctly reflect the child's true height and weight. Although the proportion of children selected for anthropometric assessment who were actually weighed and measured is easily determined, it is difficult to determine if there was systematic bias in the recorded measurements.

This chapter focuses on the quality of the anthropometric findings in the DHS-I surveys. In addition to the height and weight data, the following information is used: child's birth date and relative birth order, whether the mother was a regular resident of the household, whether the child lived with the mother, and the reported reason for not measuring the child. The evaluation concentrates on two aspects of data quality: the extent to which data are missing and the factors related to the nonmeasurement of children's height and weight, and an examination of the height and weight measurements and children's ages.

7.1 ANTHROPOMETRY IN DHS SURVEYS

7.1.1 Sample of Children

In the DHS surveys all women in the selected households are included in the sample of respondents. Information on children's health and nutrition is based on all the respondents' children born during a specified time period. The height and weight of young children of survey respondents were measured in nineteen surveys in the first phase of the DHS program (1986-1989). In these surveys, children in a specified age group were weighed and measured. In Brazil, Egypt, and Senegal, only the children of a sub-sample of respondents were included. In Senegal one-third of the children and in Egypt half of the children were identified for measuring of height and weight. The Brazil survey included anthropometry only for children of respondents from the Northeast region, which is the least developed region of the country.

Where anthropometry was included in the survey, the standard DHS-I recommendation was to measure all the respondent's children age 3 through 36 months.[1] This recommendation was followed in eleven surveys (Table 7.1). In three surveys, measurements for children age 6 through 36 months were obtained. All children under 5 years were weighed and measured in three surveys, and one survey included children 3-60 months. In four countries the upper age limit was extended through 60 months of age. In Thailand the mother's height and weight were also recorded; the maternal anthropometry data from this survey will not be evaluated here.

The DHS surveys either used self-weighted samples or, when necessary to ensure sufficient numbers for reliable estimates, some areas were over-sampled. The analyses in this chapter employ the weighted data.

7.1.2 Equipment and Training of Measurers

The measurers were trained according to the guidelines in the United Nations Manual "How to Weigh and Measure Children" (United Nations, 1986). Training was conducted either by an expert from DHS or local personnel with expertise in the area of nutrition. A quality control test to ascertain the ability of the measurers was generally administered at the end of the training period. In some countries the measurers were again tested about half-way through the survey. Measurers were instructed to read weight to 100 grams using a hanging spring scale. For height (length) measurements, measurers were taught to read to 0.1 centimeters using an adjustable wooden measuring board. It is recommended that supine length be measured for children under 24 months of age and standing height for older children. However, most surveys that included anthropometric measurements through 36 months of age measured supine length. Because there is a difference between supine length and standing height, one centimeter was subtracted from the stature of children 24 months and older who were measured lying down. This was done in the computer data editing stage. The term "height" is used in this chapter to refer to both supine and standing measurements.

The method for selecting measurers varied. In most Latin American and Caribbean countries the supervisor and field editor on each team were trained to carry out the measurements. The typical approach in the Francophone African countries was to train all interviewers. In the Anglophone African countries and in Asia two team members were usually designated to carry out the anthropometric measurements.

7.2 MISSING DATA FOR ANTHROPOMETRY

The number of children eligible for anthropometric measurement in each survey is shown in Table 7.2. The proportion of eligible children whose weight and/or height were measured ranged from 79 percent in Trinidad and Tobago to 98 percent in Morocco. Over 90 percent of the children were weighed and measured in 11 countries. The largest proportion of children with only one measurement is in Northeast Brazil, where less

[1] In Phase 2 of the DHS Program (1989-1993), all children from birth through 60 months of age were measured.

Table 7.1 Summary of anthropometric measurements of children in DHS-I. Anthropometry in DHS-I (1986-1989): Age group and sample of children included for height and weight measurement, number of children eligible, and percentage of eligible children whose month and year of birth was not known, Demographic and Health Surveys, 1985-1990

Country	Date of Fieldwork	Anthro-pometry Included	Age Group (in months)	Type of Sample	Number of Eligible Children	Percent of Eligible Children with Unknown Month or Year of Birth
SUB-SAHARAN AFRICA						
Botswana	1988	No	-	-	-	-
Burundi	1987	Yes	3-36	National	2102	2.1
Ghana	1988	Yes	3-36	National	2205	6.9
Kenya	1989	No	-	-	-	-
Liberia	1986	No	-	-	-	-
Mali	1987	Yes	3-36	National	1687	40.2
Ondo State, Nigeria	1987	Yes	6-36	State	1504	0.0
Senegal[1]	1986	Yes	6-36	1/3	640	2.0
Togo	1988	Yes	0-36	National	1782	16.3
Uganda	1989	Yes	0-60	National	4442	0.0
Zimbabwe	1989	Yes	3-60	National	3098	0.1
NORTH AFRICA						
Egypt	1989	Yes	3-36	1/2	2290	7.6
Morocco	1987	Yes	0-60	National	5693	19.9
Sudan	1990	No	-	-	-	-
Tunisia	1988	Yes	3-36	National	2405	1.2
ASIA						
Indonesia	1987	No	-	-	-	-
Sri Lanka	1987	Yes	3-36	National	2188	0.2
Thailand	1987	Yes	3-36	National	2013	1.6
LATIN AMERICA/CARIBBEAN						
Bolivia	1989	Yes	3-36	National	3050	0.1
Brazil (Northeast)	1986	Yes	0-60	1 region	1215	0.4
Colombia	1986	Yes	3-36	National	1498	0.4
Dominican Republic	1986	Yes	6-36	National	2166	0.1
El Salvador	1985	No	-	-	-	-
Ecuador	1987	No	-	-	-	-
Guatemala	1987	Yes	3-36	National	2437	0.2
Mexico	1987	No	-	-	-	-
Peru	1986	No	-	-	-	-
Trinidad & Tobago	1987	Yes	3-36	National	1072	0.0

[1] The Senegal data file only identifies children whose height and weight were actually measured.

than 2 percent of children were weighed, but did not have their height measured. The Senegal data file only identifies children whose height and weight were measured.

In the remaining analysis, "missing data" refers to those children for whom data are completely absent (i.e., no height or weight measurements were collected).

In addition to the reasons recorded by the interviewer for not measuring and weighing a child, four other factors may influence the likelihood of missing data: 1) whether the child lives with the mother, and whether the mother is a regular resident of the household; 2) the child's age; 3) the child's relative birth order;[2] and 4) urban-rural residence. In addition, missing data were examined according to maternal education and recent illness in the child (data not shown). In most surveys, the proportion with missing data was either similar across education categories, or there was a slight increase among children of mothers with higher education. The latter could usually be explained by fostering rates being higher among more educated women in these countries. Missing data rates generally were similar regardless of whether the child had recently been ill with diarrhea, fever, or a cough.[3]

[2] The definition of *relative birth order* used in this paper is the same as that used at the time the data were collected: Order 1 - last living child, Order 2 - next-to-last living child, Order 3 - second-to-last living child, etc.

[3] Questions about fever and cough were not asked in all countries.

Table 7.2 Height and weight measurement in DHS surveys: Percent distribution of height and weight measurements among eligible children, Demographic and Health Surveys, 1986-1989

Country	Percent of Children Who Were Measured for: Both Height and Weight	Height Only	Weight Only	Neither Height nor Weight	Total	Number of Eligible Children
SUB-SAHARAN AFRICA						
Burundi	94.9	0.0	0.2	4.9	100.0	2102
Ghana	90.1	0.1	0.0	9.8	100.0	2205
Mali	92.0	0.1	0.4	7.6	100.0	1687
Ondo State, Nigeria	93.2	0.1	0.1	6.6	100.0	1504
Togo	95.9	0.2	0.0	3.9	100.0	1782
Uganda	87.1	0.2	0.1	12.6	100.0	4442
Zimbabwe	80.8	0.3	0.2	18.8	100.0	3098
NORTH AFRICA						
Egypt	91.9	0.1	0.0	7.9	100.0	2290
Morocco	98.1	0.1	0.0	1.9	100.0	5693
Tunisia	85.6	0.1	0.0	14.3	100.0	2405
ASIA						
Sri Lanka	91.8	0.1	0.0	8.1	100.0	2188
Thailand	94.2	0.0	0.2	5.6	100.0	2013
LATIN AMERICA/CARIBBEAN						
Bolivia	84.9	0.0	0.0	15.1	100.0	3050
Northeast Brazil	95.1	0.2	1.5	3.2	100.0	1215
Colombia	88.9	0.1	0.3	10.7	100.0	1498
Dominican Republic	85.3	0.3	0.3	14.1	100.0	2166
Guatemala	95.5	0.0	0.1	4.3	100.0	2437
Trinidad & Tobago	78.6	0.4	0.7	20.2	100.0	1072

Note: The Senegal data file only identifies children whose height and weight were actually measured.

7.2.1 Fostering and Residency Status

Table 7.3 shows possible reasons why anthropometric measurements were not obtained. Children who were reported as not living with their mother would be unlikely to have their height and weight measured. Children whose mothers were visitors, and not regular residents in the household, may not have accompanied their mother, and may not have been included in the anthropometric assessment. The proportion of children whose height and/or weight was *not* measured is shown for these categories. As expected, the proportion of missing data is lowest for children who lived with their mothers and whose mothers were regular residents of the household (median 7 percent). Nevertheless, the proportion of missing data for this category is over 10 percent in four surveys: Bolivia (15 percent), Trinidad and Tobago (18 percent), Tunisia (14 percent), and Zimbabwe (12 percent). Somewhat higher missing data rates are found for children who lived with their mothers, but whose mothers were visitors (median 14 percent), indicating that mothers usually, but not always, take their young children along when they visit other households. In most of the countries, very few children lived away from their mothers. However, as expected, a large proportion of the children who did live away were neither weighed nor measured regardless of whether the mother was a regular resident or not.

A substantial proportion of children were "fostered out" in three countries: Dominican Republic, Uganda, and Zimbabwe. Since few of these children were weighed and measured, this contributes to a higher proportion of missing data in these surveys. Table 7.4 shows 1) the percentage of eligible children weighed and measured; 2) the percentage of eligible children who were not measured, but who lived with the mother who was a regular household resident; and 3) the percentage of eligible children who were not measured and who did not live with their mother or whose mother was a visitor in the household. In Uganda and Zimbabwe 8 percent of the children were in the last category. In four countries, over 10 percent of the eligible children were not measured even though they lived with their mothers.

Table 7.3 Missing data for anthropometry by fostering and residence status: Percentage of eligible children who were not measured for height and weight by whether the child lived with the mother, and whether the mother was a regular resident of the household, Demographic and Health Surveys, 1986-1989

Country	All Eligible Children		Child Lived with Mother and Mother Was Regular Resident		Child Lived with Mother and Mother Was Visitor		Child Did Not Live with Mother	
	Number	Percent Not Measured	Number	Percent Not Measured	Number	Percent Not Measured	Number	Percent Not Measured
SUB-SAHARAN AFRICA								
Burundi	2102	4.9	2053	4.4	44	(16.7)	5	[100.0]
Ghana	2205	9.8	2095	8.3	69	4.3	41	(95.1)
Mali	1687	7.6	1649	6.0	11	[5.5]	27	(100.0)
Ondo State, Nigeria	1504	6.6	1416	4.1	49	(14.3)	39	(89.7)
Togo	1782	3.9	1690	3.1	77	3.9	15	[93.3]
Uganda	4442	12.6	3956	4.9	131	20.6	354	95.2
Zimbabwe	3098	18.8	2684	12.0	186	22.0	228	95.6
NORTH AFRICA								
Egypt	2290	7.9	2195	7.4	93	17.7	2	[100.0]
Morocco	5693	1.9	5457	1.2	187	4.3	49	(67.3)
Tunisia	2405	14.3	2334	14.1	67	19.4	4	[75.0]
ASIA								
Sri Lanka	2188	8.1	2116	7.3	56	16.6	16	[76.5]
Thailand	2013	5.6	1895	3.0	58	8.0	59	84.9
LATIN AMERICA/CARIBBEAN								
Bolivia	3050	15.1	2967	14.5	68	22.2	15	[97.5]
Brazil (Northeast)	1215	3.2	1209	2.8	0	-	6	[85.7]
Colombia	1498	10.7	1423	8.5	40	(9.7)	36	(100.0)
Dominican Republic	2166	14.1	1979	8.7	59	20.2	128	96.2
Guatemala	2437	4.3	2400	4.0	20	[5.0]	17	[47.1]
Trinidad & Tobago	1072	20.2	1023	17.8	24	[45.8]	25	(96.0)

Note: The Senegal data file only identifies children whose height and weight were actually measured.
Figures shown in [] are based on < 25 cases.
Figures shown in () are based on 25-49 cases.

Table 7.4 Measurement of height and weight and availability of children for measurement: Percent distribution of eligible children by percent measured for height and/or weight, the percent not measured who lived with their mother who was a regular resident, and the percent not measured who did not live with their mother or whose mother was a visitor, Demographic and Health Surveys, 1986-1989

Country	Percent Measured for Height and/or Weight	Percent Not Measured and Lived with Mother Who Was a Regular Resident	Percent Not Measured and Did Not Live with Mother or Mother was Visitor	Total	Number of Eligible Children
SUB-SAHARAN AFRICA					
Burundi	95.1	4.3	0.6	100.0	2102
Ghana	90.2	7.9	1.9	100.0	2205
Mali	92.4	5.9	1.6	100.0	1687
Ondo State, Nigeria	93.4	3.9	2.8	100.0	1504
Togo	96.1	2.9	1.0	100.0	1782
Uganda	87.4	4.4	8.2	100.0	4442
Zimbabwe	81.2	10.4	8.4	100.0	3098
NORTH AFRICA					
Egypt	92.1	7.1	0.8	100.0	2290
Morocco	98.1	1.1	0.7	100.0	5693
Tunisia	85.7	13.7	0.7	100.0	2405
ASIA					
Sri Lanka	91.9	7.1	1.0	100.0	2188
Thailand	94.4	2.9	2.7	100.0	2013
LATIN AMERICA/CARIBBEAN					
Bolivia	84.9	14.1	1.0	100.0	3050
Brazil (Northeast)	96.8	2.8	0.4	100.0	1215
Colombia	89.3	8.1	2.6	100.0	1498
Dominican Republic	85.9	7.9	6.2	100.0	2166
Guatemala	95.7	4.0	0.4	100.0	2437
Trinidad & Tobago	79.8	17.0	3.3	100.0	1072

Note: The Senegal data file only identifies children whose height and weight were actually measured.

7.2.2 Reasons for Not Measuring Children

In five DHS-I countries, the reason that a child was not weighed and measured was recorded (Table 7.5) The codes "child sick," "child sleeping," and "refused" were, as expected, used almost exclusively for children who lived with their mother. These codes were recorded for fewer than 5 children who did not live with their mother in each of these countries (data not shown).

The proportion of missing values for this variable, not measuring the child, was high in three of the five countries. In Uganda and Zimbabwe, where fostering is more common than in the other countries, 73 and 60 percent, respectively, reported that absence of the child was the reason for not obtaining the measurements. In these two countries absence of the child was also given as a frequent reason for nonmeasurement among children who lived with their mother and whose mother was a regular resident: 37 percent in Uganda and 43 percent in Zimbabwe (data not shown).

Table 7.5 Reasons for not measuring children: Among children for whom neither height nor weight measurements were collected, the percentage in each response category, Demographic and Health Surveys, 1987-1989

Country	Child Sick	Refused	Child Sleeping	Child Absent	Other	Missing	Total	Number of Children
Ghana	52.5	1.8	0.0	22.4	3.2	20.1	100.0	219
Uganda	8.7	4.4	0.0	73.2	8.4	5.3	100.0	565
Zimbabwe	4.7	1.5	0.3	60.2	2.2	28.1	100.0	590
Tunisia	12.4	9.8	0.1	26.5	30.8	0.9	100.0	347
Sri Lanka	18.5	4.1	0.1	14.3	22.2	40.9	100.0	179

7.2.3 Child's Current Age

The percentage of eligible children who were neither weighed nor measured is shown in Table 7.6 by age group. The age categories chosen correspond to the various age ranges included for anthropometry in the DHS surveys. Since most surveys did anthropometric measurements for children 3-36 months of age and a few included children through 60 months, the unusual age groups of 24-36, 37-47, and 48-60 months are used. The proportion not weighed or measured is higher among very young children and older children (over 24 months). In the four countries where children up to 60 months of age were included, the proportion of children age 37-60 months who were not weighed and measured showed a marked increase. In Northeast Brazil and Morocco, less than 5 percent of the oldest children were missed. However, in Uganda and Zimbabwe, where fostering is common, up to one quarter of the oldest children were not measured. The youngest children are more likely not to be weighed or measured because of the interviewer's or mother's concern about the child being too young. Among older children the reason is that they are more difficult to locate (Table 7.5).

To examine whether older children were not measured because they were not living with their mothers, the analysis was replicated among children who lived with their mothers and whose mothers were regular household residents. Much of the missing data could be explained by the residency and fostering status, as seen when comparing Tables 7.6 and 7.7, especially in Dominican Republic, Ghana, Mali, Ondo State (Nigeria), Uganda, and Zimbabwe.

Table 7.6 Missing anthropometric data by age group: Percentage of eligible children for whom height and weight measurements were not collected, by age group, Demographic and Health Surveys, 1986-1989

	Percent of Children Who Were Neither Weighed Nor Measured								
		Age Group							Number of
Country	All Eligible Children	0-2 months	3-5 months	6-11 months	12-23 months	24-36 months	37-47 months	48-60 months	Eligible Children
SUB-SAHARAN AFRICA									
Burundi	4.9	-	11.3	1.4	2.7	6.8	-	-	2102
Ghana	9.8	-	9.0	6.8	7.9	13.3	-	-	2205
Mali	7.6	-	5.6	4.4	6.0	12.0	-	-	1687
Ondo State, Nigeria	6.6	-	-	7.0	4.4	8.8	-	-	1504
Togo	3.9	9.4	2.2	2.0	2.5	5.5	-	-	1782
Uganda	12.6	12.4	3.5	2.9	6.1	14.3	18.1	22.3	4442
Zimbabwe	18.8	-	15.4	9.8	13.8	15.9	23.3	26.7	3098
NORTH AFRICA									
Egypt	7.9	-	8.7	6.7	5.4	10.7	-	-	2290
Morocco	1.9	0.4	0.0	0.7	1.1	1.7	2.7	3.5	5693
Tunisia	14.3	-	18.3	9.4	11.0	18.6	-	-	2405
ASIA									
Sri Lanka	8.1	-	24.9	3.4	4.6	8.9	-	-	2188
Thailand	5.6	-	9.0	3.3	5.7	5.8	-	-	2013
LATIN AMERICA/CARIBBEAN									
Bolivia	15.1	-	26.3	10.5	9.4	20.4	-	-	3050
Brazil (Northeast)	3.2	(6.0)	1.6	3.0	1.7	1.5	4.5	4.7	1215
Colombia	10.7	-	21.8	6.3	7.5	13.7	-	-	1498
Dominican Republic	14.1	-	-	13.4	11.2	17.5	-	-	2166
Guatemala	4.3	-	1.3	2.6	2.6	7.7	-	-	2437
Trinidad & Tobago	20.2	-	26.2	15.5	19.5	22.4	-	-	1072

Note: The Senegal data file only identifies children whose height and weight were actually measured. Figures shown in () are based on 25-49 cases.

Table 7.7 Missing anthropometric data for children who lived with their mother who was a regular resident: Percentage of eligible children for whom height and weight measurements were not collected, who lived with their mother who was a regular resident, by age group, Demographic and Health Surveys, 1986-1989

Country	Percent of Children Who Were neither Weighed nor Measured Who Lived with Their Mother Who Was a Regular Resident								Number of Eligible Children
		Age Group							
	All Eligible Children	0-2 months	3-5 months	6-11 months	12-23 months	24-36 months	37-47 months	48-60 months	
SUB-SAHARAN AFRICA									
Burundi	4.4	-	11.7	1.4	2.7	5.6	-	-	2053
Ghana	8.3	-	9.4	7.0	7.5	9.6	-	-	2095
Mali	6.0	-	5.7	4.2	5.1	8.4	-	-	1649
Ondo State, Nigeria	4.1	-	-	5.6	3.2	4.2	-	-	1416
Togo	3.1	9.0	1.7	2.1	1.8	4.0	-	-	1690
Uganda	4.9	12.8	3.6	1.3	2.5	5.7	5.2	7.3	3956
Zimbabwe	12.0	-	14.6	9.8	10.5	10.6	12.6	14.9	2684
NORTH AFRICA									
Egypt	7.4	-	8.1	6.3	4.9	10.2	-	-	2195
Morocco	1.2	0.4	0.0	0.2	0.9	0.9	1.7	2.4	5457
Tunisia	14.1	-	17.2	9.4	10.8	18.4	-	-	2334
ASIA									
Sri Lanka	7.3	-	24.5	3.5	3.8	7.8	-	-	2116
Thailand	3.0	-	8.6	1.9	2.1	3.4	-	-	1895
LATIN AMERICA/CARIBBEAN									
Bolivia	14.5	-	26.4	10.5	9.0	19.2	-	-	2967
Brazil (Northeast)	2.8	(4.1)	1.6	3.0	1.3	1.2	4.5	4.1	1209
Colombia	8.5	-	20.7	4.6	5.5	10.8	-	-	1423
Dominican Republic	8.7	-	-	10.2	7.1	9.5	-	-	1977
Guatemala	4.0	-	1.3	2.4	2.5	7.1	-	-	2400
Trinidad & Tobago	17.8	-	23.8	13.7	17.1	19.5	-	-	1023

Note: The Senegal data file only identifies children whose height and weight were actually measured. Figures shown in () are based on 25-49 cases.

These differences can be demonstrated with two examples. In Uganda, the percentage of missing data for children who lived with their mother who was a regular household resident was 7 percent for the 48-60 month age group versus 5 percent for all children (Table 7.7). The corresponding figures for children regardless of residency and fostering status were 22 and 13 percent, respectively (Table 7.6). Hence, when looking only among those Ugandan children who are likely to be available for measuring, the overall percentage of missing data was below the median for all countries, and there was only a small increase for the older children (24-60 months). In Zimbabwe, 15 percent of the data were missing among the oldest age group versus 12 percent for all children (Table 7.7). The corresponding rates for all children were 27 and 19 percent, respectively (Table 7.6). As in the case of Uganda, the differences according to the child's age were markedly reduced when considering only the Zimbabwean children who were living with their mothers, and although the overall percentage of missing data was reduced, it still remained higher than all but three surveys. Hence, in Zimbabwe, fostering and residency status only provide a partial explanation of why the proportion of missing data was higher than in most surveys.

7.2.4 Relative Birth Order

Whether the youngest living child is more likely to be weighed and measured compared to older siblings is examined in Table 7.8. *Relative birth order* defines the relationship between the surviving children in a family. Since most surveys restricted the age for anthropometric measurement to 3-36 months, it is possible to compare only the youngest living with the next-to-youngest living child in most countries, as there are too few children in the category second-to-youngest living child.

More data are missing among the next-to-youngest living children than youngest living children in 15 of the 18 surveys (median 14 percent versus 7 percent). However, this trend is not seen in two of the four surveys that included children up to 60 months (Morocco and Northeast Brazil), but it is observed in Uganda and Zimbabwe, where more than 5 percent of children do not live with their mothers.

Among the surveys for which there are sufficient data to consider missing data for the second-to-youngest and older children, minor differences were found in the proportion of children measured compared with the youngest and next-to-youngest living children in Morocco and Northeast Brazil. This was not the case for Uganda and Zimbabwe where larger differences were observed.The analysis was repeated for children of respondents who were regular residents and who lived with their mother (Table 7.9). In Uganda, the proportion of these children with missing data was similar regardless of their relative birth order, in contrast to the large differences described above (Table 7.8). In Zimbabwe, the large differences in missing data by relative birth order shown in Table 7.8 were reduced, but there still remained a higher percentage of missing data among second-to-youngest children (19 percent), compared to next-to-youngest (12 percent) and youngest-living children (12 percent).

7.2.5 Urban-Rural Place of Residence

The proportion of missing data by place of residence is seen in Table 7.10. Except for Bolivia and Tunisia, there was a consistently lower percentage of missing data in rural areas (median 8 percent) than in urban areas (median 11 percent). In most countries the difference was less than 5 percentage points, but in four countries (Thailand, Trinidad and Tobago, Uganda, and Zimbabwe) the urban-rural difference exceeded 7 percentage points.

Table 7.8 Missing anthropometric data by relative birth order: Percentage of eligible children for whom height and weight measurements were not collected, by relative birth order, Demographic and Health Surveys, 1986-1989

	Percent of Children Who Were Neither Weighed Nor Measured				
		Relative Birth Order			
Country	All Eligible Children	Youngest Living Child	Next-to-Youngest Living Children	Second-to Youngest Living Children	Number of Eligible Children
SUB-SAHARAN AFRICA					
Burundi	4.9	3.9	12.2	*	2102
Ghana	9.8	9.2	16.8	*	2205
Mali	7.6	6.5	15.6	*	1687
Ondo State, Nigeria	6.6	6.3	10.3	*	1504
Togo	3.9	3.3	9.1	*	1782
Uganda	12.6	9.2	17.8	19.6	4442
Zimbabwe	18.8	17.0	22.0	32.1	3098
NORTH AFRICA					
Egypt	7.9	7.4	11.6	*	2290
Morocco	1.9	1.5	2.4	3.0	5693
Tunisia	14.3	13.3	19.5	*	2405
ASIA					
Sri Lanka	8.1	7.7	11.4	*	2188
Thailand	5.6	5.4	6.3	*	2013
LATIN AMERICA/CARIBBEAN					
Bolivia	15.1	14.2	21.0	*	3050
Brazil (Northeast)	3.2	3.2	2.8	3.9	1215
Colombia	10.7	10.7	9.3	*	1498
Dominican Republic	14.1	13.4	19.5	*	2166
Guatemala	4.3	3.4	10.3	*	2437
Trinidad & Tobago	20.2	19.1	27.2	*	1072

Note: The Senegal data file only identifies children whose height and weight were actually measured.
* Based on too few cases to show

Table 7.9 Missing anthropometric data for children who lived with their mother who was a regular resident by relative birth order: Percentage of eligible children for whom height and weight measurements were not collected, who lived with their mother who was a regular resident, by relative birth order, Demographic and Health Surveys, 1986-1989

Country	Percent of Children Who Were neither Weighed nor Measured Who Lived with Their Mother Who Was a Regular Resident				Number of Eligible Children
		Relative Birth Order			
	All Eligible Children	Youngest-Living Children	Next-to-Youngest Living Children	Second-to Youngest Living Children	
SUB-SAHARAN AFRICA					
Burundi	4.4	3.6	10.4	*	2053
Ghana	8.3	7.9	13.0	*	2095
Mali	6.0	5.3	11.5	*	1649
Ondo State, Nigeria	4.1	4.1	3.9	*	1416
Togo	3.1	2.8	5.9	*	1690
Uganda	4.9	4.5	5.4	5.9	3956
Zimbabwe	12.0	11.6	12.4	18.5	2684
NORTH AFRICA					
Egypt	7.4	6.9	11.0	*	2195
Morocco	1.2	0.8	1.8	2.1	5457
Tunisia	14.1	13.0	19.4	*	2334
ASIA					
Sri Lanka	7.3	7.1	9.4	*	2116
Thailand	3.0	2.9	4.4	*	1895
LATIN AMERICA/CARIBBEAN					
Bolivia	14.5	13.6	20.5	*	2967
Brazil (Northeast)	2.8	2.9	2.3	3.2	1209
Colombia	8.5	8.5	7.1	*	1423
Dominican Republic	8.7	8.2	12.3	*	1977
Guatemala	4.0	3.2	9.3	*	2400
Trinidad & Tobago	17.8	16.9	23.1	*	1023

Note: The Senegal data file only identifies children whose height and weight were actually measured.
* Based on too few cases to show

Table 7.10 Missing anthropometric data by urban-rural residence: Percentage of eligible children for whom height and weight measurements were not collected, by urban-rural residence, Demographic and Health Surveys, 1986-1989

Country	Percentage of Children Who Were neither Weighed nor Measured			Number of Eligible Children
	All Eligible Children	Place of Residence		
		Urban	Rural	
SUB-SAHARAN AFRICA				
Burundi	4.9	10.0	4.7	2102
Ghana	9.8	12.4	8.8	2205
Mali	7.6	9.5	6.9	1687
Ondo State, Nigeria	6.6	7.0	6.4	1504
Togo	3.9	5.5	3.3	1782
Uganda	12.6	20.4	11.7	4442
Zimbabwe	18.8	28.4	15.1	3098
NORTH AFRICA				
Egypt	7.9	8.3	7.7	2290
Morocco	1.9	3.0	1.2	5693
Tunisia	14.3	14.0	14.7	2405
ASIA				
Sri Lanka	8.1	8.9	7.9	2188
Thailand	5.6	12.6	4.1	2013
LATIN AMERICA/CARIBBEAN				
Bolivia	15.1	13.9	16.3	3050
Brazil (Northeast)	3.2	4.8	1.6	1215
Colombia	10.7	12.1	8.6	1498
Dominican Republic	14.1	14.5	13.7	2166
Guatemala	4.3	5.7	3.8	2437
Trinidad & Tobago	20.2	24.5	17.0	1072

Note: The Senegal data file only identifies children whose height and weight were actually measured.

7.3 AGE HEAPING AND HEIGHT AND WEIGHT MEASUREMENTS

7.3.1 Age Reporting

The accuracy and completeness of age data are crucial to the analyses of anthropometric data. Only the weight-for-height index is independent of the age of the child. Several possible systematic biases in the reporting of children's ages may affect anthropometric results: incomplete reporting (missing data), field imputation of birth date by the interviewer, and accuracy of reporting due to systematic over- or under-reporting, e.g., heaping at 12 and 24 months.

The proportion of children whose mothers did *not* report a month and year of birth is shown in Table 7.1. While the table shows the percentage with a known month and year of birth among all the children in the age group eligible to be included in the anthropometric section of the questionnaire, almost identical percentages were found for the children whose height and/or weight were actually measured (data not shown). In all countries the difference between these two percentages was less than 1 percent. Hence, there was no difference in this regard between the children who were measured and those who were missed.

A large proportion of children in Mali, Morocco,[4] and Togo did *not* have a month or year of birth reported by their mothers (40, 20, and 16 percent, respectively). Between 5 and 10 percent of children did not have a month and year of birth reported in Ghana and Egypt.

For the three countries in which more than 15 percent of the birth dates were incomplete, month or year of birth was more frequently missing among rural children and children whose mothers had no education. In Mali and Morocco, month and year of birth were less likely to be missing for the youngest living child than for older siblings. Because of these differences, a comparison was made between the proportion of wasted children with and without a complete birth date. In Mali, the difference in the proportion of wasted children whose month and year of birth was reported and those for whom this information was missing, was less than 3 percent. However, there could be greater differences in the nutritional indices based on age, i.e., weight-for-age and height-for-age.

Although Table 7.1 indicates that mothers reported a date of birth for almost all children in the remaining countries, the interviewer may have entered a month and year of birth even if the mother could not give exact information. In three surveys (Ondo State [Nigeria], Trinidad and Tobago, and Uganda), birth dates were reported for 100 percent of the children, but the accuracy of these dates is difficult to assess.

The analysis of data on month of birth for children under 5 years by Bicego and Boerma (1992) shows that there appears to be considerable displacement of months of birth. First, there is increased reporting of births for the months immediately before the survey month. For example, for an interview held in August, respondents are more likely to report July or June of the same year as month of birth than September or October. This type of displacement occurs at every year before the survey (at 12, 24, 36 months, etc. preceding the survey) and appears to be more serious in the African surveys. Overreporting of children's ages would result in more children being classified as stunted and/or underweight than is actually the case.

There also appears to be displacement of births into the first year of life and within the first year of life. The displacement is fairly strong. This would lead to under-reporting of ages for the youngest children. In addition, there is a shift of births towards the interview date. In these cases, fewer children are classified as stunted and/or underweight than there actually are.

There is, however, little evidence of heaping at 12 and 24 months of age. The extensive efforts to collect children's month and year of birth and age in the birth history ensure that heaping on multiples of 12 months, which is often a problem in surveys if only the age is asked, is limited.

Among the DHS surveys that included anthropometric measurements the patterns of displacement of month of birth described above were most pronounced in the African countries.

7.3.2 Heaping of Height and Weight Measurements

There may be a systematic bias in the reading or recording of measurements. If there is no digit preference at all, one would expect to see an even distribution of the readings on each of the ten first decimal places, i.e., 10 percent of the measurements should fall on each. The most common decimals to exhibit heaping are .0 and .5. Twenty percent of the readings should fall on either the .0 or the .5 decimal place.

Weight: The degree of heaping in decimal numbers of the weight measurements is examined in Table 7.11. There is a tendency toward heaping on whole numbers and half numbers. In Tunisia, 22 percent of the recorded weights ended with .0.

[4] In Morocco, interviewers could record the season if the month of birth was unknown; each season was approximately three months long. The age of 19 percent of all children eligible for height and weight measurement was denoted using season and year; only 1 percent of children had neither a month nor a season reported.

Table 7.11 Heaping of weight readings: Percentage of recorded weights ending with .0 and .5, ratio of the proportion of recorded weights ending with .0 or .5 to the expected proportion, Demographic and Health Surveys, 1986-1989

Country	Percent of Weight Readings Ending on .0	Percent of Weight Readings Ending on .5	Weight Heaping Ratio[1]	Number of Weight Readings
SUB-SAHARAN AFRICA				
Burundi	11.9	9.7	1.08	2000
Ghana	12.6	12.8	1.27	1986
Mali	8.7	10.4	0.95	1558
Ondo State, Nigeria	8.6	10.1	0.94	1403
Senegal	11.2	9.7	1.05	640
Togo	10.5	12.1	1.13	1709
Uganda	13.1	14.1	1.36	3876
Zimbabwe	8.9	13.6	1.12	2508
NORTH AFRICA				
Egypt	13.2	15.6	1.44	2105
Morocco	16.7	19.3	1.80	5584
Tunisia	22.4	16.1	1.93	2058
ASIA				
Sri Lanka	8.0	11.3	0.97	2009
Thailand	16.9	13.5	1.52	1899
LATIN AMERICA/CARIBBEAN				
Bolivia	14.6	13.0	1.38	2588
Brazil (Northeast)	10.4	12.9	1.16	1174
Colombia	11.9	12.1	1.20	1336
Dominican Republic	15.9	14.1	1.50	1853
Guatemala	13.1	12.1	1.26	2330
Trinidad & Tobago	13.4	17.0	1.52	851

[1] Ratio of percentage of weight readings ending with .0 or .5 divided by the expected percentage.

The final column of Table 7.11 shows the degree of heaping on both of these decimals combined. The ratio of the proportion of weight readings ending in .0 or .5 divided by the expected proportion indicates the extent to which heaping occurs. A value of 1 reflects no heaping. The greatest amount of heaping was in Morocco, where almost twice the expected number of measurements ended with .0 or .5. In Dominican Republic, Thailand, and Trinidad and Tobago fifty percent more than expected of the recorded weights ended in these two values. The median of the weight heaping ratio was 1.26 for all the countries. Thus, in about half the countries at least one quarter more than expected of the measurements ended with one of these two decimals.

Height: The heaping on decimal places for the height readings is shown in Table 7.12. Overall, heaping was more pronounced on the .0 reading than on the .5 reading and was particularly a problem in the Dominican Republic, where 62 percent of all the readings were recorded with a .0 decimal and in Tunisia, where 39 and 14 percent end with .0 and .5, respectively. As a consequence, the height heaping ratio in the Dominican Republic was over four times the expected figure. In Egypt, Ghana, Guatemala, Morocco, and Tunisia around twice the expected number of the height measurements were recorded as ending on .0 or .5. The median height heaping ratio was 1.58, indicating that, overall, 58 percent more than expected of the height readings ended with one of these two decimals.

Tables 7.11 and 7.12 suggest that there is a correlation between height and weight heaping. In order to examine this relationship the Spearman's rank correlation coefficient was calculated (Siegel, 1956). Spearman's *rho* is 0.6 ($p < 0.05$), indicating that there is a correlation between heaping for height and weight measurements at the country level.

Heaping of height measurements on the digits .0 and .5 may indicate systematic undermeasurement, since the design of the board makes it impossible to read the scale beyond the child's height, and it is less likely that the measurer would record a number that could not be seen.

Table 7.12 Heaping of height readings: Percentage of recorded heights ending with .0 and .5, ratio of the proportion of recorded heights ending with .0 or .5 to the expected proportion, Demographic and Health Surveys, 1986-1989

Country	Percent of Height Readings Ending on .0	Percent of Height Readings Ending on .5	Height Heaping Ratio[1]	Number of Height Readings
SUB-SAHARAN AFRICA				
Burundi	16.7	9.6	1.31	1995
Ghana	24.1	14.7	1.94	1989
Mali	17.3	13.2	1.52	1553
Ondo State, Nigeria	11.4	12.0	1.17	1403
Senegal	13.4	13.3	1.34	640
Togo	16.4	13.0	1.47	1713
Uganda	19.0	12.6	1.58	3878
Zimbabwe	14.1	18.1	1.61	2512
NORTH AFRICA				
Egypt	22.3	16.9	1.96	2108
Morocco	22.8	17.8	2.03	5585
Tunisia	39.4	14.0	2.67	2060
ASIA				
Sri Lanka	13.0	11.7	1.23	2011
Thailand	14.7	10.3	1.25	1896
LATIN AMERICA/CARIBBEAN				
Bolivia	19.7	15.9	1.78	2590
Brazil (Northeast)	21.2	14.7	1.80	1159
Colombia	14.0	11.1	1.25	1333
Dominican Republic	62.3	23.0	4.26	1853
Guatemala	26.0	14.1	2.01	2328
Trinidad & Tobago	22.1	14.0	1.81	847

[1] Ratio of percentage of height readings ending with .0 or .5 divided by the expected percentage.

Regarding weight measurement there is no reason to assume a direction in the bias caused by digit preference, since numbers both below and above the actual weight can be read on the scales.

7.3.3 Improbable Measurements: Flagging of the Z-Scores

Height-for-age, weight-for-height, and weight-for-age z-scores are calculated according to the guidelines developed by the Centers for Disease Control (CDC) and recommended by the World Health Organization (WHO) (1986), and are included in the DHS recode data files (IRD, 1988). In cases where there is no date of birth, age-dependent z-scores cannot be calculated, and a "missing" value will be shown for the weight-for-age and height-for-age variables. In Morocco, z-scores are calculated for children whose mothers reported the child's age as well as the season and year of birth, even if the month of birth was not reported.

Z-scores considered to be improbably high or low are not included in the data files. Rather they are flagged and not used in the analyses. The CDC guidelines were followed (Jordan, 1986): weight-for-age and height-for-age z-scores above +6 and below -6 were flagged, as were weight-for-height z-scores above +6 and below -4. In addition, the following combinations of z-scores were flagged: height-for-age z-score below -3.09 and weight-for-height z-score above +3.09, and height-for-age z-score above +3.09 and weight-for-height z-score below -3.09.

The percentage of flagged z-scores was similar for all three indices in each country (Table 7.13). Less than 1 percent of the z-scores were flagged in about half the countries. The lowest percentage was seen in Colombia (under 1 percent) and the highest in Guatemala (4 percent).

Table 7.13 Improbable z-scores: Percentage of height-for-age, weight-for-height, and weight-for-age z-score values that were flagged, Demographic and Health Surveys, 1986-1989

Country	Percent of Height-for-age z-scores Flagged	Number of Children with Height Measurement	Percent of Weight-for-height z-scores Flagged	Number of Children with Weight and Height Measurements	Percent of Weight-for-age z-scores Flagged	Number of Children with Weight Measurement
SUB-SAHARAN AFRICA						
Burundi	1.1	1995	1.2	1995	1.1	2000
Ghana	0.6	1989	0.7	1986	0.6	1986
Mali	0.9	1553	1.4	1551	0.9	1558
Ondo State, Nigeria	1.1	1403	1.1	1402	1.1	1403
Senegal	0.2	640	0.2	640	0.2	640
Togo	1.9	1713	2.0	1709	1.9	1709
Uganda	2.1	3878	2.1	3871	2.1	3876
Zimbabwe	0.6	2512	0.6	2503	0.6	2508
NORTH AFRICA						
Egypt	2.1	2108	2.2	2105	2.1	2105
Morocco	3.1	5585	3.1	5582	3.0	5584
Tunisia	1.7	2060	1.7	2058	1.7	2058
ASIA						
Sri Lanka	0.7	2011	0.7	2009	0.7	2009
Thailand	0.6	1896	0.6	1896	0.6	1899
LATIN AMERICA/CARIBBEAN						
Bolivia	1.9	2590	1.9	2588	1.9	2588
Brazil (Northeast)	0.6	1159	0.6	1156	0.6	1174
Colombia	0.5	1333	0.5	1331	0.5	1336
Dominican Republic	1.8	1853	1.5	1846	1.8	1853
Guatemala	4.2	2328	4.2	2327	4.2	2330
Trinidad & Tobago	0.4	847	0.4	843	0.4	851

7.4 OVERALL RANKING AND CONCLUSIONS

7.4.1 Overall Ranking

Countries were ranked on the basis of selected indicators of the quality of anthropometric data, reviewed in the previous sections (Table 7.14). Three indicators pertaining to coverage were combined into one score: the percentage of all the eligible children who were weighed and/or measured, the percentage of 24- to 36-month-olds weighed and/or measured, and the percentage of next-to-youngest living children weighed or measured. Two indicators referring to the extent of heaping (the degree of heaping on .0 and .5 for the height and weight measurements) were combined to form the heaping score.

Northeast Brazil, Guatemala, Morocco, Thailand, and Togo had the best coverage, whereas Bolivia, Dominican Republic, Trinidad and Tobago, Tunisia, and Zimbabwe had the poorest coverage.

The lowest (best) scores for the heaping index were Burundi, Mali, Ondo State (Nigeria), Senegal, and Sri Lanka whereas Dominican Republic, Egypt, Morocco, Trinidad and Tobago, and Tunisia had the highest (worst) scores.

Thus, Dominican Republic, Trinidad and Tobago, and Tunisia, had the poorest scores for both coverage and heaping.

The three countries with the largest proportion of flagged z-scores are Guatemala, Morocco, and Uganda. Morocco is also one of the countries with the most heaping, Guatemala ranked as number 13.5 on the heaping index, and Uganda was near the median.

7.4.2 Conclusions

Overall, the children for whom anthropometric measurements were collected were fairly representative of the children eligible for inclusion (median missing data: 8 percent). In all but one country more than 80 percent of the eligible children were weighed and measured, and in 11 of the 18 surveys more than 90 percent of the eligible children were weighed and measured. Missing data are more common for fostered children, for children under 6 months of age and older than 24 months, for urban children, and for next-to-youngest children compared with youngest children.

Table 7.14 Overall ranking for coverage and heaping: Ranking of countries according to percentage of missing values for selected categories and the total coverage score (Coverage Index); ranking of countries according to heaping of height and weight measurements and the total heaping score (Heaping Index), Demographic and Health Surveys, 1986-1989

Country	Rank Order of Countries According to the Percentage of Missing Values for Selected Categories and Total Coverage Score					Country	Rank Order of Countries According to Heaping of Height and Weight Measurements and Total Heaping Score			
	Eligible Children (A)	25- to 36-Month Age Group (B)	Next-to-Youngest Child (C)	Total Coverage Score (Sum of A,B,C)	Rank of Total Coverage Score		Weight Heaping on .0 or .5 (D)	Height Heaping on .0 or .5 (E)	Total Heaping Score (Sum of D,E)	Rank of Total Heaping Score
Morocco	1	2	1	4	1	Sri Lanka	1	2	3	1
Northeast Brazil	2	1	2	5	2	Ondo State, Nigeria	4	1	5	2
Togo	3	3	5	11	3	Senegal	2.5	7	9.5	3
Thailand	6	4	3	13	4	Burundi	5	6	11	4
Guatemala	4	6	7	17	5	Mali	2.5	9	11.5	5
Ondo State, Nigeria	7	7	4	18	6	Colombia	9	3.5	12.5	6
Burundi	5	5	10	20	7	Togo	7	8	15	7
Sri Lanka	10	8	8	26	8	Zimbabwe	6	11	17	8
Egypt	9	9	9	27	9	Thailand	17.5	3.5	21	9.5
Mali	8	10	11	29	10	Brazil (Northeast)	8	13	21	9.5
Colombia	12	12	6	30	11	Uganda	12	10	22	11
Ghana	11	11	12	34	12	Bolivia	13	12	25	12
Uganda	13	13	13	39	13	Ghana	11	15	26	13.5
						Guatemala	10	16	26	13.5
Dominican Republic	14	15	14.5	43.5	14	Egypt	15	15	30	15
Tunisia	15	16	14.5	45.5	15	Trinidad and Tobago	17.5	14	31.5	16
Zimbabwe	17	14	17	48	16	Tunisia	14	18	32	17
Bolivia	16	17	16	49	17	Dominican Republic	16	19	35	18
Trinidad & Tobago	18	18	18	57	18	Morocco	19	17	36	19

Note: Countries are ranked in descending order by both percentage of missing data for the coverage index and by amount of heaping for the heaping index. A low rank implies a lower percentage of missing data and less heaping, respectively.

Heaping of height and weight measurements on the digits .0 and .5 did not present a problem in most surveys, but was pronounced in a few. Outliers of measurements were not a problem.

The results of an analysis of the quality of the month of birth data, however, showed that there are systematic errors in age reporting in several surveys, which need to be taken into account in all anthropometric analyses. A possible consequence of the displacement of births into the last year before the survey is that the nutritional status of infants is actually worse than shown by the survey data, since a significant proportion of the infants are actually older than one year.

7.4.3 Implications for DHS-II

Since there were no major systematic errors in the DHS-I data on child anthropometry, the method of data collection was continued during DHS-II. The proportion of countries including anthropometry in the survey has been increased and two changes have been made. First, because of the value of the experience in some surveys with height and weight measurement from birth and through 60 months of age, this option was considered and adopted for the second phase of the DHS program. Second, maternal anthropometry has been included in virtually all surveys that include child anthropometry. The children and mothers are weighed with an electronic scale that has an accuracy of 100 grams and the measuring board for children has been extended to accommodate mothers' measurements as well. In addition, measurement of arm circumference has been added for mothers.

References

Bicego, G.T. and J.T. Boerma. 1992. Maternal education and child survival: A comparative study of survey data from 17 countries. *Social Science and Medicine* 36(9);1207-1227.

Dibley, M.J., J.B. Goldsby, N.W. Staehling, and F.L. Trowbridge. 1987. Development of normalized curves for the international growth reference: Historical and technical considerations. *American Journal of Clinical Nutrition* 46(5):736-748.

Institute for Resource Development (IRD) Inc. 1988. Description of the Demographic and Health Surveys. Individual Recode Date File. Columbia, Maryland: IRD.

Jordan, M.D. 1986. *Anthropometric software package: Tutorial guide and handbook*. Atlanta: Centers for Disease Control.

Siegel, S. 1956. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill Book Company.

United Nations. 1986. *How to weigh and measure children: Assessing the nutritional status of young children in household surveys*. New York: United Nations, Department of Technical Co-operation for Development and Statistical Office (National Household Survey Capability Programme).

World Health Organization (WHO). 1981. *Development of indicators for monitoring progress toward health for all by the year 2000*. ("Health for All" Series No. 4). Geneva: WHO.

World Health Organization (WHO). Working Group. 1986. Use and interpretation of anthropometric indicators of nutritional status. *Bulletin of the World Health Organization* 64(6):929-941.

CHAPTER 8

Causes of Death in Childhood: An Evaluation of the Results of Verbal Autopsy Questions Used in Seven DHS Surveys

J. TIES BOERMA
A. ELISABETH SOMMERFELT
JEROEN K. VAN GINNEKEN

Acknowledgments

We are grateful to Ron Gray for comments on this paper.

Analyzing the medical causes of death in childhood can be useful in identifying priority areas for health programs and evaluating the impact of health interventions. Since registration data are often lacking and hospital data are highly selective, increasing use is made of interview-based diagnosis of the cause of death. This approach to determining the causes of death is often called the verbal autopsy or postmortem interview technique.

There is very little experience with the use of verbal autopsy at the national level. Most population-based studies are based on small populations and carried out in the context of longitudinal epidemiological surveys. Only recently have efforts been made to standardize the methods used in verbal autopsy surveys (e.g., Gray et al., 1990). These efforts include the development of questionnaires and the use of diagnostic algorithms.

In selected DHS surveys the probable causes of death were ascertained for deceased children born during the five years preceding the survey. Whether or not a "causes of death" module was included in a DHS survey depended on the country's implementing agency. The type of questions used differed from survey to survey. The different questions used are evaluated in this chapter, on a survey-by-survey basis. Assessing the data quality is difficult. For example, consider a survey the results of which indicate that 20 percent of all deaths under 5 years of age were associated with diarrhea. The results seem plausible on the basis of longitudinal epidemiological studies (e.g., Gray, 1991). However, the data may not be of good quality. In a population where 20 percent of the children have diarrhea in the last two weeks before the survey, one may expect to find that 20 percent of the children had diarrhea during the illness preceding death, even if no children died due to diarrhea.

In this evaluation the focus is on the type of questions used in the DHS surveys and the implications this choice had on the results. For each of seven surveys with cause-of-death questions, the questions used are reviewed and a table enumerating the leading causes of death by age of the child is presented. The age groups are neonatal (0 months), postneonatal (1-11 months), and child mortality (12-59 months). If the number of deaths in one of the latter two age groups was less than 100, both age groups were combined.

The cause of death section was embedded in the health section of the DHS questionnaire, where only information on children born in the five years preceding the survey was collected. Therefore, the cause of death data refer to all children born in the last five years. Deaths of children born more than five years ago were not included in this cause of death section. Consequently, there is underrepresentation of deaths at older ages among the under fives.

The assessment commences with two Latin American surveys (Bolivia and Ecuador), followed by three surveys in North Africa (Egypt, Morocco, and Tunisia) and two surveys in sub-Saharan Africa (Cameroon and Senegal). The Cameroon survey was carried out during DHS-II.

8.1 BOLIVIA

Two types of information were used to assess the likely cause of death. First, the respondent was asked to give the main disease or accident causing the death, which was entered by the interviewer in the questionnaire and later coded, using a list of causes of death provided by the Ministry of Health. Second, for deaths not caused by an accident, inquiries were made into the presence and duration of several specific symptoms and signs during the two-week period preceding the death. These symptoms included diarrhea, diarrhea with blood, difficult breathing, common cold/cough, rash, and fever. The mother was also asked whether the baby had been sucking normally during the first days of life.

The mother was asked whether the child had died at home or in a health facility, and whether medical care had been sought for the illness preceding the death. If diarrhea was one of the signs and symptoms present before death, it was determined whether oral rehydration therapy had been used.

Twenty-six percent of the respondents said they had a death certificate for the deceased child, but in only 2 percent of the cases was the certificate actually shown to the interviewer. Therefore, the death certificates could not be used to assess the causes of death.

Fever, diarrhea, and breathing difficulties were the most common symptoms preceding death (Table 8.1). On average three of the eight symptoms probed were present. Diarrhea and fever were very common after the neonatal period (more than half of the deaths). Difficult breathing was twice as frequent as cough during the neonatal period, while both symptoms were reported with equal frequency after the neonatal period.

The duration of these symptoms was also asked, particularly to be able to exclude cases in which the symptoms started shortly before death and were not a likely cause of death. Most symptoms did not start until at least one day before death and most of these started well before. For difficult breathing a significant proportion of children (15 percent) had dyspnoea starting on the day of death. An additional 19 percent started one day before death. Most likely, these children did not have pneumonia but had breathing difficulties associated with general weakness, fever, etc. Therefore, it is very important to collect data on the duration of the dyspnoea symptoms as reported by the mother.

Mothers reported a cause of death for 91 percent of the deceased children. The proportion of deaths where the cause was

either unknown or poorly defined by the respondent did not increase with the length of the recall period and was the same for both the first and the fourth years before the survey. Among infant deaths of unknown cause, 14 percent occurred the year before the survey, 12 percent the second year before the survey, 12 percent the third year, and 13 percent the fourth year.

Table 8.1 Symptoms before death and causes of death by age in months among children under 5 years, Bolivia DHS, 1989

	Age at death (months)			
	0-59	0	1-11	12-59
SYMPTOMS				
Diarrhea	36.0	9.3	39.1	70.3
Diarrhea with blood	9.3	1.3	8.2	23.1
Cough	24.0	15.8	25.9	33.1
Dyspnoea	30.5	35.6	28.2	26.8
Rash	11.7	5.5	8.3	26.8
Convulsions	3.6	2.7	4.2	4.0
Fever	48.1	22.8	57.9	68.4
Other	29.6	28.2	31.8	27.7
CAUSES OF DEATH ACCORDING TO MOTHER				
Birth problems	13.3	32.9	3.8	0.5
Prematurity	2.7	7.7	.0	.0
Tetanus	3.3	5.7	2.0	1.9
Congenital anomaly	0.8	1.0	1.1	.0
Diarrhea	35.7	13.1	39.1	63.8
Respiratory illness	20.5	17.2	25.7	15.9
Measles	1.2	0.2	2.1	1.2
Other infections	2.0	3.1	1.3	1.7
Other diseases	4.0	4.0	4.4	3.1
Accidents	7.4	7.9	8.4	4.8
Unknown	9.2	7.4	12.1	6.8
PROBABLE DIAGNOSIS BASED ON SYMPTOMS				
Diarrhea	33.4	7.6	37.1	65.1
Respiratory infection	8.8	3.3	11.2	11.4
Measles	3.1	.0	2.6	8.7
PROBABLE DIAGNOSIS BASED ON SYMPTOMS AND MOTHER'S REPORT				
Diarrhea	26.7	4.5	30.0	54.6
Respiratory infection	1.8	1.2	2.1	2.3
Measles	0.3	.0	0.8	.0
Number of deaths	567	199	234	134

The main causes of death as reported by the mother according to the age of the child are summarized in Table 8.1. In the neonatal period, problems associated with delivery, primarily traumatic delivery and neonatal asphyxia, were mentioned by almost one-third of the respondents. Respiratory illness was the next most frequently cited cause of death (17 percent), followed by diarrhea (13 percent). Eight percent mentioned prematurity, and 6 percent tetanus. An unusually high proportion (8 percent) also mentioned accidents as a cause of neonatal death. This is likely to be due to the structure of the questionnaire and its interpretation by both interviewers and respondents. In several cases, deaths due to birth trauma were classified as accidental deaths, and there was not always sufficient detail to distinguish perinatal causes of death (mainly birth problems) from accidents.

In addition, the mother's assessment of the neonate's size at birth—available for all live births during the five years preceding the survey—was used to estimate the impact of low birth weight on mortality. Subjective assessments of the relative size of the infant at birth have been shown to be reasonable indicators of actual size at birth (Moreno and Goldman, 1990). Almost 10 percent of all neonates (deceased or surviving) were considered "very small" by the respondents, and 20 percent were "smaller than average." For 25 percent of the neonatal deaths, the baby was reportedly very small at birth, and low birthweight can be considered an associated cause of death.

During the postneonatal period, diarrhea was reported to be the leading cause of death (cited in 39 percent of the 234 deaths), followed by respiratory infection (26 percent). According to the mothers' reports, measles was not a leading cause of death.

From the list of symptoms and mother's report on the cause of death a probable diagnosis of the cause of death can be made (multiple causes possible). This was done for four leading causes of death—neonatal tetanus, diarrhea, pneumonia, and measles—to show some of the difficulties in making a probable diagnosis. The results of application of these procedures for the last three diseases are found in Table 8.1.

Initially, three criteria were used to identify deaths due to neonatal tetanus: death occurring between 2 and 30 days after birth, normal sucking during the first days after birth, and convulsions. However, in Bolivia, the question on the presence of seizures was not very clear and a number of children who had convulsions may have been missed. No deaths met all three criteria. Omitting the question on convulsions and restricting the age range at death to 4-14 days, the period during which most neonatal tetanus deaths occur, 40 deaths were found, which is 20 percent of all neonatal deaths. In five of these cases (2.5 percent of neonatal mortality), the mother had also mentioned tetanus as the cause of her child's death. Using the mothers' diagnoses, 5.7 percent of all neonatal deaths were due to tetanus.

Diarrhea was considered a probable cause if the child had diarrhea (with or without blood in the stool) for at least two days. For 33 percent of the deaths among children under five years and for 65 percent of the deaths at ages 1-4 years, diarrhea was a probable cause, based on the symptoms. In most of these cases the mothers had also spontaneously mentioned diarrhea

as the cause of death (Table 8.1). Diarrhea was generally not associated with either pneumonia or measles. In only 6 percent of all deaths after the neonatal period did diarrhea cause or contribute to the child's death in combination with pneumonia or measles.

If the child had a cough for at least four days and breathing difficulties for at least two days before death, pneumonia was listed as a cause (Kalter et al., 1990). Based on mothers' reports of their children's symptoms, lower respiratory tract infections caused fewer deaths than diarrheal diseases: pneumonia was a probable cause for 9 percent of all deaths. Respiratory infection was mentioned by the mother as the cause of death for only 2 percent and the symptom-based diagnosis was pneumonia.

Measles was considered a cause if the age at death was at least four months, a rash was present for at least three days, and the child had fever for at least three days. Measles, as defined above and occurring during the last two weeks before death, was a probable cause of 3 percent of the deaths and was associated with 9 percent of all deaths at age 12 months and over. However, mothers had mentioned measles as the cause of death for only two of these cases.

The long-term effects of measles on child mortality—children who have had measles are more likely to die from other causes, such as pneumonia, diarrhea, or tuberculosis, in the months afterwards due to reduced resistance to these diseases—have been described in several studies (Koenig et al., 1990). Therefore, mothers were asked whether the dead child had had rash and fever in the six months before death. If so, they were asked the duration of the episode and the time elapsed between this illness and the child's death.

The proportion of deaths preceded by a presumed measles infection was estimated using questions about an illness consisting of rash and fever during the six months preceding the interview (data not shown). Using the same criteria for the diagnosis of measles as above, that is, an illness with a rash lasting three days or longer and with a fever for at least three days, 14 percent of children had a history of measles in the four weeks preceding death, 19 percent in the three months preceding death, and 21 percent in the six months preceding death. For children who died of respiratory diseases, according to the mother's report, 22 percent had had measles in the three months before death. The corresponding figure for diarrheal deaths was 15 percent. This suggests that measles may be more important as a cause of death than the data in Table 8.1 show.

Although the verbal autopsy questionnaire was more extensive in Bolivia than in most other DHS surveys before 1989, it cannot be shown that this has led to more valid and reliable results. However, the results do provide an indication of the quality of the data. The duration of breathing difficulties is a very important addition, and data on the duration of other symptoms enabled a more careful assessment of the probable cause of death using diagnostic algorithms. Unfortunately, mother's reported cause of death and the diagnosis based on the symptoms often are inconsistent. The inconsistencies may be due to errors in both methods.

The proportion of women responding "don't know" to the open question on the cause of death in Bolivia is remarkably lower than in most other DHS surveys. In Bolivia, the interviewer wrote down what the mother said and the cause was coded in the office; in other surveys a short coding list was provided to the interviewer (in the questionnaire). This suggests that the large proportion of don't know responses is caused by the interviewers' problems with ascertaining the cause of death. It is, however, also possible that office editors had very loose instructions for coding the causes of death, and considerable room was left for the coders' interpretations.

8.2 ECUADOR

In Ecuador the interviewer coded the cause of death following one question to the mother:

> "Which symptoms did (NAME) have in the two weeks preceding death?"

The questionnaire provided the following instructions to the interviewer:

- Tetanus: stopped sucking 7-10 days after birth, stopped crying 3 days before death, rigid body, convulsions
- Malaria: fluctuating fever, cold shivers, shaking of the body
- Acute respiratory infection (ARI): cough; fever; nasal discharge; difficult, rapid, or noisy breathing
- Measles: exanthema on the whole body, nasal discharge, cough, fever, red eyes
- Whooping cough: persistent and severe cough
- Acute diarrhea: diarrhea and vomiting, sunken eyes, sunken fontanel, very thirsty
- Various: traffic accident, burns, drug or food poisoning
- Others (specify).

Table 8.2 shows the results of these questions for 202 deaths for children under five years by age period. Forty percent of the deaths could not be classified by the interviewer in one of

the eight categories of causes. It cannot be assessed whether the respondent did not know what the symptoms were or whether the interviewer did not know what diagnosis to make from the symptoms recalled by the respondent. The proportion of don't know responses increased with the length of the recall period as follows: 30 percent of infant deaths in the first and second years, respectively, before the survey and 52 percent in the third and fourth years, respectively, before the survey.

Table 8.2 Causes of death among children under 5 years, by age in months, Ecuador DHS, 1987 (percentages)

Cause	All	Age at death (months) 0	1-59
Diarrhea	11.9	6.4	18.3
ARI	11.4	11.9	10.7
Tetanus	5.4	9.2	1.1
Malaria	4.5	3.7	5.4
Measles	2.5	2.8	2.2
Pertussis	1.5	0.9	2.1
Accidents	5.9	4.6	7.6
Other	16.8	21.1	11.8
Don't know	40.1	39.4	40.8
Total	100.0	100.0	100.0
Number of deaths	202	109	93

For the remaining 60 percent of deaths, diarrheal diseases were the most common cause of death, especially after the neonatal period. During the neonatal period ARI and tetanus were the leading causes. Accidents, which were common in all age groups, were associated with 7 percent overall; deaths due to accidents were not likely to be classified as unknown. Presumably, this cause of death was the simplest to ascertain for the interviewer. However, it is possible that birth trauma has been reported or interpreted as an accident, since 5 percent of neonatal deaths were attributed to accidents.

Measles is conspicuously uncommon as a leading cause of death, accounting for only 2.5 percent of all deaths under five years of age. Underreporting or misclassification by the interviewer are likely explanations.

Generally, the method used in Ecuador does not appear to provide useful results or a reasonably accurate picture of the causes of death in childhood. The proportion of deaths with unknown cause is large, but more importantly, the causes of death are highly sensitive to interviewer interpretation and biases.

8.3 EGYPT

In Egypt, no symptoms checklist was used, but a limited number of questions were asked to determine whether the child had died from a few important causes of death:

- Diarrhea: Did the child have diarrhea during the seven days before death? If yes, did the child also have watery stools?
- Acute lower respiratory infections: Did the child have a cough and difficulty breathing in the seven days before death (two separate questions)?
- Measles: Did the child have measles during the last seven days before death? [It often is argued that measles is the main cause of death, if it occurred within three months before the death (e.g., Koenig et al., 1990).]
- Other illness: Did the child have any other illness during the last seven days?
- Accident: Did the child have an accident during the last seven days?
- Neonatal tetanus: Did the child have convulsions and had it been nursing normally until it became ill?

The mother was also asked whether the child had been examined by a doctor during the period of illness before death.

There were no coding categories for don't know responses. Missing values occurred for 21 of 723 deaths in children under five years (2.9 percent), apparently because the interviewer skipped the whole section. Twenty percent of the mothers mentioned other illnesses as the cause of death; the most frequently mentioned conditions were severe diarrhea, tetanus, and fever (Table 8.3). On the basis of this list of symptoms and diseases, it is possible to arrive at an estimate of the magnitude of the four leading causes of death.

Diarrheal diseases are very commonly reported (for one third of the deaths). Ninety percent of the children with diarrhea in the terminal illness had watery diarrhea. Diarrhea can be considered a likely primary or contributory cause of death if the child had diarrhea during the last week or if the mother spontaneously mentioned that the child had severe diarrhea. Under these assumptions, more than 50 percent of the postneonatal and child deaths in Egypt are associated with diarrhea.

Pneumonia is a probable cause of death for about one fourth of the child deaths if the diagnosis is based on the presence of cough with difficult breathing. It is notable that difficult breathing was more common than cough, especially among neonatal deaths and child deaths. For a very young infant with

pneumonia, it is possible that the sick child cannot mount a cough response, but for a child 1- to 4-years-old this is less common. In addition, terminal breathing difficulties among children who are very sick while dying from causes other than pneumonia are likely to be reported as difficulty breathing, which may explain the high prevalence of breathing difficulties.

Table 8.3 Causes of death and symptoms occurring before death among children under 5 years, by age in months, Egypt DHS, 1988 (percentages)

	Age at death (months)			
	0-59	0	1-11	12-59
SYMPTOMS				
Diarrhea	32.5	7.5	55.6	48.9
Watery stools	29.3	6.8	51.5	40.7
Cough	20.7	8.0	31.2	31.6
Diff. breathing	27.9	20.7	31.4	40.3
Measles	4.0	0.7	4.4	12.6
Other	20.1	14.9	26.7	19.4
Severe diarrhea	12.7	2.7	23.4	16.2
Fever	3.5	2.9	3.8	4.7
Tetanus	5.7	9.2	2.6	2.8
Convulsions	13.9	30.3	0.0	0.0
Nursing normal	15.0	32.7	0.0	0.0
Saw doctor	61.8	42.1	78.6	78.2
Missing	3.1	3.4	2.8	2.6
PROBABLE DIAGNOSIS				
Diarrhea	34.4	8.9	58.5	50.0
Pneumonia	16.1	6.3	23.9	25.7
Measles	3.3	0.0	3.2	12.6
Neonatal tetanus	6.2	13.6	0.0	0.0
Number of deaths	723	331	274	117

The diagnosis of measles could only be based on the mother's report of measles, since no symptoms were asked. Using the criterion that measles deaths can only occur in a child at least four months old, 4 percent of the postneonatal deaths and 13 percent of deaths among children 1-4 years were reportedly due to measles.

Neonatal tetanus was spontaneously mentioned by 9 percent of mothers for neonatal deaths, and convulsions and nursing problems a few days after birth were each mentioned for about 30 percent of the neonatal deaths. If the diagnosis of neonatal tetanus is based on the presence of both symptoms and death between 3 and 28 days of life, then 14 percent of the neonatal deaths were due to tetanus.

In general, it appears that focusing on very few causes of death (diarrhea, pneumonia, and measles for deaths after the neonatal period) leads to overestimation of the proportion of deaths caused by diarrhea and ARI. Also, it is not possible to distinguish between main and associated causes of death. In addition, the mix of asking a few questions on symptoms preceding death and asking for a disease itself, namely measles, does not appear to lead to useful results. It is difficult to assess whether the two questions on convulsions and feeding for neonatal deaths provide an estimate of the importance of neonatal tetanus mortality.

8.4 TUNISIA AND MOROCCO

Tunisia and Morocco used the same questionnaires to determine the causes of death in children under five years. They included:

- Questions on the presence of 17 symptoms or conditions during the illness that led to the child's death
- A question on the mother's opinion of the cause of death, with 10 coding categories.

The mother responded don't know to the latter question for 45 percent of the deaths in Tunisia and for 33 percent in Morocco (Table 8.4). About one quarter of the answers were classified as other. In Tunisia, the proportion of mothers responding don't know did not increase with the length of the recall period. Such responses were recorded for 43, 42, 43, and 36 percent among infant deaths for the first, second, third, and fourth years before the survey, respectively. In Morocco, there was a small increase when the recall period exceeded three years. The proportions responding don't know for the cause of infant deaths were 31, 31, 33, and 39 percent for the first, second, third, and fourth years before the survey, respectively.

Considering the main causes of death the following can be noted in Table 8.4:

- Diarrhea: as a symptom very commonly reported in Morocco (more than 50 percent after the neonatal period) and also frequent in Tunisia (38 percent for postneonatal deaths). The mother reported diarrhea as the cause of death for about 32 percent of the deaths after the neonatal period in Morocco and for 26 percent of the postneonatal deaths in Tunisia. It appears that in Morocco diarrhea was mild or a secondary cause for about one fifth of all deaths, where, according to the mother, diarrhea was not the cause of death but was present as a symptom.
- Acute respiratory infection: in both surveys difficult breathing was more common than cough. The difference was particularly large in Morocco. Overall, pneumonia, based on cough with difficult breathing, is less common than may have been expected. Mothers rarely gave respiratory illness as a cause of death.

Table 8.4 Symptoms and causes of death, by age in months, for deaths among children under 5 years, Tunisia DHS 1988 and Morocco DHS 1987 (percentages)

	Tunisia			Morocco		
	Age at Death (months)			Age at Death (months)		
	0-59	0	1-59	0-59	0	1-59
SYMPTOMS						
Body swollen	15.4	13.7	17.3	9.0	4.0	12.5
Extreme thinness	28.6	25.6	31.8	28.4	14.5	42.2
High fever	22.9	10.3	36.4	31.2	15.7	46.8
Diarrhea	20.3	3.4	38.2	34.0	11.7	55.6
Vomiting	16.7	5.1	29.1	34.4	14.9	53.6
Mouth closed	11.9	11.1	12.8	10.8	13.7	7.9
Cough	8.8	4.3	13.6	10.6	6.0	16.0
Dyspnoea	11.9	7.7	16.3	21.0	23.4	19.0
Ictere	12.3	6.8	18.2	4.0	5.6	2.2
Skin rash	7.9	5.1	10.9	4.0	2.0	5.2
Convulsions	6.2	4.3	8.1	8.0	5.2	10.7
Stiff body	8.8	5.1	12.7	4.0	6.0	2.1
Muscular contractions	4.4	3.4	5.5	6.8	9.3	4.5
Accidents	0.9	0.0	1.9	1.4	1.2	1.5
Intoxication	0.9	0.9	0.9	0.8	0.4	1.0
Other	37.9	47.9	27.3	25.6	38.3	13.9
CAUSE OF DEATH ACCORDING TO MOTHER						
Diarrhea	12.8	0.9	25.5	19.6	7.3	31.6
Tuberculosis	2.6	4.3	0.9	0.2	0.0	0.5
Respiratory disease	6.2	4.3	8.2	5.0	7.3	2.8
Meningitis	2.6	0.9	4.5	0.6	0.0	1.3
Whooping cough	0.9	0.0	1.9	1.4	0.0	3.2
Tetanus	0.9	0.0	1.8	3.0	4.8	1.2
Measles	1.3	0.0	2.7	2.2	0.0	3.5
Diphtheria	0.9	1.7	0.0	1.6	0.4	2.6
Other	24.2	32.5	15.5	28.8	40.7	17.7
Missing	1.8	2.6	0.9	4.2	3.6	4.8
Don't know	45.4	53.0	37.2	33.4	35.9	30.7
PROBABLE CAUSE OF DEATH						
Malnutrition	38.3	35.9	40.9	33.2	17.3	47.7
Pneumonia	4.0	1.7	6.4	4.2	2.8	5.8
Pneumonia with fever	3.1	0.9	5.5	2.4	1.2	3.8
Diarrhea with fever	11.9	2.6	21.9	19.4	5.6	33.0
Measles	2.2	0.0	4.6	1.4	0.0	2.4
Tetanus	2.2	4.3	0.0	4.2	8.5	0.0
Accidents	1.8	0.9	2.7	2.2	1.6	2.4
Malaria	0.9	0.0	1.8	1.6	0.0	8.1
Pertussis	4.8	2.6	7.2	5.0	1.2	8.9
Number of deaths	227	117	110	500	248	252

- Measles: skin rash was not commonly reported in either country, but was reported for neonates. The lack of a specific term for a measles-associated skin rash may have contributed. Mothers also did not often mention measles as the cause of death.

- Neonatal tetanus: neonatal tetanus was not reported at all in Tunisia, but in Morocco it was mentioned for 5 percent of all neonatal deaths. Based on the symptoms, i.e., inability to open the mouth and convulsions, spasms, or body stiffness, the probable diagnosis of tetanus was made for neonatal deaths between 3 and 31 days. In this case 4 and 10 percent of the neonatal deaths are caused by tetanus in Tunisia and Morocco, respectively. In Morocco, the diagnosis of tetanus based on the symptoms agreed for only 29 percent with mother's report of tetanus.

- Malnutrition: extreme thinness of the child and, to a lesser extent, swollen body are potential symptoms of protein calorie malnutrition, and were reported frequently. If either of these two symptoms is taken as evidence of malnutrition then about one third of all deaths are associated with malnutrition in both coun-

tries. Extremely thin for neonates probably refers to low birth-weight babies. It is not clear how reliable the reports are. If it is malnutrition, the symptoms would have to be present for at least a month or so, but such information was not collected.

The leading probable causes of death that result from combining information on the list of symptoms and mothers' reports are listed in Table 8.4. It can be concluded that the checklist of symptoms in Tunisia and Morocco provides some insight into the leading causes of death in childhood, but many questions remain. Diarrhea appears to be overestimated and respiratory infections, measles, and neonatal tetanus underestimated. The questionnaires also included symptoms that were not well specified and causes of death that were not useful (e.g., diphtheria and typhoid).

8.5 SENEGAL

Three questions were asked in Senegal to determine the probable cause of death:

- Did the child have one of the following symptoms during the disease that led to the child's death? (the presence of 12 signs and symptoms were probed; see Table 8.5)
- Did the child have one of the following symptoms just before death? (five symptoms were probed)
- What was the principal cause of death? (there were coding categories for six conditions and for other causes)

The results are shown in Table 8.5. The list of symptoms during the disease leading to death does not include the important symptoms of diarrhea and difficult breathing. For 18 percent of the deaths the mother did not know what symptoms the child had had. This was a particularly common situation if it concerned a neonatal death: 38 percent don't know responses. The proportion of deaths with unknown cause according to the mother increased with the length of the recall period: 40 percent of the infant deaths in the year before the survey, 40 percent in the second year before the survey, 55 percent in the third, and 51 percent in the fourth year before the survey. High fever was a symptom for more than 70 percent of the postneonatal and childhood deaths. Dehydration was also very frequently reported for these children: about 45 percent. Most likely mothers understood the term dehydration. There were three symptoms referring to cough: cough, cough and vomiting, and attacks of coughing. Cough and vomiting, and attacks of coughing were more frequently reported than cough, which is inconsistent.

Muscular spasms, dehydration, and stiff body were all reported as symptoms occurring just before death (but may have been present longer) for about one in five deaths. Ten percent had convulsions. These questions do not provide useful information.

For 42 percent of the under-five deaths the mother could not give a cause of death. For neonatal deaths the value was 66 percent. Diarrhea, measles, malaria, and other conditions were the most commonly reported causes. Pneumonia and accidents were not on the list of possible answers.

Table 8.5 Symptoms and causes of death among children under 5 years by age in months, Senegal DHS 1986 (percentages)

	Age at Death (months)			
	0-59	0	1-11	12-59
SYMPTOMS PRESENT DURING TERMINAL ILLNESS				
Could not drink	27.8	33.7	33.5	18.5
Could not cry	14.0	16.3	15.5	10.8
High fever	58.7	32.1	72.0	72.5
Skin rash	12.8	4.6	16.8	17.1
Cough	9.7	5.1	14.3	10.4
Red eyes	14.3	6.1	19.3	18.0
Cough and vomiting	28.8	8.7	40.4	38.3
Attacks of coughing	5.5	2.0	9.3	5.9
Dehydration	32.6	5.6	45.3	47.3
Red hair	6.6	0.0	6.8	12.2
Swollen feet	3.6	1.0	0.6	8.1
Accidents	1.0	0.5	1.2	1.4
Don't know	18.3	37.8	5.6	10.4
SYMPTOMS PRESENT JUST BEFORE DEATH				
Muscular spasms	19.3	15.8	23.6	19.4
Convulsions	10.0	7.1	9.9	12.6
Dehydration	24.9	4.1	32.3	37.8
Stiff body	21.2	17.3	20.5	25.2
Paralysis	5.7	4.6	6.2	6.3
CAUSE OF DEATH ACCORDING TO MOTHER				
Tetanus	4.0	6.6	5.6	0.5
Whooping cough	1.7	0.5	3.1	1.8
Diarrhea	16.2	2.0	24.8	22.5
Measles	11.1	1.0	12.4	18.9
Malaria	4.8	0.5	6.2	7.7
Influenza	2.6	1.0	3.7	3.2
Other	16.2	20.9	15.5	12.6
Don't know	42.3	66.3	27.3	32.0
PROBABLE CAUSES OF DEATH				
Diarrhea	16.2	2.0	24.8	22.5
Malaria	14.9	0.0	22.4	22.5
ARI	11.9	4.1	18.6	14.0
Measles	8.1	0.0	9.9	14.0
Whooping cough	1.7	0.5	3.1	1.8
Neonatal tetanus	4.8	14.3	0.0	0.0
Total	579	196	161	222

The last part of Table 8.5 shows probable causes of death which, taking into account the limitations of the Senegal questionnaire, are based on the following criteria:

- Diarrhea: based on mother's report (about 25 percent of postneonatal and childhood deaths).

- Malaria/meningitis: based on mother's report of malaria or on the symptoms of high fever with muscular spasms or convulsions in a child at least 1 month old. Since Senegal is in the "meningitis belt," meningitis is also probable and it is virtually impossible to distinguish between the two with the DHS questions.

- Acute respiratory infection: based on symptoms of cough (cough only, cough with vomiting, or attacks of coughing) with high fever.

- Measles: high fever and skin rash in a child at least 4 months old or diagnosis from mother's report.

- Whooping cough: mother's report of whooping cough, with cough and vomiting as reported symptoms.

- Neonatal tetanus: unable to drink, and just before death symptoms of muscular spasms or convulsions or stiff body, in a neonate aged 3-31 days. For 14 percent of the neonatal deaths tetanus could be considered a probable diagnosis.

In general, the Senegal questions on the causes of death have several inconsistencies and omissions and the results on the leading causes of death should be interpreted very carefully.

8.6 CAMEROON

The DHS-II survey in Cameroon was conducted in 1991 and built upon the experience of the other DHS surveys and verbal autopsy studies. Therefore, the data will be analyzed somewhat more extensively than for the other surveys.

For deaths not caused by an accident, two types of information were used to assess the probable cause of death. First, the respondent was asked to give the main cause of death, which was recorded by the interviewer on the questionnaire and later coded in the office, using a list of causes of death. Two causes could be coded. Second, inquiries were made into the presence, severity, and duration of selected symptoms and signs during the illness that led to the child's death. These symptoms, which included diarrhea, diarrhea with blood, cough, difficult/rapid breathing, rash, fever, convulsions, very thin, and swollen legs and/or face, were used to make a probable diagnosis (based on diagnostic algorithms). In order to distinguish between neonates, who were normal at birth, and those who were not, the mother was also asked whether the baby had been sucking normally during the first days of life. The latter group of babies includes those traumatized during delivery and premature, as well as those with congenital malformations. The loss of the ability to suckle a few days after birth is typical of neonatal tetanus.

8.6.1 Causes of death according to mother

The data on the main cause of death as reported by the mother for neonatal deaths and deaths at 1-59 months are summarized in Table 8.6. For all under five deaths there were 2.5 percent missing values and 15 percent don't know responses. These were more common for neonatal deaths: 6 percent missing and 24 percent don't know. The proportion of infant deaths with don't know responses increased with the length of the recall period: from 11 percent for deaths in the year before the survey, to 12, 21, and 21 percent in the second, third, and fourth years before the survey, respectively.

Table 8.6 Cause of death according to the mother: Percent of deaths attributed to different causes by age in months for children born in the last five years, Cameroon DHS, 1991

	Age at Death (months)		
Cause of Death[1]	0	1-59	All
Prematurity	11.6	0.0	4.3
Birth problems	9.2	0.0	3.4
Tetanus	9.3	1.9	4.7
Congenital malf.	0.5	1.4	1.0
Malaria	8.8	15.7	13.2
Measles	1.2	18.9	12.3
Respiratory illness	13.6	11.2	12.1
. Pneumonia	4.7	6.6	5.9
. Asthma	1.9	0.7	1.1
. Pertussis	0.7	2.1	1.6
. ARI symptoms	6.2	1.8	3.4
Diarrhea	1.2	17.4	11.4
Fever	2.4	4.5	3.7
Malnutrition	0.0	4.2	2.6
Anemia	0.0	1.6	1.0
Other infections	0.0	1.6	1.0
Accidents	1.4	1.8	1.7
Other	11.6	9.6	10.3
Don't know	23.9	9.3	14.7
Missing	5.5	0.7	2.5
Total	100.0	100.0	100.0
Number of deaths	111	188	299

[1] One cause per child.

During the neonatal period, respiratory illnesses were the most frequently cited cause of death (14 percent), followed by prematurity (12 percent), tetanus (9 percent), birth problems (9 percent), and malaria (9 percent). The reliability of mothers' reports on the causes of death is not clear. Malaria may have been overreported, since it is not common before six weeks of age.

After the neonatal period, measles is the leading cause of death (19 percent, as reported by the mother), followed by diarrhea (17 percent), malaria (16 percent), and respiratory diseases (11 percent). Malnutrition was reported as the main cause of death for 4 percent of the deaths, and accidents accounted for 2 percent.

A secondary cause of death was also recorded if the mother reported more than one cause. This occurred for only 4 percent of all deaths and was attributed mostly to malaria or anemia (not included in Table 8.6).

8.6.2 Prevalence of Symptoms Before Death

The percentages of children for whom each of the symptoms occurred during the terminal illness are shown in Table 8.7. Among neonatal deaths dyspnoea was very common (32 percent), while fever, cough, and convulsions were also reported for more than 10 percent of the deaths. Among the deaths at 1-59 months, fever (58 percent), dyspnoea (44 percent), diarrhea (42 percent), and being very thin (41 percent) were commonly reported. Each of the remaining symptoms, with the exception of diarrhea with blood, were reported for more than 10 percent of the deaths.

To be able to distinguish between symptoms that are very common in childhood (such as diarrhea or thinness), but perhaps unrelated to the child's death, and symptoms that contribute to the death, it was asked whether the symptom or sign was severe. Table 8.7 shows that, for example, about three quarters of the respondents thought the diarrhea was severe.

It was also asked whether the symptom lasted until death, and, if not, how long before death it stopped. These data would enable a distinction between causes that lasted until death (main or associated causes) and causes that stopped before death (contributory causes of death). Table 8.7 shows that in the large majority of cases the symptom lasted until death. If not, it usually stopped just a few days before death (data not shown). Therefore, the distinction between main, associated, and contributory causes of death will not be made here.

Table 8.7 Symptoms during the illness that led to death: Percent with symptom present, with symptom being severe, and with symptom lasting until death, by age at death, Cameroon DHS, 1991

	Neonatal Deaths (N=111)			Deaths 1-59 Months (N=188)		
Symptom	Symptom Present	Symptom Severe	Lasted until Death	Symptom Present	Symptom Severe	Lasted until Death
Diarrhea	6.0	2.0	4.8	41.6	31.9	32.7
Diarrhea w/blood	1.9	1.2	0.0	4.8	3.5	4.8
Cough	14.0	11.2	12.4	28.9	17.9	23.6
Dyspnoea	31.5	27.9	29.9	43.6	36.8	40.1
Fever	20.3	15.2	14.6	58.4	44.4	50.8
Convulsions	11.5	10.7	7.1	19.6	14.4	18.4
Rash	2.5	0.8	2.5	17.2	15.6	14.0
Very thin	7.1	5.1	7.1	40.6	34.1	35.5
Swollen legs	6.1	2.4	3.5	12.4	9.8	10.7

Note: Children who died of accidents are included in the denominator.

8.6.3 Cause of Death Derived from Symptoms

Table 8.8 presents the probable causes of death based on various diagnostic algorithms. Among neonatal deaths low birth weight was common: 19 percent of the deaths had either a reported birth weight of less than 2500 grams or, if no birth weight was available, the mother reported her child was very small at birth. Most of the deaths caused by low birth weight appeared to be associated with premature delivery: 17.5 percent of all neonatal deaths were reportedly delivered prematurely and had low birth weight, while only 1.5 percent were delivered on time, but had low birth weight, most likely due to intrauterine growth retardation. Some of the premature babies might in fact have been small-for-date babies due to intrauterine growth retardation.

Neonatal tetanus deaths typically occur between 3 and 30 days of life (about 90 percent occur at 4-14 days). In Cameroon, slightly more than one-fourth of the neonatal deaths occurred between 3-30 days and were associated with normal sucking during the first days of life (Table 8.8). This proportion may include all tetanus deaths, but also includes deaths due to nontetanus causes. If the reported convulsions, which probably also include spasms of the body in tetanus cases, are included, 5 percent of the neonatal deaths can be considered due to probable tetanus.

Diarrhea was not common during the neonatal period, but was very common among deaths of older children. More than one third of the children dying after the neonatal period had at least two days of diarrhea, 27 percent had at least two days of

Table 8.8 Presence of symptoms during the disease that led to death: Percent with selected combinations of symptoms, Cameroon DHS, 1991

Possible Diagnosis	Symptoms	Age at Death (months)		
		Neonatal	1-59	All
Low birth weight	Low birth weight	19.0	5.7	10.6[a]
	• With prematurity	17.5	2.8	8.3
	• Delivery on time	1.5	2.9	2.4
Neonatal tetanus	Death at 3-30 days with normal sucking at birth	27.4	-	10.2[a]
	• With convulsions	4.5	-	1.7
Diarrheal diseases	Diarrhea ≥ 2 days	4.8	35.9	24.4
	Diarrhea severe, ≥ 2 days	2.0	26.7	17.6[a]
	Diarrhea with blood, ≥ 2 days	1.9	4.9	3.8
Pneumonia	Cough ≥ 1 day &/or dyspnoea ≥ 2 days	25.0	-	9.3[a]
	Cough ≥ 4 days & dyspnoea ≥ 2 days	-	16.3	10.3[a]
Measles	Death at 4 months and older with rash ≥ 3 days	-	15.0	9.4
	• With fever ≥ 3 days	-	5.6	3.5[a]
Malaria	Fever severe, ≥ 2 days	9.9	37.1	27.1
	• Without rash, diarrhea, or difficult breathing	6.9	15.8	12.5[a]
Malnutrition	Very skinny, severe ≥ 1 month	-	11.2	7.0
	Swollen legs or face, severe, ≥ 1 mo.	-	3.6	2.3
	Either very skinny or swollen legs/face	-	13.1	8.3[a]

Note: Children who died of accidents are included in the denominator.
[a] These diagnostic criteria were used to determine the probable cause of death in Tables 8.9 and 8.10

severe diarrhea, and 5 percent had diarrhea with blood (the latter is an indicator of dysentery).

If the diagnosis of respiratory illness in neonates was based on the presence of either at least one day of cough or at least two days of difficult breathing, then 25 percent of the neonatal deaths were associated with respiratory illness. The criteria used for the diagnosis of pneumonia (acute lower respiratory infection) in older children were cough for at least four days and difficult breathing for at least two days. The duration of breathing difficulties appears to be especially important, since many mothers report terminal breathing difficulties for their deceased children. About one in six deaths after the neonatal period was due to pneumonia.

A child was considered to have died from measles if the death occurred at the age of four months and older, with rash and fever for at least three days; this accounted for 6 percent of the deaths after the neonatal period. If fever is omitted from the criteria, the proportion is 15 percent. Information was not obtained about deaths that occurred as a complication of measles after the clinical symptoms of measles had subsided (so-called post-measles deaths).

Malaria is difficult to diagnose. Serious fever for at least two days was reported for 37 percent of the deaths after the neonatal period. Of these, about 16 percent were without rash, diarrhea, or difficult breathing. The latter two symptoms may occur in conjunction with malaria, but excluding them probably makes the diagnosis of malaria on the basis of serious fever more specific.

The diagnosis of malnutrition was made if the child was reportedly very thin for at least 1 month before death (wasting, marasmus), or had swollen legs or face for at least 1 month (kwashiorkor). Among deaths after the neonatal period, 13 percent were associated with malnutrition.

8.6.4 Comparison of Mother's Reported Cause and Symptom-based Diagnosis

For the five most common illnesses leading to death after the neonatal period, mother's reported cause of death was compared to the symptom-based diagnosis. In Table 8.9, the third column shows the percent of deaths for each diagnosis, derived from either the mother's reported cause or the symptoms. The fourth column only includes cases in which mother's cause of death agreed with the diagnosis based on the symptoms. The proportions derived from each of the sources can be found in columns one and two of Table 8.9.

Table 8.9 Mother's reported cause of death and diagnosis based on reporting of probed symptoms for leading causes among deaths 1-59 months: Percent from mother's report, from reported symptoms, from either source, and from both sources (in which both sources agree), Cameroon DHS, 1991 (N = 188 deaths)

Disease	From Mother's Report	From Symptoms	Either Mother or Symptoms	Both Mother and Symptoms
Diarrhea	17.4	26.7	32.7	11.4
Malaria	15.7	15.8	23.2	8.5
Respiratory infection	11.2	16.3	22.7	7.3
Measles	18.9	5.6	19.0	3.3
Malnutrition	4.2	13.1	14.5	2.8

Diarrhea was a mother-reported or a symptoms-based diagnosis for 33 percent of the deaths, but both sources were in agreement for only 11 percent of the deaths. For diarrhea, malaria, and respiratory infection the proportion based on both sources is about one-third of the proportion based on either source. For measles and malnutrition the difference is much larger.

8.6.5 Probable Causes of Death: A Synthesis

Table 8.10 presents the probable causes of death, based on mother's report and on the symptoms as in Table 8.8. How the final diagnosis was made is indicated and multiple causes of death were allowed.

Low birth weight is the leading cause of death for neonatal mortality (19 percent), and is particularly prominent during the first days of life. Most of these deaths appear to be associated with reported prematurity. Birth problems, such as prolonged labor leading to asphyxia and other obstetric complications, account for 9 percent of neonatal mortality. Respiratory illness is a probable cause of death for 7 percent, and tetanus accounts for another 7 percent. The diagnosis of neonatal tetanus was based on the combination of age at death (3-30 days), normal sucking at birth, and mother's report of tetanus. Accidents are associated with 1 percent of the neonatal deaths. No cause of death is established for more than half of the neonatal deaths, including deaths for which only malaria/fever was mentioned, since malaria is unlikely for neonates, and fever only does not provide a diagnosis. This is due to the lack of knowledge among mothers about symptoms preceding neonatal death (e.g., 25 percent responded don't know to the open question on the cause of death), the lack of detailed questions on symptoms associated with causes of neonatal death, and the disagreement between mothers' diagnosis and symptoms reported for some deaths. In addition, the assessment of neonatal causes of death may be more difficult using the verbal autopsy technique.

Table 8.10 Probable causes of death, based on mother's report on the main cause of death, and diagnostic algorithms, Cameroon DHS, 1991

NEONATAL MORTALITY (N = 111)

Cause of Death	Criteria for Diagnosis	Percent
Low birth weight	Symptoms	19.0
Birth problems	Mother	9.2
Congenital anomalies	Mother	0.5
Tetanus	Mother, death 3-30 days, normal sucking first days	7.0
Respiratory illness	Mother & symptoms	7.0
Diarrhea	Symptoms	2.0
Accidents	Mother	1.4
No cause identified		59.5

POSTNEONATAL AND CHILD MORTALITY (N = 188)

Cause of Death	Criteria for Diagnosis	Percent
Diarrhea	Symptoms (severe ≥ 2 d.)	26.7
Respiratory infection	Symptoms (cough & dyspnoea)	16.3
Measles	Mother or symptoms	19.0
Malaria	Mother or symptoms	23.2
Malnutrition	Mother or symptoms	14.5
Anemia	Mother	1.6
Accidents	Mother	1.8
No cause identified		21.0

ALL CHILDREN UNDER FIVE YEARS (N = 299)

Cause of Death	Criteria for Diagnosis	Percent
Diarrhea	Symptoms (severe,≥ 2 d.)	17.6
Respiratory infection	Symptoms (cough & dyspnoea)	12.9
Measles	Mother or symptoms	12.0
Malaria	Mother or symptoms	14.6
Malnutrition	Mother or symptoms	9.1
Anemia	Mother	1.6
Accidents	Mother	1.8
Low birth weight	Symptoms	7.1
Birth problems	Mother	3.4
Tetanus	Mother & symptoms	3.7
No cause identified		35.3

Note: Multiple causes of death allowed.

After the neonatal period, diarrheal diseases are the leading cause of death with 27 percent, followed by malaria (23 percent), measles (19 percent), pneumonia (16 percent), and malnutrition (15 percent). Anemia and accidents each accounted for less than 2 percent. The accidents included two deaths due to traffic accidents, one fall, one burn, and one classified as other. There was also one death due to poisoning. The causes of death may occur in combination with each other. Although one can argue about the accuracy of the estimates of the relative importance of the most prominent causes of death in

childhood, it is clear from the Cameroon DHS survey that preventable causes of death are the most common killers in childhood.

In sum, the cause of death questions used in Cameroon appeared to have resulted in more plausible results than any of the preceding six DHS surveys discussed in this chapter with causes of death modules. The proportion of deaths that were classified as unknown was considerably smaller than in other surveys and reached acceptable levels for deaths after the neonatal period. Malaria and malnutrition also appeared on the list of leading causes of death. This in itself may present a more genuine picture of the leading causes of death, compared to verbal autopsy studies that focus only on diarrhea, pneumonia, and measles. It is, however, very uncertain how accurate the estimates of mortality due to malaria and malnutrition are.

8.7 CONCLUSION

In general, the results on the causes of death in the seven DHS surveys analyzed here are disappointing. Primarily, this is due to inadequate questions asked in the earlier surveys, which led to large proportions of deaths with unknown causes and unlikely distributions of the leading causes of death. The more extensive questionnaires were not very successful in Bolivia but were perhaps moderately successful in Cameroon. The quality of data is, however, difficult to assess and one has to rely on common sense to assess the resulting causes of death distribution. The same approach had to be used to evaluate data quality from epidemiological studies (Gray, 1991), since validation studies are few.

Classification into main and contributory causes is not feasible on the basis of a short questionnaire. However, the use of multiple causes gives a better picture of the causes of death pattern than the use of single causes. Therefore, multiple causes should be allowed, as was done for Cameroon, and no attempt has to be made to distinguish between main and contributory causes.

Based on the results of a few studies a recall period of 6-24 months has been recommended (Gray, 1990). The length of the recall period in DHS surveys is 0-4 years. In three of the surveys, there was a moderate increase in the proportion of don't know responses where the recall period was more than two years. However, there was no increase in four other surveys. This does not suggest that the length of the recall period is the major problem. However, information given for deaths more than two years ago may be less accurate as well, but this cannot be evaluated with the DHS data sets.

Further improvements can possibly be made when more emphasis is placed on traditional names and classifications of causes of death. Such an effort has been shown to be worthwhile in several studies, but may take at least six weeks of research. Since DHS surveys are often carried out in multiple languages, such anthropological studies may not be feasible within the short time-frame of a DHS survey.

Causes of neonatal mortality generally are more difficult to determine in verbal autopsy than causes of death among older children. Not much effort has been made to determine causes of neonatal mortality, except for tetanus mortality, in the DHS program, but efforts to determine these causes would certainly be worthwhile.

In summary, it remains to be seen whether it is possible to obtain reasonably accurate data on the leading causes of death in childhood in large-scale cross-sectional surveys. With a well-developed questionnaire (more validation studies are required) it is possible to obtain a general picture of the causes of death which can be used for advocacy purposes. If the objective is to assess cause-specific mortality trends (e.g., four of the World Summit for Children Goals are cause-specific mortality reductions) one has to be more cautious for two reasons: misclassification and sampling errors. The results of validation studies show that misclassification of causes of death is common, and such studies are assumed to give the best possible picture (since only hospital deaths are used).

References

Gray, R.H., G. Smith, and P. Barss. 1990. The Use of Verbal Autopsy Methods to Determine Selected Causes of Death in Children. Occasional Paper No. 10. Baltimore, Maryland: Institute for International Programs, the Johns Hopkins University.

Gray, R.H. 1991. Interview-based diagnosis of morbidity and causes of death. Paper presented at seminar on Measurement of Maternal and Child Mortality, Morbidity and Health Care: Interdisciplinary Approaches. IUSSP. Cairo, November 4-7, 1991.

Kalter, H.D., R.H. Gray, R.E. Black, and S.A. Gultiano. 1990. Validation of post-mortem interviews to ascertain selected causes of death in children. *International Journal of Epidemiology* 19(2): 380-386.

Koenig, M.A., B. Khan, J.D. Wojtyniak, J.D. Clemens, J. Chakraborty, V. Fauveau, J.F. Phillips, J. Akbar, and U.S. Barua. 1990. Impact of measles vaccination on childhood mortality in Matlab, Bangladesh. *Bulletin of the World Health Organization* 68(4): 441-447.

Moreno, L. and N. Goldman. 1990. An assessment of survey data on birth weight. *Social Science and Medicine* 31(4): 491-500.

Sommerfelt, A.E., J.T. Boerma, L.H. Ochoa, and S.O. Rutstein. 1991. Maternal and child health in Bolivia: Report on the in-depth DHS survey in Bolivia 1989. Columbia, Maryland: Institute for Resource Development/MacroSystems Inc.

Summary of DHS Surveys, 1985-1990

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA					
Botswana	Aug-Dec 1988	Central Statistics Office	All women 15-49	4,368	AIDS, PC, adolescent fertility
Burundi (Husband Survey)	Apr-Jul 1987	Département de la Population Ministère de l'Intérieur	All women 15-49	3,970	AM, SAI, adult mortality
Burundi	Apr-Jul 1987	Département de la Population Ministère de l'Intérieur	Husbands	542	KAP study
Ghana[1]	Feb-May 1988	Ghana Statistical Service	All women 15-49	4,488	AM, SM, WE
Kenya[2]	Dec-May 1988/89	National Council for Population and Development	All women 15-49	7,150	
Liberia	Feb-Jul 1986	Bureau of Statistics Ministry of Planning and Economic Affairs	All women 15-49	5,239	TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel USED/CERPOD	All women 15-49	3,200	AM, VC, childhood physical handicaps
Mali (Male Survey)	Mar-Aug 1987	Institut du Sahel USED/CERPOD	Men 20-55	970	KAP study
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	All women 15-49	4,213	AM, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique Ministère de l'Economie et des Finances	All women 15-49	4,415	AM, CD
Sudan	Nov-May 1989/90	Department of Statistics Ministry of Economic and National Planning	EMW 15-49	5,860	M, MM, female circumcision family planning services
Togo	Jun-Nov 1988	Unité de Recherche Démographique Université du Benin	All women 15-49	3,360	AM, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	All women 15-49	4,730	AM, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	All women 15-49	4,201	AIDS, AM, PC, SAI, WE
NORTH AFRICA					
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911	AM, CD, MM, PC, SAI, WE, women's status
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982	AM, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184	AM, CD, S, SAI

[1]Data available for 943 husbands interviewed with a husband's questionnaire
[2]Data available for 1,133 husbands interviewed with a husband's questionnaire

CMW = currently married women
EMW = ever-married women

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Supplemental Studies, Modules, and Additional Questions
ASIA					
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,844	PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623	KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865	AM, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775	AM, S, SAI
LATIN AMERICA & CARIBBEAN					
Bolivia	Mar-Jun 1989	Instituto Nacional de Estadística	All women 15-49	7,923	AM, CD, MM, PC, S, WE
Bolivia (In-depth)	Mar-Jun 1989	Instituto Nacional de Estadística	All women 15-49	7,923	Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	All women 15-44	5,892	AM, PC, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	All women 15-49	5,329	AM, PC, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	All women 15-49	7,649	NFP, S, SAI, SM, family planning communication
Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	All women 15-49	3,885	
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	All women 15-49	4,713	SAI, CD, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	All women 15-49	5,207	S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	All women 15-44	5,160	S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar, Secretaría de Salud	All women 15-49	9,310	NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	All women 15-49	4,999	NFP, employment, cost of family planning
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	All women 15-49	2,534	
Trinidad and Tobago	May-Aug 1987	Family Planning Association Trinidad and Tobago	All women 15-49	3,806	AM, NFP, breastfeeding

AIDS acquired immune deficiency syndrome
AM anthropometric measurements
CD causes of death (verbal report of symptoms)
S sterilization
M migration
MM maternal mortality
NFP natural family planning
PC pill compliance
WE women's employment
SAI service availability information
SM social marketing
TBH truncated birth history
VC value of children