PN-ACA-874

Demographic and Health Surveys Comparative Studies No. 22

Childhood Immunization: 1990-1994

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March 1997

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Recommended citation:

Sommerfelt, A. Elisabeth and Andrea L. Piani. 1997. *Childhood Immunization: 1990-1994.* DHS Comparative Studies No. 22. Calverton, Maryand: Macro International Inc.

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Preface

One of the most significant contributions of the DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Comparative Studies* series and the *DHS Analytical Reports* series examine these data across countries in a comparative framework, focusing on specific topics.

The objectives of DHS comparative research are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. While *Comparative Studies* are primarily descriptive, *Analytical Reports* utilizes a more analytical approach.

The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered are selected by staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The *Comparative Studies* are based on a variable number of data sets reflecting the number of countries for which data were available at the time the report was prepared. Each report provides detailed tables and graphs for countries in four regions: sub-Saharan Africa, the Near East and North Africa, Asia, and Latin America and the Caribbean. Survey-related issues such as questionnaire comparability, survey procedures, data quality, and methodological approaches are addressed in each report, as necessary. Where appropriate, data from previous DHS surveys are used to evaluate trends over time.

Comparative Studies published under the current phase of the DHS program (DHS-III) are, in some cases, updates and expansions of reports published earlier in the series. Other reports, however, will cover new topics that reflect the expanded substantive scope of the DHS program.

It is anticipated that the availability of comparable information for a large number of developing countries will have long-term usefulness for analysts and policymakers in the fields of international population and health.

Martin Vaessen
Project Director

Acknowledgments

The authors thank Anne Cross and Jacob Adetunji for their careful reviews of earlier drafts of this report and for their helpful comments and suggestions. We appreciate that the data processing staff was available to us whenever we requested their input. We also thank Adrienne Kols and Trina Yannicos for their editorial work, Kaye Mitchell for report production, and Jonathan Dammons for graphics work.

Executive Summary

Immunization against childhood diseases contributes to reductions in mortality, morbidity, and permanent disability among children. The Expanded Program on Immunization, initiated in 1974 by the World Health Assembly, has helped focus the efforts of public health programs in developing countries and of donor organizations (Henderson et al., 1988) on the importance of vaccination services. The 1989 World Health Assembly and the 1990 World Summit for Children set the goal of achieving 90 percent vaccination coverage by the year 2000 (WHO and UNICEF, 1985).

An assessment of immunization coverage rates provides information on various aspects of whether a health care system is successful in providing vaccination services to children. The proportion of children who have received at least one vaccination demonstrates the extent to which there is any contact at all with vaccination services. On the other hand, sustained contact is required in order to provide full protection against all immunizable diseases. In addition to looking at absolute coverage levels, it is important to note whether improvement or deterioration has occurred; studying secular trends in immunization coverage indicates whether there are changes in the performance of the health care system. Monitoring and evaluation is required, even in countries with high coverage levels, in order to know whether the immunization services reach children with the needed vaccinations.

This report aims to present comparative survey findings related to childhood vaccination against six diseases—tuberculosis, diphtheria, whooping cough (pertussis), tetanus, poliomyelitis and measles—using data from the USAID-funded Demographic and Health Surveys (DHS) program. The DHS surveys embody a dependable source of vaccination coverage information for developing countries and use a consistent approach to yield comparable results across countries and over time. The surveys provide nationally representative estimates of vaccination coverage using rigorous sampling techniques in the selection of respondents. In addition to providing overall vaccination coverage rates, the information collected also allows analyses that can be used to identify subgroups of children who are at high risk of not being vaccinated or of receiving suboptimal vaccination services. Some of these possible analyses of the DHS data are presented in this report, focusing on differences between children according to urban-rural place of residence, whether there is a radio in the household, mother's level of education, mother's age, sex of the child, length of the preceding birth interval, and child's birth order. The analyses in this report are based on data from 28 countries that participated in the worldwide DHS program from 1990 to 1994: 14 countries in sub-Saharan Africa, 4 in North Africa and the Middle East, 4 in Asia, and 6 in Latin America and the Caribbean.

Whenever possible, the vaccination information in this report is derived from the child's written vaccination record or health card. The mother's recall is used when there is no written record of a vaccination given to the child. Most of the coverage levels are reported for children 12-23 months of age. Overall coverage rates are shown using separate estimates for (1) vaccination coverage by the time of the survey, and (2) vaccinations received before the child's first birthday.

The proportion of children for whom the interviewer saw a written vaccination record ranged from 35 percent in Niger and Nigeria to 89 percent in Rwanda. The highest card rates were found for sub-Saharan African countries, and Asian countries tended to have the lowest rates. There are large differences in vaccination coverage rates across countries. For example, vaccination against measles in the first year of life exceeds 75 percent only in three countries (Jordan, Kenya, and Rwanda). In contrast, only one-third to one-half of children in 10 countries (Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Indonesia, Madagascar, Pakistan, Paraguay, Senegal, and Sudan) receive a measles vaccine before their first birthday. In Niger and Nigeria, coverage rates are even lower—only 1 in 5 and 1 in 3 children, respectively, are vaccinated against measles. In the remaining 13 countries, one-half to three-quarters of the children receive a measles vaccination in the first year of life (Bangladesh, Northeast Brazil, Colombia, Egypt, Ghana, Malawi, Morocco, Namibia, Peru, the Philippines, Tanzania, Turkey, and Zambia).

The drop-out rates between the first and third doses of the multiple dose vaccines (DPT and polio) indicate the proportion of children who initiated the series of vaccinations but did not complete them. Relatively low drop-out rates (less than 10 percent) are seen in only three countries (Jordan, Malawi and Rwanda). Drop-out rates are high (25 to 50 percent) in 10 countries (Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Madagascar, Niger,

Nigeria, Pakistan, Paraguay, and Peru); while intermediate drop-out rates of 10 to 25 percent are seen in the remaining 15 countries.

An examination of secular trends indicates that vaccination coverage rates are increasing. There has been a clear increase in immunization coverage levels in all eight countries that had a previous DHS survey.[1] The smallest increase is observed for Kenya where coverage levels were already relatively high in the previous survey, and the largest change is in Senegal where coverage rates have increased dramatically, although there continues to be room for further improvement.

In addition to looking at overall vaccination coverage rates, these analyses also examine differentials in the rates for different population subgroups in order to identify groups that are underserved. There are clear coverage differentials in most countries with urban children having higher coverage rates than their rural counterparts. Children from households with a radio tend to have higher coverage rates than those from households without a radio, reflecting primarily differences in socioeconomic status, but possibly also a difference in the mother's exposure to broadcast messages about the importance of childhood vaccinations. The largest differentials are seen in mother's level of education. Children whose mothers have no formal schooling have consistently lower vaccination coverage levels than those whose mothers have at least completed primary education. There are much smaller differentials according to the child's birth order or the length of the preceding birth interval, with lower order births and children born after longer birth intervals tending to have somewhat better vaccination coverage rates. Similar differentials are noted according to the mother's age at delivery. The pattern of differentials is not consistent across countries; however, there is a tendency toward higher coverage rates among children of mothers in the middle age group (20-34 years). The smallest differences are according to the sex of the child; there do not appear to be consistent differences in vaccination coverage rates between boys and girls.

The following recommendations will facilitate monitoring and evaluation of the performance of vaccination services:

- In countries with high or relatively high coverage rates, continuing support for vaccination services will ensure continued high coverage rates for most children. Particular emphasis should be placed on reaching children at high risk of not being vaccinated and extending vaccination services to underserved population subgroups.

- Countries with low or relatively low vaccination coverage levels need increased support for vaccination services, with primary emphasis on providing all children with vaccination services.

- The need to expand the list of recommended vaccines for young children should be explored.

- For countries that are already succeeding in providing vaccination services to infants, the next step is to extend the emphasis of vaccination programs beyond the first year of life.

- Vaccination coverage rates should be monitored with consistent methodology.

- Survey results should report at least the following minimal information:

  (i) Percent of children 12-23 months of age for whom a written vaccination record was seen by the interviewer.

  (ii) Percent of all children age 12-23 months who received each of the following vaccinations by the time of the survey among children 12-23 months of age: BCG, DPT1, DPT2, DPT3, polio1, polio2, polio3, and measles vaccine.[2]

[1] It is recommended that the immunization coverage estimates which are presented in the first comparative report on immunization (Boerma et al., 1990) be used for DHS surveys conducted from 1986 to 1989 rather than the rates published in most of the individual first country reports for these surveys.

[2] It is important to include both of the following measures of vaccination status when reporting the results of coverage surveys: (1) vaccination status by the time of the survey among children 12-23 months of age, and (2) vaccination status in the first 12 months of life among children 12-23 months of age. Vaccination status by the time of the survey is simple to calculate from the survey data. Vaccination by the first birthday gives an indication of the timeliness of vaccination; however, the calculations are more complex (leaving the potential for errors) and require a number of assumptions (see *Methodology,* Section 2.3).

(iii) Percent of all children age 12-23 months who received each of the following vaccinations by their first birthday: BCG, DPT1, DPT2, DPT3, polio1, polio2, polio3, and measles vaccine.[2]

Attaining the goal of the World Summit for Children of 90 percent vaccination coverage by the year 2000 is a realistic possibility for a few of the countries included in this report. However, for many countries, making this goal a reality represents an enormous challenge which would require a large and determined effort.

1 Introduction

Immunization against childhood diseases is an important component of efforts to improve children's health and to reduce mortality, morbidity, and permanent disability among children. The Expanded Program on Immunization (EPI), initiated in 1974 by the World Health Assembly, has helped focus the efforts of public health programs in developing countries and of donor organizations (Henderson et al., 1988). The 1989 World Health Assembly and the 1990 World Summit for Children set the goal of achieving 90 percent vaccination coverage by the year 2000 (WHO and UNICEF, 1985).

Immunization coverage rates provide information on various aspects of how successful a health care system is in providing vaccination services to children. The proportion of children who have received at least one vaccination demonstrates the extent to which children have any contact with vaccination services. Sustained contact, however, is required to provide full protection against all the immunizable diseases. Also important is whether coverage rates have improved or deteriorated; secular trends in immunization coverage indicate changes in the performance of the health care system. Frequent monitoring is required, even in countries with high coverage levels, to determine whether immunization services are reaching children with the needed vaccinations. This analysis also examines differentials in vaccination coverage rates in order to identify population subgroups that are underserved.

The Demographic and Health Surveys (DHS) Program provides a consistent source of data for countries in Africa, Asia, and Latin America and the Caribbean. This comparative report, covering 28 countries, focuses on survey findings related to childhood vaccinations against tuberculosis, diphtheria, whooping cough (pertussis), tetanus, poliomyelitis, and measles. All but one of the surveys conducted during the second phase of the program (DHS-II, 1988-93) are included; the Yemen standard recode file was not available for analysis. In addition, findings are presented for six surveys conducted during the current 5-year phase of the program (DHS-III, 1992-1997). The findings from the Sudan survey, which was carried out during the first phase of the program (DHS-I, 1984-1989), are also included in this report because they were not ready for inclusion in the comparative report that summarized the findings for DHS-I countries (Boerma et al., 1990). The comparative analyses presented here cover 14 developing countries in sub-Saharan Africa, 4 in the Near East and North Africa, 4 in Asia, and 6 in Latin America and the Caribbean. DHS standard recode data files were used for the analyses presented here. The raw data files were used for tables on polio at birth and yellow fever vaccination.

2 DHS Information on Immunization

2.1 SAMPLE OF CHILDREN

Information about the vaccination status of young children is obtained from cross-sectional surveys where the respondents are women of reproductive age. The DHS surveys provide nationally representative vaccination coverage estimates in all countries but Brazil and Sudan. In the 1991 Brazil DHS, only the Northeast region was surveyed. Ongoing civil conflict in Sudan limited the 1989/90 DHS survey to the northern part of that country. The samples comprise women age 15-49 years in the households selected for participation in the survey. In countries in sub-Saharan Africa and in Latin America and the Caribbean, as well as in Morocco and the Philippines, all women in the selected households, regardless of their marital status, were identified as respondents. In the remaining Asian and North African countries, only ever-married women were interviewed. For most countries in this report, the analyses are based on children of women who slept in the households the night before the interview (*de facto* sample). The exceptions are Jordan and Indonesia where the samples consisted of the household's usual residents (*de jure* sample).

Information about vaccinations was obtained for all of the DHS respondents' children born following a specified cut-off date. Vaccination information was obtained for children under 5 years of age in all countries except Bangladesh, Bolivia, and Ghana, where information was collected only for children under 3 years of age. Most of the analyses in this report focus on the findings for children age 12-23 months at the time of the survey. The mother was asked about the child's month and year of birth. This information, combined with the month and year of interview, is used to calculate the child's age.

DHS surveys use either self-weighted samples or samples where some geographic areas are over-sampled in order to ensure that the number of respondents is sufficient to obtain more accurate estimates. More detailed descriptions of the sampling design for each country can be found in the DHS Final Report for each survey. The analyses presented in this report use the weighted data.

The number of respondents ranges from approximately 4,000 women in Cameroon to almost 23,000 women in Indonesia, with the number of living children available for analysis ranging from 2,056 children age 0-35 months in Ghana to 13,393 children age 0-59 months in Indonesia (Table 2.1). The number of children 12-23 months of age ranges from 579 in Northeast Brazil to 2,670 in Indonesia.

2.2 SUMMARY OF IMMUNIZATION INFORMATION

The 28 DHS surveys covered in this report asked respondents about written vaccination records and immunization coverage for children born in the five-year period preceding the survey. In three of the more recent surveys (Bangladesh, Bolivia, and Ghana), these questions were limited to children born in the three-year period preceding the survey. Table 2.2 presents the immunization information collected in each country.

Guidelines from the World Health Organization (WHO) for many years have recommended a schedule of eight basic vaccinations in the first year of life for children in developing countries (WHO, 1989). These recommendations also emphasize that children should be vaccinated even if they are ill with common childhood diseases in order to utilize all opportunities for immunization and increase coverage rates (Steinhoff et al., 1985). The schedule includes a dose of BCG (bacille Calmette-Guérin) soon after the child's birth to protect against tuberculosis; three doses of polio vaccine to protect against poliomyelitis; three doses of a triple vaccine (DPT) to protect against diphtheria, whooping cough (pertussis), and tetanus; and a vaccination against measles. It is recommended that DPT and polio vaccines be given at 6, 10, and 14 weeks of age and that measles vaccine be given at 9 months. Information was collected for each of these basic vaccinations in all of the countries profiled in this report. In recent years, the international recommendations have been expanded to include a fourth dose of polio vaccine, with the additional dose to be given soon after birth. Most countries used the live attenuated oral polio vaccine (OPV), while a few countries used both OPV and killed, inactivated polio vaccine. The latter was administered in a combined injection with DPT (DPTP). In some countries, it is recommended that infants also be given vaccines against other diseases, such as yellow fever or hepatitis.

Table 2.1 Characteristics of surveys

Survey sample information and other characteristics, Demographic and Health Surveys, 1990-1994

Country	Date of fieldwork	Sample weights	Number of respondents	Number of children	
				0-59 months	12-23 months
Sub-Saharan Africa					
Burkina Faso	Dec-Mar 1992/93	W	6,354	5,545	1,104
Cameroon	Apr-Sep 1991	W	3,871	3,189	663
Ghana	Sep-Dec 1993	SW	4,562	2,056[a]	651
Kenya	Feb-Aug 1993	W	7,540	5,650	1,124
Madagascar	May-Nov 1992	W	6,260	5,013	1,072
Malawi	Sep-Nov 1992	W	4,850	3,789	774
Namibia	Jul-Nov 1992	W	5,421	3,602	788
Niger	Mar-Jun 1992	W	6,503	5,717	1,087
Nigeria	Apr-Oct 1990	W	8,781	7,107	1,380
Rwanda	Jun-Oct 1992	W	6,551	5,042	1,010
Senegal	Nov-Aug 1992/93	SW	6,310	5,124	959
Sudan	Nov-May 1989/90	SW	5,860	6,062	1,150
Tanzania	Oct-Mar 1991/92	W	9,238	7,257	1,616
Zambia	Jan-May 1992	W	7,060	5,396	1,123
Near East/North Africa					
Egypt	Nov-Dec 1992	W	9,864	8,089	1,594
Jordan	Oct-Dec 1990	W	6,461	7,963	1,615
Morocco	Jan-Apr 1992	SW	9,256	4,853	985
Turkey	Aug-Oct 1993	W	6,519	3,532	716
Asia					
Bangladesh	Nov-Mar 1993/94	W	8,989	3,601[a]	1,174
Indonesia	May-Jul 1991	W	22,909	13,393	2,670
Pakistan	Dec-May 1990/91	W	6,611	5,860	1,215
Philippines	Apr-Jun 1993	W	15,029	8,512	1,742
Latin America/Caribbean					
Bolivia	Nov-May 1993/94	W	8,603	3,335[a]	1,111
Brazil (NE)	Sep-Dec 1991	W	6,222	3,163	579
Colombia	May-Aug 1990	W	8,644	3,659	748
Dominican Republic	Jul-Nov 1991	W	7,320	3,660	815
Paraguay	May-Aug 1990	W	5,827	3,834	791
Peru	Oct-Mar 1991/92	W	15,882	7,999	1,509

W = weighted sample; SW = self-weighted sample
[a] 0-35 months

Table 2.2 Summary of immunization information

Immunization questions included in the survey, according to type of vaccine, Demographic and Health Surveys, 1990-1994

Country	Basic questions	Polio0	Imovax	DPT recall	Yellow fever	Hepatitis	DPT & polio boosters	Source of vaccination
Sub-Saharan Africa								
Burkina Faso	yes	yes[1]	yes	no	yes[1]	no	no	no
Cameroon	yes	no	no	yes	yes	no	no	no
Ghana	yes	no	no	no	no	no	no	no
Kenya	yes	yes[1]	no	no	no	no	no	no
Madagascar	yes	yes[1]	no	no	no	no	no	no
Malawi	yes	no	no	no	no	no	no	no
Namibia	yes	yes[1]	no	no	no	no	no	no
Niger	yes	yes[1]	yes	no	yes[1]	no	no	no
Nigeria	yes	no	no	no	no	no	no	no
Rwanda	yes	yes[1]	no	no	no	no	yes	no
Senegal	yes	no	no	no	yes	no	no	no
Sudan	yes[2,3,4]	no	no	yes	no	no	no	yes
Tanzania	yes	no	no	no	no	no	no	no
Zambia	yes	no	no	yes	no	no	no	no
Near East/North Africa								
Egypt	yes	no	no	yes	no	yes	no	no
Jordan	yes[2,3]	no	no	no	no	no	yes	no
Morocco	yes	no	no	no	no	no	no	no
Turkey	yes	no	no	yes	no	no	no	yes
Asia								
Bangladesh	yes	no	no	yes	no	no	no	no
Indonesia	yes	no	no	no	no	no	no	yes
Pakistan	yes	yes[1]	no	no	no	no	no	no
Philippines	yes	no	no	yes	no	no	no	no
Latin America/Caribbean								
Bolivia	yes[4]	yes	no	yes	no	no	no	no
Brazil (NE)	yes	no	no	yes	no	no	no	no
Colombia	yes	no	no	no	no	no	no	no
Dominican Republic	yes	yes[1]	no	no	no	no	no	no
Paraguay	yes	no	no	no	no	no	no	no
Peru	yes	yes	no	yes	no	no	no	yes

[1] Card information only
[2] If a mother reported that a child did not have a card, she was not asked if the child ever had one.
[3] Mothers who presented health cards for children were not probed for additional vaccination information beyond what was recorded on the health card.
[4] The ever-vaccinated question preceding the mother's report of specific vaccines was not asked.

DHS immunization information comes from two sources: vaccination dates entered on written vaccination records or health cards and mothers' reports of vaccinations received. The health card is the preferred source of immunization data; it is considered to be of higher quality than the mother's report, and the recorded vaccination dates allow the timing of vaccinations to be examined. The mother's recall of vaccinations was elicited if a written record was not shown to the interviewer.

The following series of basic immunization questions was asked of respondents in each of the 28 countries.

- First, the mother was asked if the child had a card where his or her vaccinations were written down.[1] The interviewer documented whether the child had such a health card and whether the card was seen. For children who did not have a card, the interviewer asked if the child ever had one.

[1] In Egypt, vaccination information is recorded on birth certificates.

- If the respondent presented a health card to the interviewer, vaccination dates were copied from the card onto the questionnaire. If the card indicated that a vaccination was given but no date was recorded, the interviewer entered a special code on the questionnaire. The interviewer also probed the respondent to find out if the child had received other vaccinations that were not listed on the card.

- If the respondent was unable to present a health card to the interviewer, immunization information was based entirely on the mother's recall of vaccinations. The interviewer asked if the child had ever received any vaccinations to prevent him or her from getting diseases. If the mother said yes, she was asked to recall specific immunizations: namely BCG, polio vaccine (including the number of doses), and measles vaccine.

Surveys in seven countries (Colombia, Ghana, Malawi, Morocco, Nigeria, Paraguay, and Tanzania) followed this format without deviation. Most of these questions plus some additional ones were asked in Bolivia, Jordan, and Sudan. In Jordan and Sudan, for example, the surveys did not ask whether the child ever had a health card; therefore, no distinction can be made between children who no longer had a card and those who never had one. Also in Jordan and Sudan, mothers who presented health cards for children were not probed for additional vaccination information beyond that recorded on the card. Finally, the surveys in Bolivia and Sudan did not ask respondents who could not produce a health card whether the child was ever vaccinated before inquiring about specific vaccines.

In the remaining countries, questions were added to collect information on a variety of topics including polio vaccine soon after birth, combined injections of DPT and inactivated, killed polio vaccine, booster doses of DPT and polio vaccine given after the first birthday, vaccinations against yellow fever and hepatitis, and maternal recall of DPT. The source of vaccination also was of interest in several countries. These additional immunization questions are described below.

Ten countries collected information on the polio vaccination given at the time a child is born, which is known as "polio at birth" or "polio0." Six of these countries are in sub-Saharan Africa (Burkina Faso, Kenya, Madagascar, Namibia, Niger, and Rwanda), one is in Asia (Pakistan), and three are in Latin America and the Caribbean (Bolivia, the Dominican Republic, and Peru). Health card information is available for polio0 in all 10 countries. Only in 2 of the 10 countries were mothers specifically asked to recall whether the child had received a dose of polio vaccine when he or she was born. Mothers in Peru were asked a direct question on whether the child had received this initial polio vaccination. In Bolivia, after asking about the number of polio doses, the interviewer asked if the first dose was given at the time of birth or later.

In Burkina Faso and Niger, DPT and polio vaccine are sometimes given in the same injection (DPTP) which is known as Imovax. Information on DPTP coverage is collected from both the health card and from the mother's report; mothers were asked a general question about whether the child had received an injection and the number of doses received.

In most countries, mothers were not asked to report if the child had received DPT vaccine. The vaccination history for DPT was assumed to be the same as for polio vaccine because in most cases it is recommended that DPT and polio vaccinations be given on the same day. In the following 10 countries, however, mothers were asked to report on DPT as well as polio vaccinations: Bangladesh, Bolivia, Northeast Brazil, Cameroon, Egypt, Peru, Philippines, Sudan, Turkey, and Zambia.

Four West African countries (Burkina Faso, Cameroon, Niger, and Senegal) gathered information about a vaccination to prevent yellow fever. Health card information is available in all four countries, but only in Cameroon and Senegal were mothers asked to recall whether the child had been vaccinated against yellow fever.

Egypt recently added a vaccine against hepatitis to its immunization recommendations. Health card information was recorded for up to three doses of the hepatitis vaccine. If there was no vaccination record, mothers were asked to recall whether the child had received hepatitis vaccine and, if so, the number of doses.

In Jordan and Rwanda, questions also were asked about DPT and polio boosters, that is, vaccines given after 1 year of age.

Surveys in Indonesia, Peru, Sudan, and Turkey inquired about the place where vaccinations were administered. In Sudan, mothers reported where *most* of the vaccines had been received, while in Peru and Turkey

mothers reported the site of the *most recent* or *last* vaccination. In Indonesia, the source of vaccination was documented for each vaccination recorded on the health card.

A change from earlier DHS surveys is that, in all but three countries featured in this report, immunization information was collected for all children regardless of survival status. Bangladesh, Bolivia, and Sudan are the exceptions; here immunization information was collected only for surviving children. The analyses in this report are for children alive at the time of the survey.

Another change from the standard questions used in DHS-I surveys is the recall information provided by mothers about vaccinations not recorded on a health or vaccination card.

2.3 METHODOLOGY

Some measures of vaccination status correspond directly to the response categories for one or more of the survey questions. The various health card categories are examples of this. Other variables require more careful definition and are described below.

Ever Vaccinated

In this report, children for whom a health card was shown to the interviewer are defined as ever vaccinated if at least one vaccination was recorded on their health card or if the mother reported that the child had received one of the vaccinations. Children without a written vaccination record are defined as ever vaccinated if the mother reported that the child had ever received a vaccination to prevent disease. In Bolivia and Sudan, the two countries where mothers were not asked this general question, children are defined as ever vaccinated if the mother reported that the child had received at least one of the specific vaccinations inquired about.

Specific Vaccinations by the Interview Date

For BCG and measles vaccine, a child is considered to have been vaccinated if one of the following three conditions is met: a date is recorded on the health card, the card indicates that the vaccination was given although no date is shown, or the mother reports that the vaccination was received.

Anyone with experience in examining children's vaccination records in the field knows that occasionally the records are not clear. For example, a vaccination may be recorded in the wrong space, or the health provider recording a second dose may think that the child has already received the first dose but forget to indicate this on the card. One approach to analyzing immunization information is to summarize the number of children with recorded vaccinations for each dose of a multiple dose vaccine such as DPT. Using this approach, children with records of DPT2 and DPT3, but not DPT1, would contribute to the percentages of children who have received the second and third doses of the vaccine but not to the percentage who have received the first dose. A second approach is to count the number of doses that the child is documented to have received. This approach would credit the child described above with the first and second doses of DPT, but not the third dose. In other words, the analysis would assume that the first dose of DPT vaccine was erroneously written in the space for DPT2 and that the second dose was wrongly recorded in the space for DPT3. When there are few missing values for the vaccination variables, these two approaches result in no substantive differences.

The analyses in this report follow the second approach, which also is the approach used in the DHS country reports. Thus the number of doses of DPT and polio vaccines received are counted, as opposed to tabulating the frequency of responses for each of the three doses in the series. Because there are few missing values for these variables, there are no substantive differences between these two approaches to estimating vaccination coverage (data not shown).

If a card was not shown to the interviewer, the mother's report that the child had received, for example, polio vaccine indicates that at least one dose was given. The mother's response to the question about how many times the child was given polio vaccine determines whether the child is also considered to have received polio2 (if the mother said "two times") or polio3 (if the mother said "three times" or more). The value "8" for this variable is considered a "don't know" response, and the child is judged to have received only one dose of the vaccine. The value "8" ("98" and "998" in the case of two- and three-digit variables, respectively) is commonly used to denote a "don't know" response in the DHS questionnaires. Because children are unlikely to have received eight doses of polio vaccine in the surveys included in this report, it is reasonable to consider this code a "don't know" response.

In most countries, the mother's report of whether the child had received polio vaccine and, if so, how many times, is also used to estimate how many doses of DPT the child received. In countries where the mother was asked separate questions about DPT, this information is used instead of the information about polio vaccine.

Specific Vaccinations in the First Year of Life

Vaccination in the first year of life is estimated for all children according to the following methodology. First, for a given immunization, e.g. measles vaccine, the children who have a valid date on their vaccination card are identified. A valid date is one with no missing or special values for day, month, or year of vaccination. The percentage of children who received the vaccination in the first year of life among those with a valid vaccination date is then calculated. An assumption is made that the proportion vaccinated in the first year of life is the same for vaccinated children without a valid date (either because they had no health card so the mother's report of measles vaccination is used or because there is a special value for the day, month, or year of vaccination on the card) as for children with a valid vaccination date. The proportion vaccinated in the first year among those with a valid date is then applied to all children who have received the vaccination at any time before the survey date in order to estimate the proportion vaccinated in the first year of life among all children.

For instance, in a hypothetical survey of 1,000 children age 12-23 months, 800 were vaccinated against measles at some time prior to the interview date. Of the vaccinated children, 600 have a valid vaccination date, and, of these, 450 received the vaccination in the first year of life. There are an additional 200 children who have been vaccinated against measles but who do not have a valid vaccination date. In this example, 75 percent of the children with a valid date were vaccinated in the first year of life (that is, 450 out of 600 children). Assuming the same pattern holds for children who were vaccinated but lack a valid date, an additional 150 children were vaccinated in the first year of life (that is, 75 percent of 200 children). Hence, a total of 600 children (450 with a valid date plus 150 without a valid date) were vaccinated in the first year of life. This is 60 percent of all the children surveyed.

This method for estimating the proportion of children vaccinated in the first year of life also is used in the DHS First Country Reports.

Comparison with DHS-I Vaccination Coverage Results

In most DHS-I surveys, health card information was not complemented by mother's recall of vaccinations given to the child. In the report comparing the immunization findings from these DHS surveys, a technique was developed to allow estimation of vaccination coverage rates among all children (Boerma et al., 1990). In contrast, most DHS-I First Country Reports only present vaccination findings among those children for whom a health card was shown to the interviewer, yielding artificially high vaccination coverage rates. Hence, it is recommended that the findings presented in the Immunization Comparative Report for DHS-I countries be used as the source of vaccination information for DHS-I countries rather than the First Country Reports.

3 Sources of Vaccination Data

3.1 AVAILABILITY OF HEALTH CARDS

The health card was the dominant source of immunization data in most surveys; mothers presented cards to an interviewer for over 50 percent of children age 12-23 months in 19 countries (Table 3.1). Because the health card provides a documented record of a child's immunization history, it is considered to be a more reliable source of information than the mother's report of vaccinations. Two questions were asked of respondents in order to determine the health card status of a child. The first question determined whether the child had a health card and if it was seen by an interviewer. The second question asked if children without a card had ever had one. Responses to these two questions allowed the children to be categorized into four different groups: (i) children who had a health card that was seen by an interviewer; (ii) children who had a card, but it was not seen by an interviewer; (iii) children who no longer had a card; and (iv) children who never received a card.[2]

[2] In Jordan and Sudan, respondents whose children did not have a card were not asked if these children ever had a card. Because this second question was not included in the questionnaire, no distinction can be made between children who no longer had a card and those who never had a card.

Table 3.1 Health card status

Percent distribution of children age 12-23 months according to health card status, Demographic and Health Surveys, 1990-1994

	Currently has a card		Does not currently have a card				
Country	Card seen	Card not seen	Had card earlier	Never had a card	Missing information	Total	Number of children
Sub-Saharan Africa							
Burkina Faso	72.7	11.8	2.1	12.6	0.8	100.0	1,104
Cameroon	52.1	25.2	2.3	20.1	0.2	100.0	663
Ghana	68.2	18.3	1.8	11.7	0.0	100.0	651
Kenya	69.2	27.7	0.5	2.4	0.3	100.0	1,124
Madagascar	59.1	21.0	6.3	13.6	0.0	100.0	1,072
Malawi	86.4	11.0	0.4	2.1	0.2	100.0	774
Namibia	70.1	26.2	1.1	1.7	0.9	100.0	788
Niger	35.3	9.0	4.8	50.2	0.6	100.0	1,087
Nigeria	34.7	31.2	1.3	32.6	0.1	100.0	1,380
Rwanda	87.8	7.0	2.5	2.5	0.1	100.0	1,010
Senegal	64.4	18.0	2.2	15.1	0.2	100.0	959
Sudan	46.2	30.3	23.6[a]		0.0	100.0	1,150
Tanzania	78.1	17.7	1.6	2.2	0.3	100.0	1,616
Zambia	75.7	19.5	1.2	3.6	0.0	100.0	1,123
Near East/North Africa							
Egypt	55.2	42.1	0.1	2.5	0.0	100.0	1,594
Jordan	64.0	34.0	2.0[a]		0.0	100.0	1,615
Morocco	65.4	18.1	8.2	8.1	0.2	100.0	985
Turkey	41.6	38.5	5.3	14.7	0.0	100.0	716
Asia							
Bangladesh	45.5	27.6	9.3	17.5	0.1	100.0	1,174
Indonesia	35.2	37.4	1.4	25.8	0.2	100.0	2,670
Pakistan	29.6	36.5	3.4	30.3	0.3	100.0	1,215
Philippines	35.1	53.6	1.2	9.9	0.2	100.0	1,742
Latin America/Caribbean							
Bolivia	35.1	41.8	2.6	19.7	0.9	100.0	1,111
Brazil (NE)	68.4	20.6	1.4	9.5	0.2	100.0	579
Colombia	59.3	36.5	2.0	2.1	0.1	100.0	748
Dominican Republic	61.3	27.2	8.9	2.5	0.1	100.0	815
Paraguay	51.3	24.9	3.7	19.2	0.9	100.0	791
Peru	51.0	42.6	2.1	4.3	0.1	100.0	1,509

[a] Respondents with children who did not have a card were not asked if the child ever had a card. No distinction can be made between children who did not have a card but had one earlier and children who never had a card.

The proportion of children with cards seen by an interviewer varies greatly across countries in this analysis. Figure 3.1 shows a regional ranking of the countries surveyed by the proportion of cards that were seen by an interviewer. In 8 of the 14 sub-Saharan African countries the interviewer saw health cards for at least two-thirds of children, and in Malawi and Rwanda interviewers saw cards for close to 90 percent of children. A smaller proportion of children showed health cards in Cameroon, Madagascar, Senegal, and Sudan (between 46 and 64 percent). In Niger and Nigeria, immunization data from cards were available only for one-third of children.

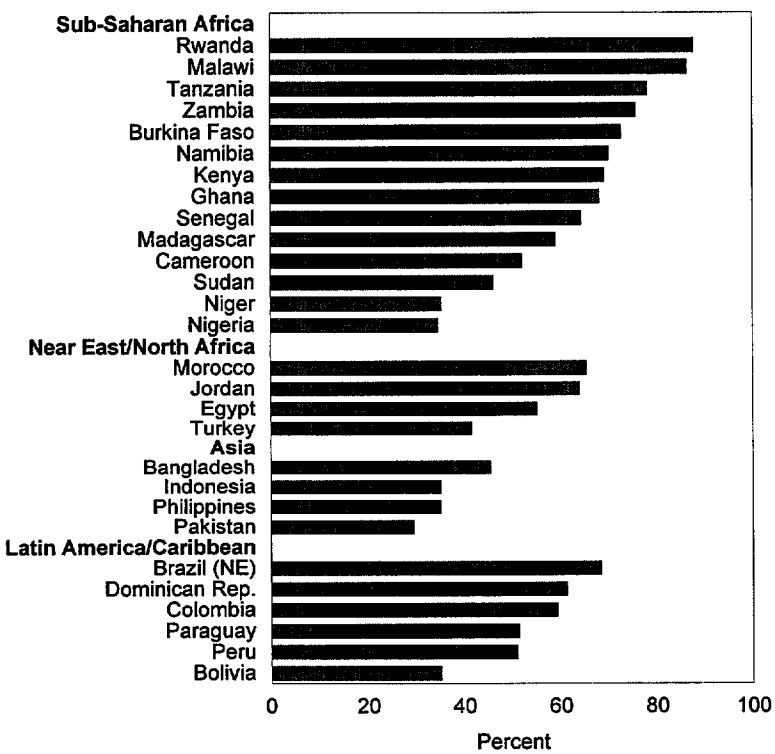
Of the four countries surveyed in North Africa and the Near East, health cards were seen for 42 percent of children in Turkey and 55 percent of children in Egypt. Jordan and Morocco have the highest proportion of cards seen in this region, about two-thirds.

Among countries surveyed in Asia—and across all 28 countries in this study—Pakistan has the lowest proportion of cards seen: 30 percent. Approximately one-third of children in Indonesia and the Philippines and almost one-half of children in Bangladesh had cards that were seen by an interviewer.

Considerable variation in health card status is also found in Latin America and the Caribbean. The proportion of cards seen in this region is lowest in Bolivia (35 percent) and highest in Northeastern Brazil (68 percent). Respondents presented cards for over half of all children in Colombia, the Dominican Republic, Paraguay, and Peru.

The proportion of children with a card that was *not* seen by an interviewer ranges from a low of 7 percent in Rwanda to a high of 54 percent in the Philippines. Thirty percent or more of children in 11 countries, 6 of which are located in Asia, the Near East, or North Africa, had a card that was not seen by an interviewer. In a report on the data quality of DHS immunization data, Boerma and Bicego (1993) discussed several reasons why an interviewer might not see a card for a child. One possibility is that the card was kept at another location, perhaps at a health facility or in another household. Another possibility is that the respondent could not find the card in the house during the interview or was reluctant to search for it. The interviewer also may not have insisted on seeing the card.

Figure 3.1 Percentage of children age 12-23 months whose immunization card was seen by the interviewer, Demographic and Health Surveys, 1990-1994



The percentage of children who once possessed a health card but no longer have it ranges from 0.1 percent in Egypt to 9 percent in Bangladesh and the Dominican Republic. In most countries, less than 5 percent of children fall into this category. Greater variation is found in the proportion of children who never received a health card. Niger has the highest proportion of children (50 percent) who never had a health card, followed by Nigeria (33 percent), Pakistan (30 percent), and Indonesia (26 percent). In 11 countries, between 10 and 20 percent of children never received a health card. In all but one (Morocco) of 11 other countries, less than 5 percent of children never had a health card. In Jordan and Sudan, where the questionnaires did not distinguish between children who never had a health card and children who used to have such a card, 2 percent and 24 percent of children, respectively, did not have a written immunization record. Less than 1 percent of children in all countries have missing health card information.

3.2 HEALTH CARD DIFFERENTIALS

Child's Age

Table 3.2 shows the percentage of children under 5 years of age for whom a health card was presented by age group.[3] Generally, cards are seen most often among children age 6-11 months and children age 12-23 months. The lowest card levels usually are found among older children (those between 48 and 59 months of age). At one point these children may have had a card, but over time the cards may have been misplaced or discarded. Lower card rates among older children might also result from recent improvements in immunization services. In seven countries, however,

[3] Health card information is available only for children 0-35 months in Bangladesh, Bolivia, and Ghana.

Table 3.2 Health card possession

Percentage of children under age five for whom a health card was presented, by age of child in months, Demographic and Health Surveys, 1990-1994

Country	Age of child (months) 0-5	6-11	12-23	24-35	36-47	48-59	Total	Number of children
Sub-Saharan Africa								
Burkina Faso	49.4	67.4	72.7	70.0	61.6	57.7	63.7	5,545
Cameroon	37.7	50.3	52.1	40.8	37.0	32.8	41.7	3,189
Ghana	51.4	65.8	68.2	58.7	a	a	61.6	2,056
Kenya	65.6	73.8	69.2	62.7	57.5	52.7	62.4	5,650
Madagascar	40.4	51.6	59.1	58.3	51.3	48.2	52.5	5,013
Malawi	65.4	85.9	86.4	71.3	56.5	44.8	67.8	3,789
Namibia	83.1	82.6	70.1	57.7	54.8	50.4	64.3	3,602
Niger	21.5	33.2	35.3	34.1	31.2	28.6	31.0	5,717
Nigeria	28.7	39.0	34.7	29.3	25.3	16.2	28.1	7,107
Rwanda	80.5	89.6	87.8	80.9	76.3	67.4	79.6	5,042
Senegal	41.0	63.2	64.4	52.5	43.8	39.0	50.0	5,124
Sudan	27.6	47.8	46.2	33.0	30.4	23.6	34.0	6,062
Tanzania	67.6	85.2	78.1	69.1	61.2	48.0	63.6	8,489
Zambia	57.3	80.8	75.7	69.4	58.9	55.0	66.4	5,396
Near East/North Africa								
Egypt	46.7	57.6	55.2	50.3	45.9	42.3	49.0	8,089
Jordan	30.9	64.2	64.0	57.6	56.5	50.4	55.5	7,963
Morocco	64.7	75.9	65.4	58.0	50.2	42.4	57.1	4,853
Turkey	35.2	55.7	41.6	26.7	19.0	15.1	29.9	3,532
Asia								
Bangladesh	35.4	57.5	45.5	26.8	a	a	39.4	3,601
Indonesia	23.8	44.6	35.2	23.8	16.2	11.7	24.4	13,393
Pakistan	27.4	39.1	29.6	20.2	13.9	11.7	22.4	5,860
Philippines	34.6	49.3	35.1	29.1	24.4	17.5	29.9	8,512
Latin America/Caribbean								
Bolivia	28.0	38.4	35.1	29.0	a	a	32.5	3,335
Brazil (NE)	46.0	71.7	68.4	67.0	67.4	63.2	64.9	3,163
Colombia	60.4	68.1	59.3	42.2	46.6	38.3	50.6	36,585
Dominican Republic	53.5	60.5	61.3	47.1	29.8	25.7	45.1	3,660
Paraguay	39.0	51.4	51.3	45.7	46.3	38.5	44.2	4,257
Peru	53.4	55.8	51.0	46.0	44.1	37.7	46.6	7,999

[a] Immunization questions only asked for children 0-35 months

including Bolivia and Ghana, children under age 6 months have the lowest proportion of cards seen by an interviewer. Many of these children probably have not made contact with the health care system and hence would not have had the opportunity to receive a vaccination card. Namibia and Peru also exhibit a different pattern from most countries: card levels are highest among children age 0-11 months and begin to decline as the age of the child increases.

Socio-Demographic Characteristics

Table 3.3 presents health card levels for children age 12-23 months by five background characteristics: urban-rural place of residence, educational level of the mother, birth order of the child, mother's age at the time of delivery, and sex of the child.

Urban-rural place of residence. In general, the proportion of children with health cards seen by an interviewer is higher among urban than rural children. In most countries, the difference between children living in urban and rural areas ranges from 1 to 12 percentage points. Differentials by place of residence are much greater, however, in Niger where health cards were seen for 79 percent of urban children compared to only 26 percent of their rural counterparts. A similar but less pronounced difference is found in Turkey: 52 percent of children in urban areas compared to 27 percent of children in rural areas presented cards. In five countries (Colombia, the Dominican Republic, Kenya, Namibia, and Rwanda), cards were seen among a higher proportion of rural than urban children.

Mother's level of education. In all but four countries, health card levels are higher among children of mothers who attained secondary or higher levels of education compared to children of uneducated mothers. In some countries, such as Cameroon, the Dominican Republic, Ghana, Nigeria, Paraguay, and Turkey, differences in health card levels between children of the most and least educated mothers reach 20 percentage points or more.

Children of mothers who completed primary school have health card levels similar to those of children of mothers who had some primary schooling in most sub-Saharan African countries, in one North African country (Egypt) and in three Asian countries (Bangladesh, Indonesia, and the Philippines). In Bolivia, Colombia, Ghana, Paraguay, Peru, Senegal, and Turkey, cards are more likely to be seen if the child's mother completed primary school than if the child's mother attended but did not complete this level of schooling. In contrast, in Northeast Brazil, the Dominican Republic, Jordan, Morocco, Namibia, Nigeria, and Pakistan, card levels are significantly higher for children of mothers who did not complete primary school compared to children of mothers who completed their primary education.

Although the lowest card levels most often are found among children of uneducated mothers, the highest card levels are not always found among children of the most educated mothers, that is, the ones with secondary school education or more. The highest card levels also are found among children of mothers who completed primary school and among children of mothers who attended but did not complete primary school.

Birth order. There is some evidence of a relationship between health card levels and a child's birth order. Generally, children of higher birth orders (6 or more) have lower card levels than children of lower birth orders. The greatest variation in card levels by birth order is found in Indonesia and Turkey. In both these countries, about 50 percent of first births had health cards compared to only 20 percent of children of birth orders of 6 or more.

Mother's age at the time of delivery. In 15 countries, most of them in sub-Saharan Africa, health card levels are highest for children born to mothers age 20-34 years; in some of these countries, the lowest card levels are found among children delivered by younger mothers (less than 20 years) and in other countries among children delivered by older mothers (35 years or more). Kenya and Turkey show the greatest differences in health card levels by mother's age at delivery. In Kenya interviewers saw cards for 72 percent of children whose mothers were age 20-34 years, 67 percent of children whose mothers were less than 20 years of age, and 56 percent of children whose mothers were age 35 or more at delivery. The corresponding proportions in Turkey are 44 percent, 40 percent, and 24 percent.

In seven countries (Bolivia, Northeast Brazil, Egypt, Indonesia, Jordan, Peru, and the Philippines), children born to the youngest mothers had the highest health card levels. In Bolivia, Egypt, Indonesia, and Jordan, card levels decrease as the age of the mother increases. In Northeast Brazil, Peru, and the Philippines, there is little difference in card levels between children born to mothers age 20-34 years and those born to mothers age 35 years or more.

In five remaining countries (Colombia, the Dominican Republic, Namibia, Niger, and Zambia), health card levels

Table 3.3 Health card possession by background characteristics

Percentage of children age 12-23 months for whom a health card was shown, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at birth			Sex		Total	Number of children
	Urban	Rural	None	Less than primary	Primary	Secondary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female		
Sub-Saharan Africa																	
Burkina Faso	81.0	71.2	72.1	73.1	(71.3)	(88.5)	74.3	69.5	74.7	73.3	71.5	73.1	71.9	70.7	74.7	72.7	1,104
Cameroon	57.5	48.5	40.0	57.2	55.7	61.6	57.8	54.7	47.0	49.2	53.8	51.2	54.1	56.9	46.9	52.1	663
Ghana	75.1	65.2	57.4	67.1	76.5	(82.2)	76.0	66.1	67.3	63.6	66.3	69.7	62.9	69.2	67.1	68.2	651
Kenya	58.7	71.1	58.6	73.6	72.4	66.6	70.1	65.4	78.9	64.9	66.9	71.8	56.0	68.3	70.1	69.2	1,124
Madagascar	65.0	58.2	50.6	59.2	(61.9)	65.8	64.9	58.3	57.1	57.5	57.0	61.4	52.6	62.0	56.1	59.1	1,072
Malawi	U	U	86.5	85.7	87.6	(88.2)	88.7	86.9	85.7	85.0	84.2	87.8	83.8	84.7	88.2	86.4	774
Namibia	58.9	75.8	74.0	75.1	63.6	63.6	68.9	69.0	70.4	73.2	64.3	70.6	73.6	70.3	69.9	70.1	788
Niger	78.6	26.0	32.4	56.8	*	*	34.7	41.3	33.7	31.7	33.0	35.2	38.6	33.7	37.2	35.3	1,087
Nigeria	43.9	32.3	25.7	54.0	45.5	49.3	35.5	35.9	30.7	36.2	33.5	35.5	32.3	30.9	38.5	34.7	1,380
Rwanda	84.6	87.9	85.8	89.3	91.3	87.8	87.1	88.2	88.8	87.0	81.3	88.3	88.1	88.1	87.4	87.8	1,010
Senegal	72.2	60.1	62.8	64.6	74.3	(76.6)	68.8	68.5	61.1	61.5	60.3	65.4	64.1	63.8	65.2	64.4	959
Sudan	52.8	42.4	40.9	50.2	53.3	51.9	54.1	44.1	44.7	43.9	44.9	47.0	42.3	47.7	44.6	46.2	1,150
Tanzania	82.4	77.0	74.2	79.5	80.9	(72.2)	74.8	77.9	79.3	80.4	76.8	78.7	77.3	79.4	76.9	78.1	1,616
Zambia	76.9	74.7	71.3	74.5	77.5	77.9	73.3	75.9	79.1	74.8	74.1	76.0	76.4	75.3	76.0	75.7	1,123
Near East/ North Africa																	
Egypt	57.3	54.0	53.7	58.7	(60.7)	54.7	58.4	56.1	53.8	51.4	60.3	55.2	51.2	55.6	54.8	55.2	1,594
Jordan	66.0	59.3	55.8	68.3	60.3	66.1	70.0	65.1	62.5	61.3	68.9	65.3	55.4	63.7	64.4	64.0	1,615
Morocco	72.8	61.6	64.6	79.7	58.9	67.0	67.0	66.9	67.3	61.2	63.6	67.1	60.6	66.0	64.8	65.4	985
Turkey	51.7	27.1	28.3	(19.7)	48.9	49.7	50.6	43.1	28.1	20.1	39.8	43.6	24.1	43.4	39.4	41.6	716
Asia																	
Bangladesh	50.5	44.9	44.1	46.2	47.8	48.2	44.7	45.5	48.9	42.2	44.5	45.8	45.7	48.2	42.7	45.5	1,174
Indonesia	42.7	31.9	26.4	32.2	35.2	44.5	47.6	33.7	29.9	21.6	42.2	34.4	30.8	37.2	33.3	35.2	2,670
Pakistan	34.7	27.3	29.2	(37.1)	25.2	32.6	29.2	30.0	31.1	28.3	25.3	31.5	21.8	30.7	28.7	29.6	1,215
Philippines	35.8	34.4	(20.4)	36.2	34.4	35.8	41.8	36.3	30.9	30.2	36.1	34.9	35.4	34.8	35.4	35.1	1,742
Latin America/ Caribbean																	
Bolivia	39.5	30.5	22.7	31.2	39.5	40.8	39.4	36.3	29.2	33.4	38.5	35.4	30.4	38.6	31.7	35.1	1,111
Brazil (NE)	70.5	66.1	66.2	70.7	(50.3)	69.4	70.7	68.3	67.4	67.0	71.7	67.6	68.4	68.8	67.9	68.4	579
Colombia	57.3	63.2	(61.6)	53.8	72.6	57.4	55.0	61.1	64.9	60.7	54.9	59.8	62.1	55.5	63.4	59.3	748
Dominican Republic	59.7	63.4	41.7	68.5	50.3	61.7	60.4	61.9	62.9	59.0	45.7	64.1	(68.1)	60.4	62.2	61.3	815
Paraguay	55.3	48.0	(30.9)	42.1	59.2	61.0	51.6	58.8	47.8	44.1	45.8	52.9	49.1	50.4	52.4	51.3	791
Peru	51.6	50.0	53.3	52.2	58.5	47.4	49.8	50.9	53.0	50.8	52.9	50.5	51.5	51.1	50.8	51.0	1,509

U = Unknown (not available)
Note: An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed. Figures in parentheses are based on 25-49 unweighted cases.

increase with the age of the mother. In Cameroon, card levels are similar for children born to the oldest and youngest mothers and are only slightly lower for children born to mothers age 20-34 years.

Sex of child. In 16 countries, male children are more likely than female children to have a health card that was seen by an interviewer. The difference in card levels between male and female children is greatest in Cameroon where interviewers saw the cards of 57 percent of male children compared to 47 percent of female children. Differences of 5 percentage points or more are found in Bangladesh, Bolivia, and Madagascar.

In the other 12 countries, female children had higher card levels than male children. In Colombia and Nigeria, there is an 8-percentage-point difference in card levels between male and female children.

4 Children Ever Vaccinated

4.1 VACCINATION STATUS AND POSSESSION OF A HEALTH CARD

Table 4.1 combines two types of data: the source of immunization information for each child and whether the child had ever been vaccinated. Based on these data, children age 12-23 months are divided into three groups: (i) a health card was seen by the interviewer and the child had received at least one vaccination; (ii) the mother's report was the sole source of vaccination information and she reported that the child had been vaccinated; and (iii) the child had never been vaccinated (regardless of whether a card was shown to the interviewer).

A comparison of Tables 3.1 and 4.1 shows the expected relationships between vaccination status and the possession of a health card. The percentage of children with at least one vaccination according to a written record of vaccination closely approximates the percentage of children for whom a card was shown. The percentage of children who were ever vaccinated based on the mother's recall is roughly equivalent to the sum of two health card categories: children who have a card that the interviewer did not see and children who no longer have a card. Finally, the percentage of children never vaccinated is generally similar to the percentage of children who reported never having a health card. There are a few exceptions. In Madagascar and Niger, the percentage never vaccinated is higher than the percentage who never had a card by 6 and 8 percentage points, respectively, indicating that some children are not vaccinated at all even though they have been given a card. In Bolivia, Northeast Brazil, Paraguay, and Turkey, the proportion never vaccinated is smaller—by 5 to 12 percentage points—than the proportion who never had a card, suggesting that in these countries some children are vaccinated without receiving a health card.

4.2 CHILDREN EVER VACCINATED ACCORDING TO HEALTH CARD STATUS

There are clear differences in the percentage of children age 12-23 months who were ever vaccinated according to the four health card categories (Table 4.2). As expected,

Table 4.1 Children ever vaccinated

Percent distribution of children age 12-23 months according to vaccination status, including source of immunization information, Demographic and Health Surveys, 1990-1994

Country	Children ever vaccinated		Children never vaccinated	Missing	Total	Number of children
	Health card	Maternal recall				
Sub-Saharan Africa						
Burkina Faso	72.7	14.7	11.9	0.8	100.0	1,104
Cameroon	52.1	26.3	20.5	1.1	100.0	663
Ghana	68.2	17.8	13.2	0.8	100.0	651
Kenya	69.0	27.8	2.9	0.3	100.0	1,124
Madagascar	59.1	21.3	19.5	0.1	100.0	1,072
Malawi	86.4	11.1	2.2	0.3	100.0	774
Namibia	69.5	25.8	3.6	1.2	100.0	788
Niger	32.3	8.7	58.0	0.9	100.0	1,087
Nigeria	34.7	29.3	34.7	1.2	100.0	1,380
Rwanda	87.8	9.5	2.5	0.3	100.0	1,010
Senegal	64.4	20.5	14.7	0.3	100.0	959
Sudan[1]	46.1	32.9	21.0	0.0	100.0	1,150
Tanzania	77.9	18.5	3.2	0.4	100.0	1,616
Zambia	75.3	20.6	4.1	0.0	100.0	1,123
Near East/ North Africa						
Egypt	54.4	41.8	3.7	0.1	100.0	1,594
Jordan	64.0	34.1	1.9	--	100.0	1,615
Morocco	65.4	28.3	5.9	0.4	100.0	985
Turkey	41.6	55.5	2.9	--	100.0	716
Asia						
Bangladesh	45.5	40.7	13.7	0.2	100.0	1,174
Indonesia	34.8	41.4	22.6	1.2	100.0	2,670
Pakistan	29.6	42.5	26.9	0.9	100.0	1,215
Philippines	35.1	58.2	6.3	0.4	100.0	1,742
Latin America/ Caribbean						
Bolivia[1]	34.9	49.6	14.6	0.9	100.0	1,111
Brazil (NE)	68.4	28.5	2.4	0.7	100.0	579
Colombia	59.3	39.7	0.9	0.1	100.0	748
Dominican Republic	61.3	37.9	0.7	0.2	100.0	815
Paraguay	50.0	40.2	8.9	0.9	100.0	791
Peru	50.8	45.4	3.5	0.3	100.0	1,509

[1] The question on whether a child ever had a vaccination was not included in Sudan or Bolivia. If the mother reported that a child had received a specific vaccination, BCG, polio, or measles, the child was counted as ever vaccinated.

almost all the children for whom a written vaccination record was shown to the interviewer had received at least one vaccination (99 to 100 percent). There are only two exceptions, Niger and Paraguay, where only 92 percent and 97 percent, respectively, of children who presented cards had ever been vaccinated. Children whose mothers said that they had a card for the child but were unable to show it to the interviewer also tend to have high ever-vaccinated levels, although slightly lower than among children for whom a card was actually seen. The main exception is Niger, where a surprisingly low percentage of these children are vaccinated (56 percent). In six countries (Burkina Faso, Cameroon, Ghana, Namibia, Nigeria, and Tanzania), between 82 and 95 percent of these children have ever been vaccinated. In the remaining 21 countries, 95 to 100 percent of the children in this category have received at least one vaccination.

In 13 countries there are enough children who used to have a health card, but no longer do so, to allow an examination of the ever-vaccinated rate for this group. In most of these countries (Bangladesh, the Dominican Republic, Morocco, Paraguay, Peru, Rwanda, Tanzania, and Turkey), the ever-vaccinated coverage rate for children who no longer have a card is about the same as for children who currently have a card. In Bolivia, Indonesia, and Pakistan, the rate for children who no longer have a card is 5 to 17 percentage points lower than for children with a card. In Madagascar and Niger, the rate is far lower for these children than for children who currently have a card.

Among children who never had a health card, the ever-vaccinated rates are generally much lower than for children with a card. In four countries (Northeast Brazil, Egypt, Paraguay, and Turkey), vaccination rates are about 60 to 80 percent among these children. In the remaining 20 countries with a sufficient number of children in this category (including Jordan and Sudan), only 5 to 39 percent have ever been vaccinated.

These differences in the ever-vaccinated rates according to children's health card status are to be expected. It is interesting, however, that there are such large differences in coverage rates between children who, according to their mothers, never had a card and children whose mothers claimed that they had had a card in the past or that they had a card but could not show it to the interviewer. Although the mother's report of vaccinations had to be relied upon for the children in all these categories, the fact that vaccination coverage rates are much lower for children who never had a written vaccination record suggests that mothers are able to recall whether their children have been vaccinated.

Table 4.2 Children ever vaccinated by health card status

Percentage of children age 12-23 months ever vaccinated according to health card status, Demographic and Health Surveys, 1990-1994

	Currently has a card		Does not currently have a card			
Country	Card seen	Card not seen	Had card earlier	Never had a card	Total	Number of children
Sub-Saharan Africa						
Burkina Faso	100.0	92.1	*	13.7	87.5	1,104
Cameroon	100.0	93.5	*	5.0	78.4	663
Ghana	100.0	82.4	*	10.5	86.0	651
Kenya	99.8	97.6	*	10.8	96.8	1,124
Madagascar	100.0	96.5	0.0	8.0	80.4	1,072
Malawi	100.0	96.9	*	*	97.5	774
Namibia	99.1	91.6	*	*	95.4	788
Niger	91.6	55.7	27.6	4.8	41.3	1,087
Nigeria	100.0	82.6	*	7.7	64.1	1,380
Rwanda	100.0	96.8	100.0	4.5	97.2	1,010
Senegal	100.0	96.0	*	13.8	85.1	959
Sudan	99.8	98.3	13.3[a]		79.0	1,150
Tanzania	99.6	94.7	98.0	6.2	96.4	1,616
Zambia	99.5	97.9	*	9.9	95.9	1,123
Near East/ North Africa						
Egypt	98.6	95.0	*	66.5	96.2	1,594
Jordan	100.0	99.5	11.6[a]		98.1	1,615
Morocco	100.0	98.3	96.3	32.5	93.9	985
Turkey	100.0	99.6	100.0	81.3	97.1	716
Asia						
Bangladesh	100.0	98.1	100.0	24.2	86.2	1,174
Indonesia	98.9	95.8	82.4	17.3	76.3	2,670
Pakistan	100.0	96.5	92.6	13.8	72.2	1,215
Philippines	100.0	99.2	*	38.6	93.3	1,742
Latin America/ Caribbean						
Bolivia	99.6	98.5	93.9	30.8	84.9	1,111
Brazil (NE)	100.0	99.5	a	70.7	96.9	579
Colombia	100.0	99.4	a	a	99.9	748
Dominican Republic	100.0	99.4	99.6	a	99.2	815
Paraguay	97.4	100.0	98.4	60.9	90.9	791
Peru	99.8	99.4	100.0	22.4	96.3	1,509

Note: An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.
[a] Respondents with children who did not have a card were not asked if the child ever had a card. No distinction can be made between children who did not have a card but had one earlier and children who never had a card.

5 Vaccination Coverage Rates

5.1 VACCINATION COVERAGE FOR SPECIFIC VACCINES BY TIME OF INTERVIEW

Table 5.1 presents coverage levels for vaccinations received any time before the interview among children age 12-23 months. These coverage estimates include information from both written vaccination records and mothers' reports, and they show coverage rates for BCG, up to three doses of DPT and polio vaccine, measles vaccination, full immunization, and no vaccinations. The first four figures in this chapter show the coverage levels for BCG, three doses of polio vaccine, measles vaccination, and full immunization, respectively, for children age 12-23 months by the source of the information. "Full" vaccination coverage is defined as BCG, three doses of DPT and polio vaccine, and measles vaccine.[4] Only in Northeast Brazil are there substantial differences in the coverage rates for the two multiple dose vaccines, with polio vaccination rates being 6 to 10 percentage points higher than those for DPT. In most countries, the proportion of children who have received DPT

[4] BCG is not required for "full" vaccination status in Jordan.

Table 5.1 Immunization coverage for specific vaccinations

Percentage of children age 12-23 months who received specific vaccinations based on health card information and maternal recall by the time of the survey, Demographic and Health Surveys, 1990-1994

Country	BCG	DPT 1	DPT 2	DPT 3	Polio 1	Polio 2	Polio 3	Measles	All	None	Percent with vaccination card	Number of children
Sub-Saharan Africa												
Burkina Faso	85.4	79.1	64.9	40.6	81.0	66.2	41.0	59.6	34.6	13.1	72.7	1,104
Cameroon	75.5	70.1	59.1	47.4	73.2	62.7	48.7	56.0	40.0	21.6	52.1	663
Ghana	83.1	81.7	73.1	62.4	81.9	73.7	62.4	64.4	54.8	15.2	68.2	651
Kenya	96.2	95.9	92.6	86.8	95.4	92.4	85.7	83.8	78.2	3.3	69.2	1,124
Madagascar	75.0	76.5	66.3	53.8	76.5	66.3	53.8	54.0	43.4	20.0	59.1	1,072
Malawi	97.0	97.0	94.3	88.6	97.0	94.2	88.2	85.9	81.8	2.5	86.4	774
Namibia	91.2	92.5	82.4	69.5	92.5	82.4	69.5	75.6	57.8	4.8	70.1	788
Niger	39.9	36.3	24.2	20.3	35.8	24.4	20.1	27.8	17.4	58.8	35.3	1,087
Nigeria	60.6	62.6	46.5	32.9	63.0	46.7	32.9	45.6	29.0	35.9	34.7	1,380
Rwanda	96.9	96.3	95.4	91.2	96.3	95.4	91.2	89.8	86.3	2.9	87.8	1,010
Senegal	83.6	77.0	68.8	58.8	78.2	69.3	59.3	57.2	49.1	15.2	64.4	959
Sudan	76.2	76.6	68.5	59.3	76.6	69.2	60.9	61.2	51.6	21.0	46.2	1,150
Tanzania	95.4	94.3	90.4	79.8	93.8	89.1	77.1	81.2	71.2	5.2	78.1	1,616
Zambia	95.1	93.8	87.5	76.8	93.9	87.9	76.4	77.0	66.6	4.1	75.7	1,123
Near East/ North Africa												
Egypt	89.5	93.1	87.8	76.4	95.0	90.1	78.9	81.5	67.4	3.8	55.2	1,594
Jordan[1]	16.8	97.5	96.7	94.8	97.8	97.1	95.3	89.4	87.9	2.1	64.0	1,615
Morocco	93.4	91.8	86.5	79.4	91.8	86.5	79.4	79.8	75.7	6.2	65.4	985
Turkey	89.1	94.6	88.4	77.6	94.4	87.9	77.2	77.9	64.2	3.1	41.6	716
Asia												
Bangladesh	85.5	84.0	77.6	66.1	84.8	78.0	66.9	68.8	59.1	14.9	45.5	1,174
Indonesia	73.6	72.6	65.4	55.8	72.6	65.4	56.1	57.5	48.3	24.0	35.2	2,670
Pakistan	69.7	67.1	60.0	42.7	67.8	60.5	42.9	50.2	35.1	28.2	29.6	1,215
Philippines	91.2	91.2	87.9	79.9	91.0	86.2	78.2	81.4	71.5	6.8	35.1	1,742
Latin America/ Caribbean												
Bolivia	76.9	76.5	60.0	42.8	79.0	62.5	38.9	55.7	31.2	15.1	35.1	1,111
Brazil (NE)	76.1	89.6	80.8	68.0	95.2	90.0	78.1	83.1	56.0	3.1	68.4	579
Colombia	94.4	98.2	90.8	82.0	98.8	91.7	83.2	82.4	68.3	1.0	59.3	748
Dominican Republic	69.5	95.5	84.8	64.5	97.2	87.7	66.9	69.6	36.7	0.8	61.3	815
Paraguay	67.3	89.1	76.4	53.0	88.7	76.1	53.3	58.1	34.2	9.1	51.3	790
Peru	90.6	92.2	82.1	68.1	93.6	86.0	69.9	74.0	57.7	4.1	51.0	1,509

[1] BCG is not included in the calculation of full immunization in Jordan, because it is not required by the immunization program.

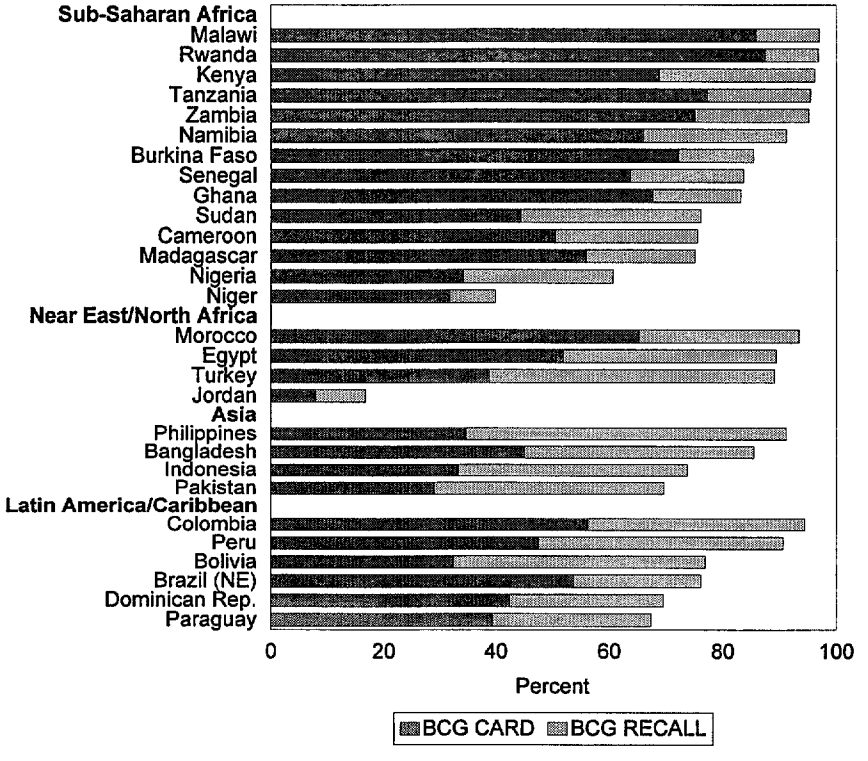
and the corresponding dose of polio vaccine are similar. Hence, coverage levels for DPT and polio are discussed together in this section: for example, if the coverage level for *either* DPT1 or polio1 has reached a given coverage level, e.g., 75 percent, the coverage for the first dose of these vaccines is said to be 75 percent.

BCG. BCG vaccination, usually given soon after birth, constitutes part of the national vaccination program in all but one of the countries surveyed. In Jordan, some children receive BCG although it is not a required part of the national program. Subsequently in this report, Jordan will not be included in discussions related to BCG vaccine. In five countries (Kenya, Malawi, Rwanda, Tanzania, and Zambia), at least 95 percent of children received BCG (Figure 5.1a). Between half and three-quarters of children were vaccinated with BCG in the Dominican Republic, Indonesia, Nigeria, Pakistan, and Paraguay, while Niger has the lowest BCG coverage levels, with only two children in five receiving the vaccine. In the remaining 16 countries, BCG coverage levels vary from 75 to 95 percent.

DPT1 and polio1. The coverage rates for the first dose of DPT and/or polio vaccines are generally slightly lower than those for BCG. Coverage levels are high, 95 percent or greater, for the first dose of at least one of the multiple dose vaccines in eight surveys (Northeast Brazil, Colombia, the Dominican Republic, Egypt, Jordan, Kenya, Malawi, and Rwanda). In four countries (Cameroon, Indonesia, Nigeria, and Pakistan), only one-half to three-quarters of children received the first dose of the multiple dose vaccines, while only about one-third of children in Niger received these vaccinations. Coverage levels in the remaining 15 countries fall between 75 and 95 percent.

DPT2 and polio2. There are only two countries where at least 95 percent of children received the second dose of DPT and/or polio vaccine: Rwanda and Jordan. One-half to three-quarters of children received the second dose in nine countries (Bolivia, Burkina Faso, Cameroon, Ghana, Indonesia, Madagascar, Pakistan, Senegal, and Sudan). Somewhat less than half the children in Nigeria and about one-quarter of the children in Niger were given the second dose. In the remaining 15 countries, coverage levels range between 75 and 95 percent.

Figure 5.1a Immunization coverage of BCG among children age 12-23 months, according to source of information, Demographic and Health Surveys, 1990-1994



DPT3 and polio3. Jordan is the only country where the coverage rate for the third dose of the multiple dose vaccines reaches 95 percent. In 10 countries (Bangladesh, the Dominican Republic, Ghana, Indonesia, Madagascar, Namibia, Paraguay, Peru, Senegal, and Sudan), between half and three-quarters of children received the third dose. In four countries, coverage levels for the third dose are between roughly 40 and 50 percent (Bolivia, Burkina Faso, Cameroon, and Pakistan). About one-third of children in Nigeria and only one-fifth in Niger received the third dose. Coverage levels for the third dose of the multiple dose vaccines are between 75 and 95 percent in the remaining 11 countries. Figure 5.1b shows the coverage levels for the third dose of polio vaccine only.

Measles vaccine. Measles vaccination coverage does not reach 95 percent in any country (Figure 5.1c). The coverage rates range from just 28 percent in Niger and 46 percent in Nigeria to a high of 90 percent in Rwanda. Between one-half and three-quarters of children age 12-23 months were vaccinated against measles in 13 countries (Bangladesh, Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Ghana, Indonesia, Madagascar, Pakistan, Paraguay, Peru, Senegal, and Sudan). Coverage levels are between 75 and 90 percent in another 13 countries (Northeast Brazil, Colombia, Egypt, Jordan, Kenya, Malawi, Morocco, Namibia, the Philippines, Rwanda, Tanzania, Turkey, and Zambia).

Full vaccination. The percentage of children age 12-23 months who are fully vaccinated ranges from 17 percent in Niger to a high of just 88 percent in Jordan (Figure 5.1d). At least three-quarters of children are fully vaccinated in only five countries (Jordan, Kenya, Malawi, Morocco, and Rwanda). One-third to one-half of the children are fully vaccinated in eight countries (Burkina Faso, Cameroon, the Dominican Republic, Indonesia, Madagascar, Pakistan, Paraguay, and Senegal). Less than one-third of the children have received all the vaccinations in Bolivia, Niger, and Nigeria. In the remaining 12 countries, between one-half and three-quarters of the children have received all vaccinations.

No vaccinations. The percentage of children age 12-23 months who have received none of the eight vaccinations ranges from 59 percent in Niger to less than 1 percent in the Dominican Republic. In 13 countries, between 5 and 24 percent of children have not received any vaccinations (Bangladesh, Bolivia, Burkina Faso, Cameroon, Ghana, Indonesia, Madagascar, Morocco, Paraguay, the Philippines, Senegal, Sudan, and Tanzania). In Niger, Nigeria, and Pakistan, large proportions of children received no vaccinations: about three-fifths, one-third, and one-quarter, respectively. In the remaining 12 countries, at most 5 percent of children have never been vaccinated.

Figure 5.1b Immunization coverage of polio3 among children age 12-23 months, according to source of information, Demographic and Health Surveys, 1990-1994

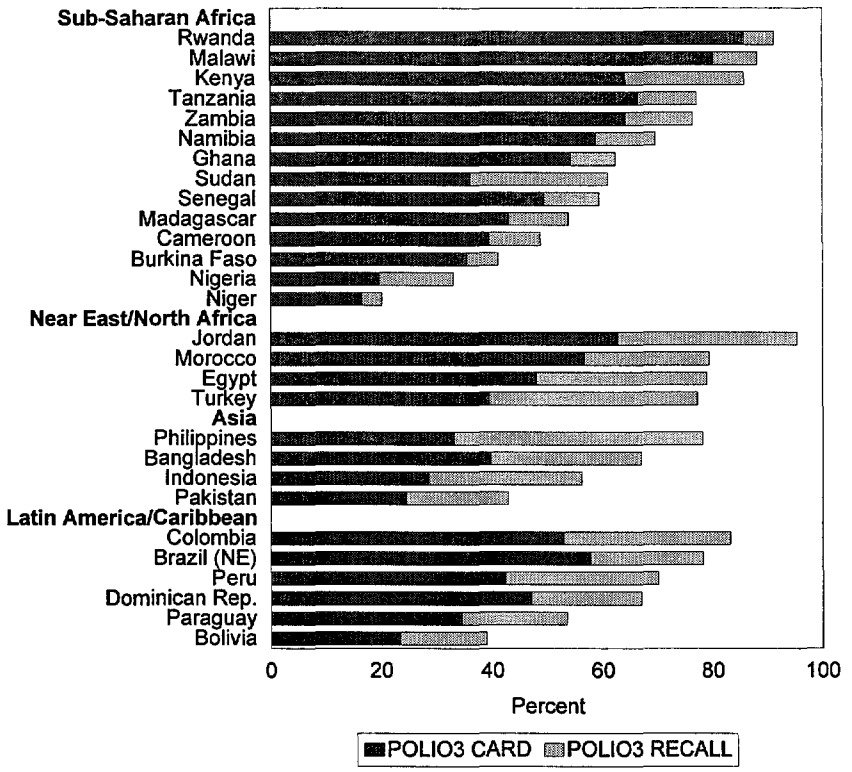


Figure 5.1c Immunization coverage of measles among children age 12-23 months, according to source of information, Demographic and Health Surveys, 1990-1994

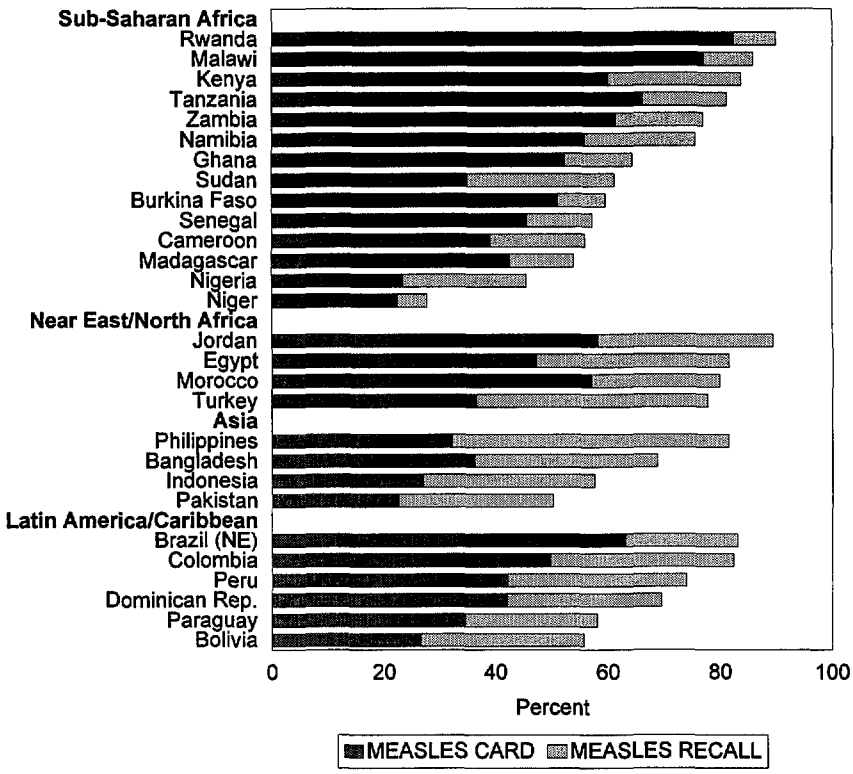
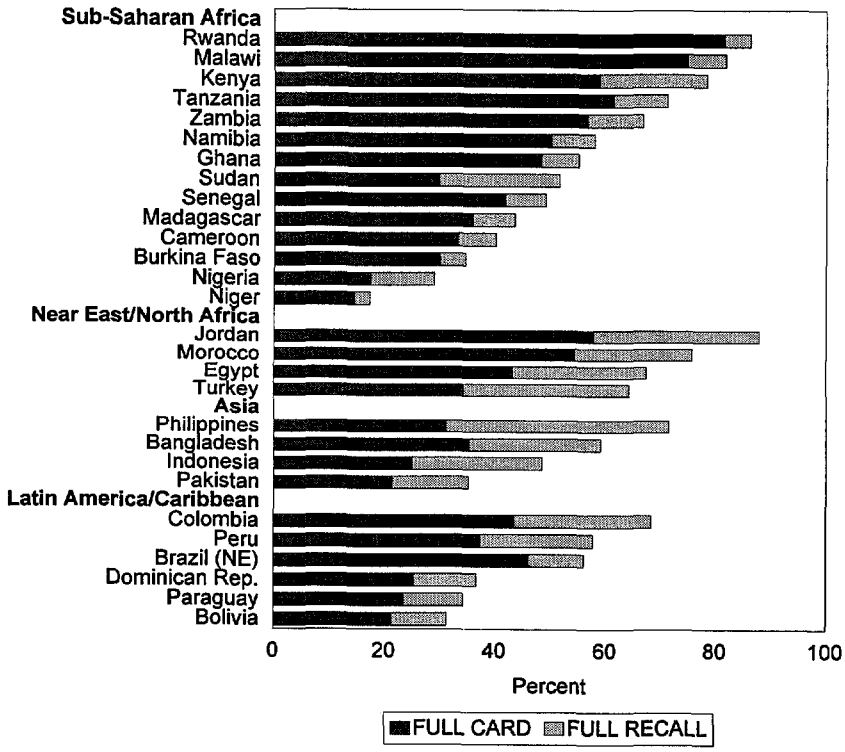


Figure 5.1d Full immunization coverage among children age 12-23 months, according to source of information, Demographic and Health Surveys, 1990-1994



5.2 VACCINATION COVERAGE FOR SPECIFIC VACCINES IN THE FIRST YEAR OF LIFE

The proportion of children 12-23 months of age who are vaccinated before the first birthday is, of course, lower than the proportion vaccinated by the time of the survey (Table 5.2). The largest difference is for measles vaccine which is administered later in the first year of life. In addition to presenting the vaccination coverage levels before the first birthday, this section also discusses the differences in these two measures of immunization coverage.

BCG. BCG vaccination levels before the first birthday exceed 95 percent only in Rwanda. Between one-half and three-quarters of children age 12-23 months received BCG during their first year of life in 10 countries (Bolivia, Northeast Brazil, Cameroon, the Dominican Republic, Indonesia, Madagascar, Nigeria, Pakistan, Paraguay, and Sudan). Only about one-third of children in Niger were vaccinated against tuberculosis before the first birthday. In the remaining 15 countries where BCG is a recommended vaccination, coverage rates are higher, ranging between 75 and 95 percent.

Table 5.2 Immunization coverage during infancy

Percentage of children age 12-23 months who received specific vaccinations during the first year of life (0-11 months), Demographic and Health Surveys, 1990-1994

Country	BCG	DPT 1	DPT 2	DPT 3	Polio 1	Polio 2	Polio 3	Measles	All	None	Number of children
Sub-Saharan Africa											
Burkina Faso	80.2	73.5	55.2	32.6	75.5	55.9	32.8	37.1	23.4	18.9	1,104
Cameroon	71.5	66.5	55.4	42.2	69.6	58.9	43.6	44.2	31.3	25.6	663
Ghana	80.8	78.9	68.6	57.1	79.1	69.3	57.3	50.6	42.9	17.5	651
Kenya	94.7	95.3	91.8	85.4	94.7	91.3	84.1	76.3	70.1	4.3	1,124
Madagascar	68.9	71.0	60.1	47.7	71.0	60.1	47.6	39.1	31.7	25.1	1,072
Malawi	94.7	94.9	91.3	83.6	94.9	91.5	83.7	70.1	67.2	4.8	774
Namibia	89.7	88.4	79.6	64.5	88.4	79.6	64.5	63.4	51.0	9.2	788
Niger	35.3	32.1	21.0	17.2	31.7	21.1	17.0	20.4	12.9	63.7	1,087
Nigeria	50.1	50.9	39.9	28.5	51.3	40.2	28.6	30.4	22.1	47.4	1,380
Rwanda	96.5	95.9	95.0	90.6	95.9	95.0	90.6	86.0	82.7	3.3	1,010
Senegal	79.9	73.6	65.1	54.6	74.7	65.6	55.1	44.6	38.8	18.8	959
Sudan	69.3	68.9	60.3	51.5	69.7	61.8	53.1	47.6	40.1	27.8	1,150
Tanzania	92.7	92.2	86.6	73.0	91.5	84.0	68.4	69.0	56.9	7.1	1,616
Zambia	93.5	92.3	83.6	69.9	92.3	84.6	70.3	65.9	54.9	5.4	1,123
Near East/ North Africa											
Egypt	88.8	92.5	86.4	72.7	94.2	88.6	75.0	70.3	57.2	4.8	1,594
Jordan[1]	15.8	96.0	94.8	92.2	96.3	95.2	92.6	76.1	74.7	3.6	1,615
Morocco	92.3	89.5	81.5	73.8	89.5	81.5	73.8	66.9	63.4	7.8	985
Turkey	87.4	92.9	87.6	76.8	92.8	87.1	76.4	69.0	58.6	4.7	716
Asia											
Bangladesh	80.5	79.4	72.6	60.7	80.2	73.0	61.4	54.8	47.8	19.8	1,174
Indonesia	71.5	69.8	62.6	51.4	70.0	62.6	51.3	46.3	39.2	26.6	2,670
Pakistan	62.5	61.5	52.2	34.7	61.9	52.8	34.8	36.4	23.8	34.0	1,215
Philippines	88.3	88.9	85.0	77.6	88.3	83.1	75.5	70.9	62.1	8.6	1,742
Latin America/ Caribbean											
Bolivia	71.2	70.5	50.5	29.1	72.0	53.5	26.9	34.2	17.3	21.0	1,111
Brazil (NE)	69.1	82.6	64.4	49.4	88.3	74.2	54.6	60.3	36.8	9.1	579
Colombia	91.6	95.6	86.2	73.2	96.3	87.5	74.7	68.2	53.8	3.4	748
Dominican Republic	66.8	84.4	70.7	48.4	90.1	74.9	55.8	48.4	24.8	6.7	815
Paraguay	61.0	81.0	67.1	41.8	80.3	67.3	42.7	41.9	22.9	14.9	790
Peru	88.3	86.6	74.8	58.9	88.5	78.6	60.0	51.0	40.6	7.7	1,509

[1] BCG is not included in the calculation of full immunization in Jordan, because it is not required by the immunization program.

For BCG, the difference between the percentage vaccinated before the first birthday and the percentage vaccinated before the date of the interview ranges from less than 1 to 11 percentage points. The difference is less than 3 percentage points in half the surveys. It is 5 percentage points or more in nine countries (Bangladesh, Bolivia, Northeast Brazil, Burkina Faso, Madagascar, Nigeria, Pakistan, Paraguay, and Sudan) and reaches 11 percentage points in Nigeria.

DPT1 and polio1. In Colombia, Jordan, Kenya, and Rwanda, over 95 percent of children received the first doses of DPT and/or polio during the first year of life. There are six other countries with fairly high coverage rates for these vaccinations before the first birthday: the Dominican Republic, Egypt, Malawi, Tanzania, Turkey, and Zambia all have coverage rates between 90 and 95 percent. In eight countries (Bolivia, Cameroon, Indonesia, Madagascar, Nigeria, Pakistan, Senegal, and Sudan), between one-half and three-quarters of children received at least the first dose of the multiple dose vaccines in the first year of life, while in Niger only about one-third of children did so. In the remaining nine countries, between 75 and 90 percent of the children have received the first dose of at least one of these vaccines by their first birthday.

For the first doses of DPT and polio vaccine, the difference between the percentages vaccinated before the first birthday and by the time of the survey are similar to those seen for BCG. The difference is less than 4 percentage points in half the surveys. In 10 surveys (Bolivia, Northeast Brazil, Burkina Faso, the Dominican Republic, Madagascar, Nigeria, Pakistan, Paraguay, Peru, and Sudan), the difference is at least 5 percentage points, and it reaches 11 and 12 percentage points, respectively, in the Dominican Republic and Nigeria.

DPT2 and polio2. Coverage levels for the second dose of at least one of the multiple dose vaccines exceed 95 percent in Jordan and Rwanda, while the levels are between 90 and 95 percent in Kenya and Malawi. Between 75 and 90 percent of children received the second dose of these vaccines during their first year of life in nine countries (Colombia, Egypt, Morocco, Namibia, Peru, the Philippines, Tanzania, Turkey, and Zambia). In Nigeria, only two children in five and, in Niger, only one child in five received the second dose. Between one-half and three-quarters of children received the second dose of these vaccines by their first birthday in the remaining 13 countries.

For the second dose of the multiple dose vaccines, the difference between the percentage vaccinated by the first birthday and the percentage vaccinated by the time of the survey ranges from less than 1 to 16 percentage points; the median difference is 4 percentage points. There are 13 countries with a difference of at least 5 percentage points (Bangladesh, Bolivia, Northeast Brazil, Burkina Faso, the Dominican Republic, Madagascar, Morocco, Nigeria, Pakistan, Paraguay, Peru, Sudan, and Tanzania). The difference exceeds 10 percentage points in Northeast Brazil, Burkina Faso, and the Dominican Republic.

DPT3 and polio3. The coverage rate by the first birthday for the third dose of DPT and/or polio vaccines does not reach 95 percent in any country. Jordan and Rwanda have the highest coverage levels, 93 percent and 91 percent, respectively. In five countries (Egypt, Kenya, Malawi, the Philippines, and Turkey), 75 to 85 percent of children received the third dose of at least one of the vaccines. In four countries (Cameroon, Madagascar, Pakistan, and Paraguay), only between one-third and one-half of the children were given the third dose. Coverage rates for these vaccinations in the first year of life are even lower in another four countries (Bolivia, Burkina Faso, Niger, and Nigeria), ranging from 17 to 33 percent. In the remaining 13 countries, between half and three-quarters of children received the third dose.

Not surprisingly, the differences are somewhat larger for the third dose of the multiple dose vaccines than for the first and second doses when comparing vaccination coverage by the first birthday to vaccination coverage by the time of the interview. The difference in these coverage rates ranges from less than 1 percentage point for both vaccines to a high of 19 percentage points for DPT3 and a high of 24 percentage points for polio3. Across all the countries, the median difference between the percentage of children vaccinated by the first birthday and the percentage vaccinated any time before the survey is 5 percentage points. The difference exceeds 10 percentage points in four Latin American countries (Bolivia, Northeast Brazil, the Dominican Republic, and Paraguay), indicating that the third dose of the vaccines often is not given to these children until after their first birthday.

Measles vaccine. Measles vaccination coverage levels by the first birthday are highest in Jordan, Kenya, and Rwanda (76 to 86 percent). In contrast, only one-third to

one-half of children have been vaccinated against measles by their first birthday in 10 countries (Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Indonesia, Madagascar, Pakistan, Paraguay, Senegal, and Sudan). Only one child in five in Niger and only one child in three in Nigeria received measles vaccine before their first birthday. In the remaining 13 countries, between one-half and about three-quarters of children have been vaccinated against measles by their first birthday.

As expected, measles vaccine coverage by the first birthday is considerably lower than coverage by the time of the survey because there is little time between the recommended age at vaccination (9 months) and the first birthday. Coverage by the first birthday is at least 13 percentage points less than coverage by the time of the survey in half the countries. The difference ranges from a low of 4 percentage points in Rwanda to a high of 23 percentage points in Northeastern Brazil and Burkina Faso. The difference is between 10 and 20 percentage points in 19 countries and between 20 and 23 percentage points in five countries, four of which are in Latin America (Bolivia, Northeast Brazil, Burkina Faso, the Dominican Republic, and Peru).

Full vaccination. The highest coverage levels for having received all six vaccinations by the first birthday are seen in Rwanda and Jordan (83 percent and 75 percent, respectively). Only between one-third and one-half of children were fully vaccinated by the first birthday in seven countries (Bangladesh, Northeast Brazil, Ghana, Indonesia, Peru, Senegal, and Sudan). Nine countries have even lower coverage rates for full vaccination: fewer than one-third of children have received all the vaccinations in Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Madagascar, Niger, Nigeria, Pakistan, and Paraguay. Coverage rates of 50 to 70 percent are found in the 10 remaining countries.

The difference between those fully vaccinated by the first birthday and by the interview date is less than 11 percentage points in half the countries. Nowhere does the difference exceed 20 percentage points.

No vaccinations. Less than 5 percent of children did not receive any vaccinations by their first birthday in seven countries (Colombia, Egypt, Jordan, Kenya, Malawi, Rwanda, and Turkey). Between 5 and 10 percent of children were not vaccinated during the first year of life in another eight countries. In six countries (Bangladesh, Bolivia, Burkina Faso, Ghana, Paraguay, and Senegal), the rate for no vaccinations by the first birthday is considerably higher, between 15 and 21 percent, and in another six countries (Cameroon, Indonesia, Madagascar, Nigeria, Pakistan, and Sudan), between one-quarter and one-half of the children had no vaccinations by the first birthday. The situation in Niger is even worse: almost two-thirds of children received no vaccines by the first birthday.

The median difference between the percentage of children who have received no vaccinations by their first birthday and by the day of the interview is 4 percentage points across all countries, ranging from less than 1 to 12 percentage points. The difference exceeds 10 percentage points in only one country (Nigeria), and it falls between 5 and 9 percentage points in eight countries. Differences tend to be larger in Latin American countries.

5.3 POLIO VACCINATION AT BIRTH

Surveys in the ten countries of Bolivia, Burkina Faso, the Dominican Republic, Kenya, Madagascar, Namibia, Niger, Pakistan, Peru, and Rwanda collected data on polio0. It is recommended that this initial dose of polio be given at birth; it was added to the series of polio doses (polio1, polio2, and polio3) when the recommended number of doses needed to vaccinate a child against polio was increased from three to four.

Prevalence levels of polio0 reflect the recent introduction and promotion of this vaccination in a number of countries. For example, the promotion of polio0 in Rwanda began during the interval when children age 12-23 months would have been born. Because of this, the proportion of children vaccinated with polio0 does not represent equal probabilities of exposure to the vaccine in this country and in many of the other countries that have recently added this dose of polio to the immunization schedule.

As shown in Table 5.3, coverage levels for polio0 among children age 12-23 months are lowest in Pakistan (11 percent), Niger (14 percent), and Madagascar (19 percent). One-third of children in Bolivia, Burkina Faso, and the Dominican Republic and almost two-thirds of children in Kenya, Namibia, and Rwanda received a dose of polio at the time of birth. Coverage of polio0 is highest in Peru, where 82 percent of children received polio0.

The health card is the major source of polio0 immunization information in all countries with the exception of Peru. Because mothers were not asked specifically about

Table 5.3 Polio vaccination at birth

Percentage of children age 12-23 months who received polio0 by source of immunization information and background characteristics, Demographic and Health Surveys, 1990-1994

Country	Source of information			Residence		Education				Sex		Number of children
	Card	Maternal recall	Total	Urban	Rural	None	Less than primary	Primary	Secondary or higher	Male	Female	
Sub-Saharan Africa												
Burkina Faso	31.6	0.3	31.9	58.9	27.2	29.9	44.7	35.8	60.8	28.9	35.0	1,104
Kenya	56.5	5.1	61.6	62.3	61.5	49.5	60.5	69.2	65.2	60.8	62.4	1,124
Madagascar	17.4	1.3	18.7	23.8	17.9	14.5	18.3	27.5	21.9	19.8	17.5	1,072
Namibia	58.2	3.7	61.9	59.7	63.1	58.3	64.3	58.7	61.7	62.3	61.6	788
Niger	14.0	0.0	14.1	56.3	5.0	11.9	24.9	38.3	64.9	13.8	14.3	1,087
Rwanda	63.4	2.1	65.5	89.7	64.3	60.0	67.9	71.2	84.7	64.6	66.4	1,010
Asia												
Pakistan	9.3	1.6	10.9	19.8	6.7	8.5	24.6	19.3	16.1	11.7	10.0	1,215
Latin America/ Caribbean												
Bolivia	25.1	7.7	32.7	41.2	24.0	19.4	24.9	31.4	43.8	33.2	32.3	1,111
Dominican Republic	29.4	3.6	33.0	33.2	32.7	19.3	34.3	27.7	36.1	32.0	34.0	815
Peru	39.5	42.2	81.7	89.0	70.5	66.7	70.4	76.2	90.7	80.3	83.1	1,510

polio0 except in Bolivia and Peru, the analysis relies on the *number* of polio doses reported by mothers to surmise whether a child was given polio0. If a mother reported that a child had received four or more doses of polio, the child was assumed to have received polio0. This assumption increases coverage rates everywhere but in Niger; the additional coverage ranges from less than 1 percentage point in Burkina Faso to 8 percentage points in Bolivia.

Table 5.3 also shows the proportion of children vaccinated with polio0 by selected socio-demographic characteristics. These variables and their categories are described in Chapter 6, which presents coverage differentials for the basic vaccinations discussed above. Children living in urban areas are more likely to receive polio0 than their rural counterparts everywhere except Namibia, where coverage rates are slightly higher in rural than in urban areas. Urban-rural residential differences are quite large in Niger: 56 percent of urban children compared with just 5 percent of rural children were vaccinated with polio0. In comparison, differences are less than 1 percentage point in the Dominican Republic and Kenya.

The proportion of children vaccinated with polio at the time of birth is lowest among children of uneducated mothers, although there is little difference in prevalence levels in Namibia between children of uneducated mothers and children of mothers who completed primary school. Children whose mothers have attained secondary schooling or higher generally are most likely to have received polio0. In four countries (Bolivia, Niger, Peru, and Rwanda), the prevalence of polio0 is positively correlated with mother's level of education.

There is no consistent difference by gender in the proportion of children vaccinated with polio at birth. In some countries, male children have slightly higher polio0 vaccination levels than female children; the reverse is true in other countries. In nine of the ten countries, the difference is less than 3 percentage points. In Burkina Faso, coverage levels are 6 percentage points higher among girls than boys.

5.4 VACCINATION AGAINST YELLOW FEVER AND HEPATITIS

Vaccination against yellow fever. Surveys in Burkina Faso, Cameroon, Niger, and Senegal collected data on the vaccination against yellow fever, which is recommended at 9 months of age. In Cameroon and Senegal, mothers were asked to recall if the child had received a yellow fever vaccination. In Burkina Faso and Niger, questionnaires did

not seek maternal recall of yellow fever vaccinations; instead, the surveys presumed that children were vaccinated against yellow fever depending upon the number of doses mothers reported for oral polio vaccine and the number of vaccination injections the child had been given. If a mother reported two doses of oral polio and three or more injections, the child was considered to have been vaccinated against yellow fever; the two doses of oral polio represented polio1 and polio2 and the three injections were assumed to represent polio3 (as DPTP), measles vaccine, and yellow fever, in that order. Based on similar logic, if a mother reported that the child had received three doses of oral polio and two or more injections, the three doses of polio reflected polio1, polio2 and polio3, respectively, with the injections representing vaccinations against measles and yellow fever. This assumption expanded coverage levels for yellow fever in Burkina Faso and Niger by about 1 percent. Yellow fever vaccination information comes primarily from the health card. While mothers in Senegal reported that 11 percent of children age 12-23 months had received the yellow fever vaccination, in Burkina Faso, Cameroon, and Niger, only 2 percent of children or less were reported to have received this vaccine.

Coverage of the yellow fever vaccination among children is fairly high in Burkina Faso and Senegal: about one-half of children age 12-23 months received this vaccination (Table 5.4). Coverage is lower in Niger (22 percent) and extremely low in Cameroon (2 percent). Among children with health cards in Cameroon, less than 1 percent have been vaccinated against yellow fever, indicating that this vaccine is not reaching the children it is intended for, perhaps because the vaccine has only recently been added to the immunization program.

The proportion of children vaccinated against yellow fever is also shown for a broader age group of children, those 12-59 months of age. When older children are included in the analysis, the percentage vaccinated against yellow fever is higher, especially in Senegal where coverage increases from 55 percent of children age 12-23 months to 68 percent of children age 12-59 months.

Table 5.4 also presents yellow fever vaccination coverage by selected socio-demographic characteristics (see Chapter 6 for a description of the variables). Urban-rural differences in the proportion of children vaccinated against yellow fever are quite prominent in Burkina Faso, Niger, and Senegal. The largest residential differences appear in Niger where 52 percent of urban children, but only 16 percent of rural children, received a yellow fever vaccination. Burkina Faso has an 11-percentage-point difference in yellow fever vaccination coverage levels between urban and rural children; the difference in Senegal is 20 percentage points. In Burkina Faso, Niger and Senegal, children of uneducated mothers are the least likely to receive a yellow fever vaccination, and coverage increases with the level of mother's education. In all countries, female children are slightly more likely than male children to have received a vaccination to prevent yellow fever.

Vaccination against hepatitis. Information about hepatitis vaccination was collected in Egypt. Because this vaccination was recently added to the immunization program, only a small proportion of children had received this vaccine: 4 percent of children age 12-23 months received the first dose of hepatitis vaccine, and less than 1 percent received the second and third doses (findings not shown).

Table 5.4 Vaccination against yellow fever

Percentage vaccinated against yellow fever among children age 12-23 months by source of immunization information and characteristics, and percentage vaccinated among children 12-59 months of age, Demographic and Health Surveys, 1990-1994

	12-23 months of age												
	Source of information			Residence		Education				Sex			
Country	Card	Maternal recall	Total	Urban	Rural	None	Less than primary	Primary	Secondary or higher	Male	Female	Number of children	Age 12-59 months total
Sub-Saharan Africa													
Burkina Faso	49.1	1.2	50.3	59.6	48.7	48.8	51.5	55.2	82.9	48.4	52.3	1,104	56.0
Cameroon	0.3	2.0	2.3	2.3	2.3	2.2	1.1	3.0	3.2	2.2	2.4	663	5.0
Niger	21.3	0.6	21.9	52.2	15.5	19.7	36.3	38.3	63.8	20.4	23.8	1,087	25.4
Senegal	44.5	10.5	55.1	68.1	47.8	50.1	67.7	75.7	89.4	53.4	56.8	959	67.7

5.5 AGE AT VACCINATION

Table 5.5 summarizes the age at vaccination among children 12-23 months of age. The table focuses on the proportion of children who received their vaccinations at the recommended ages, that is, 0-3 months for BCG, 2-4 months for DPT1, and 4-6 months for DPT3. For measles vaccination, three ages at vaccination are examined: less than 8 months, 8 months, and the recommended age of 9-11 months. The recommended age for measles vaccination represents a balance. Children who are vaccinated too young may not develop antibodies to the measles virus because of the presence of maternal antibodies which are passively transferred to the child *in utero*. Waiting too long to vaccinate children, however, exposes them to the risk of developing measles, which, in turn, increases their susceptibility to other infections, such as tuberculosis, diarrheal illnesses, and pneumonia, and increases their risk of becoming undernourished and of dying. Hence information about the age at measles vaccination is of interest to immunization programs.

In order to examine the timeliness of these vaccinations, the findings in Table 5.5 are compared with those in Table 5.2. In other words, the proportion of children vaccinated at the recommended age is compared with the proportion vaccinated at any time during the first year of life. The discussion revolves around what percentage of first-year vaccinations were administered at the optimal time.

In eight of the countries where BCG is included in the immunization program (Northeast Brazil, Indonesia, Madagascar, Niger, Nigeria, Pakistan, Paraguay, and Sudan), fewer than half the children vaccinated against tuberculosis in the first year were given BCG during the first four months of life. Between half and almost three-quarters of the children vaccinated received BCG at the recommended age in another eight countries (Bangladesh, Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Ghana, the Philippines, and Senegal). Over three-quarters of the children vaccinated were given BCG in the first four months of life in the remaining 11 countries.

Between 75 and 90 percent of children given DPT1 in the first year of life received the vaccination at the age of 2-4 months in seven countries (Colombia, Egypt, Jordan, the Philippines, Peru, Turkey, and Zambia). In the remaining 21 countries, a lower proportion of vaccinated children received DPT1 at the recommended age, ranging from a little more than half the children in Nigeria to 70 percent in several countries.

The proportions of vaccinated children who received DPT3 on time (age 4-6 months) are quite similar to the proportions calculated for on-time administration of DPT1 with the exception of six countries. In Northeast Brazil, Bolivia, Colombia, the Dominican Republic, Egypt, and Zambia, a considerably smaller proportion of DPT3 vaccinations than of DPT1 vaccinations were administered at the recommended ages, suggesting that DPT3 vaccinations are not given on time in these countries.

Table 5.5 Immunization coverage by age

Among children age 12-23 months, the percentage who were vaccinated at about the recommended age (in months) with BCG, DPT1, DPT3, and measles vaccine, Demographic and Health Surveys, 1990-1994

Country	BCG 0-3	DPT1 2-4	DPT3 4-6	Measles vaccination <8	Measles vaccination 8	Measles vaccination 9-11
Sub-Saharan Africa						
Burkina Faso	64.7	47.6	19.3	1.3	2.3	33.5
Cameroon	57.0	41.9	27.5	3.9	3.0	37.3
Ghana	61.8	50.3	33.0	6.0	1.9	42.6
Kenya	89.3	60.1	58.1	4.1	6.5	65.8
Madagascar	45.8	38.9	27.5	2.5	2.6	34.0
Malawi	84.2	69.5	54.7	4.7	3.3	62.2
Namibia	84.3	53.3	40.5	6.3	2.8	54.3
Niger	24.5	19.2	11.6	5.7	1.5	13.2
Nigeria	36.3	27.5	18.7	3.1	1.9	25.4
Rwanda	94.1	66.2	65.2	5.3	2.9	77.9
Senegal	65.8	46.1	34.6	4.2	3.8	36.6
Sudan	41.2	39.5	30.7	7.7	6.6	33.2
Tanzania	79.1	50.4	39.3	6.0	7.9	55.2
Zambia	77.3	74.2	45.3	4.1	6.5	55.3
Near East/ North Africa						
Egypt	83.6	83.0	46.0	2.2	4.4	63.6
Jordan	14.8	85.0	72.6	2.8	1.9	71.3
Morocco	87.3	57.5	53.2	1.2	3.7	62.0
Turkey	76.7	79.5	53.6	3.6	4.7	60.8
Asia						
Bangladesh	50.9	50.0	37.0	3.3	3.8	47.6
Indonesia	46.5	45.9	27.4	5.5	5.8	35.0
Pakistan	40.3	37.0	20.9	2.3	1.7	32.4
Philippines	69.6	71.5	56.3	5.9	1.7	63.2
Latin America/ Caribbean						
Bolivia	52.8	41.1	8.0	2.0	2.1	30.0
Brazil (NE)	46.4	56.1	11.6	1.9	1.6	56.8
Colombia	77.3	73.7	26.3	4.8	4.2	59.3
Dominican Republic	57.0	60.8	21.4	1.8	0.6	45.9
Paraguay	44.5	49.4	23.2	5.0	1.7	35.2
Peru	79.5	68.3	35.7	2.7	2.7	45.5

Figure 5.2 shows the percent distribution of age at measles vaccination among children age 12-23 months who received this vaccination before the first birthday. In 25 countries, 80 to 90 percent of these children were vaccinated against measles at the age of 9-11 months. The remaining children were vaccinated too early, at age 8 months or younger. In Indonesia, Niger, and Sudan, a smaller proportion of children—between two-thirds and three-quarters—received measles vaccine at the recommended age. About half of the children vaccinated too early in Indonesia and Sudan received the vaccine at age eight months; the remainder were vaccinated against measles by age seven months. In contrast, most of the children vaccinated too early in Niger received the vaccine by the age of seven months; as a result, more than one-quarter of *all* children in Niger vaccinated against measles during the first year received the vaccine at age 7 months or younger.

5.6 INTERVAL BETWEEN DOSES

Too short an interval (less than four weeks) between successive doses of DPT and polio vaccines is a problem because it may result in an inadequate immune response and hence inadequate protection against disease (Cutts et al., 1991). When the interval between doses is too long (more than seven weeks), the child is unprotected until the full series has been received. Table 5.6 summarizes the information on the interval between doses of DPT for children age 0 to 59 months with valid vaccination dates.

With the exception of Niger, the intervals between DPT1 and DPT2 and between DPT2 and DPT3 within each country are similar; therefore the intervals between the first and second doses and between the second and third doses will be discussed together. Short intervals of less than 4 weeks are seen for less than 8 percent of children, except for the interval between the second and third doses in Niger, where 25 percent of DPT3 doses were given too soon. In three countries (Bolivia, Northeast Brazil, and Egypt), the vast majority of intervals between DPT doses, between 85 and 90 percent, are longer than 7 weeks; in these countries only 9 to 14 percent of the vaccinations are given at the recommended interval of 4-7 weeks. In another five countries (Burkina Faso, Colombia, the Dominican Republic, Niger, and Paraguay), about one-third to two-thirds of all intervals are too long, while about one-quarter to one-half of the intervals are the recommended length. At the other

Figure 5.2 Among children age 12-23 months vaccinated against measles in the first year of life, the percent vaccinated before age 8 months, at age 8 months, and at age 9-11 months, Demographic and Health Surveys, 1990-1994

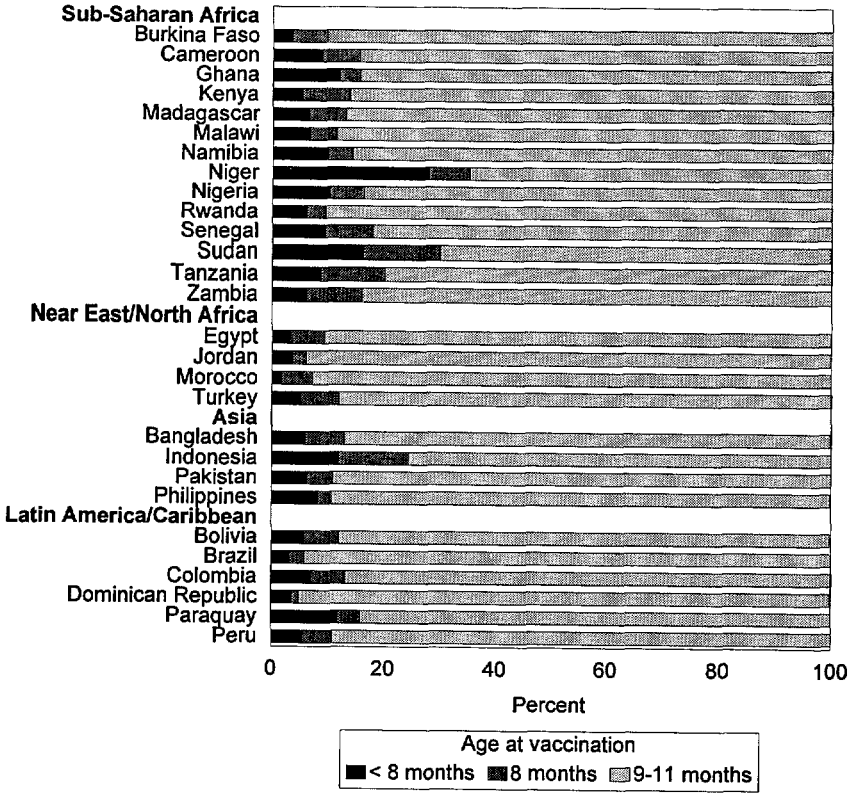


Table 5.6 Interval between DPT vaccinations

Percent distribution of children age 0-59 months with valid immunization dates for DPT1, DPT2 and DPT3, by length of interval between doses, Demographic and Health Surveys, 1990-1994

	Interval between DPT1 and DPT2					Interval between DPT2 and DPT3				
Country	<4 weeks	4-7 weeks	>7 weeks	Total	Number	<4 weeks	4-7 weeks	>7 weeks	Total	Number
Sub-Saharan Africa										
Burkina Faso	4.7	35.0	60.3	100.0	2,625	4.6	44.1	51.3	100.0	1,744
Cameroon	5.3	68.5	26.1	100.0	1,027	5.5	66.9	27.7	100.0	880
Ghana[1]	3.0	61.4	35.6	100.0	1,023	2.6	58.1	39.3	100.0	855
Kenya	4.7	81.3	14.0	100.0	3,010	6.0	77.3	16.8	100.0	2,836
Madagascar	7.0	73.2	19.8	100.0	2,149	5.3	70.6	24.1	100.0	1,879
Malawi	4.5	62.9	32.7	100.0	2,209	3.6	57.2	39.2	100.0	2,015
Namibia	4.8	61.2	34.0	100.0	1,617	4.8	64.8	30.4	100.0	1,428
Niger	4.0	48.3	47.7	100.0	953	25.1	45.2	29.8	100.0	793
Nigeria	6.7	67.3	26.0	100.0	1,314	7.6	64.8	27.6	100.0	972
Rwanda	3.8	87.7	8.5	100.0	3,636	3.5	84.8	11.7	100.0	3,488
Senegal	6.3	64.6	29.1	100.0	2,085	6.6	60.3	33.1	100.0	1,825
Sudan	2.9	72.0	25.1	100.0	1,652	3.4	73.0	23.6	100.0	1,358
Tanzania	6.3	60.4	33.3	100.0	4,190	6.0	56.7	37.3	100.0	3,777
Zambia	4.8	64.6	30.6	100.0	2,961	3.4	64.4	32.2	100.0	2,667
Near East/ North Africa										
Egypt	1.4	14.1	84.5	100.0	3,115	1.1	14.2	84.7	100.0	2,762
Jordan	3.0	83.8	13.2	100.0	4,263	2.8	81.3	15.9	100.0	4,120
Morocco	2.2	77.8	20.0	100.0	2,343	1.6	75.5	22.9	100.0	2,203
Turkey	2.9	76.9	20.2	100.0	916	3.3	74.4	22.2	100.0	833
Asia										
Bangladesh[1]	5.7	67.8	26.5	100.0	1,133	4.7	67.2	28.2	100.0	976
Indonesia	4.9	58.4	36.6	100.0	2,497	5.7	55.9	38.4	100.0	2,195
Pakistan	4.9	70.7	24.5	100.0	1,037	3.7	69.6	26.7	100.0	897
Philippines	5.7	71.0	23.3	100.0	2,104	4.7	70.1	25.2	100.0	1,892
Latin America/ Caribbean										
Bolivia[1]	2.7	11.5	85.9	100.0	685	2.1	11.8	86.0	100.0	504
Brazil (NE)	1.3	8.8	89.8	100.0	1,752	0.9	10.8	88.3	100.0	1,573
Colombia	6.5	27.0	66.5	100.0	1,432	8.0	26.5	65.5	100.0	1,284
Dominican Republic	3.8	41.7	54.6	100.0	1,018	4.5	38.4	57.2	100.0	859
Paraguay	8.4	48.0	43.6	100.0	1,216	8.0	47.6	44.4	100.0	993
Peru	4.2	57.3	38.6	100.0	2,973	4.7	52.9	42.4	100.0	2,699

[1] Children age 0-35 months

end of the spectrum are five countries (Jordan, Kenya, Morocco, Rwanda, and Turkey) where 75 to 88 percent of all intervals are of the recommended length. In these countries, only 9 to 23 percent of the intervals are longer than 7 weeks. In the remaining 15 countries, between half and three-quarters of the intervals are 4-7 weeks and between 20 and 42 percent are longer than 7 weeks.

5.7 MISSED OPPORTUNITIES FOR MEASLES VACCINATION

Vaccination coverage could be increased if all opportunities to vaccinate eligible children were utilized (du Lou and Pison, 1994; Kahn et al., 1995). Missed opportunities are particularly unfortunate when a child receives one needed vaccination but, at the same time, is not given another vaccination for which he or she also is eligible.

Table 5.7 presents the number of children age 12-23 months with a health card who received a dose of DPT, polio, or BCG at 9-11 months of age and, of these, the proportion who did not receive a measles vaccination. In most countries, between 10 and 20 percent of opportunities to vaccinate against measles were missed, with slightly more missed opportunities in Indonesia, Morocco, Pakistan, Senegal, and Turkey. The Dominican Republic shows the highest proportion of missed opportunities, 34 percent. In

contrast, only 8 percent of children in the Philippines and 5 percent of children in Northeast Brazil did not simultaneously receive a measles vaccination when vaccinated for BCG, DPT, or polio at age 9-11 months.

Table 5.7 Missed opportunities for measles vaccination

Among children age 12-23 months who received DPT, polio, or BCG at 9-11 months according to the health card, the percentage who did not receive a measles vaccination at that time, Demographic and Health Surveys, 1990-1994

Country	Children 12-23 months with a health card, who received DPT, polio or BCG at 9-11 months: Percentage who did not receive measles vaccine	Number of children
Sub-Saharan Africa		
Burkina Faso	16.3	170
Cameroon	12.3	69
Ghana	11.3	80
Kenya	18.7	53
Madagascar	19.7	130
Malawi	16.4	88
Namibia	18.8	72
Niger	16.5	73
Nigeria	19.2	92
Rwanda	*	15
Senegal	20.5	83
Sudan	12.8	109
Tanzania	12.3	277
Zambia	16.7	183
Near East/North Africa		
Egypt	12.1	79
Jordan	11.9	77
Morocco	22.5	71
Turkey	22.7	27
Asia		
Bangladesh	19.4	100
Indonesia	21.4	206
Pakistan	26.0	80
Philippines	7.9	76
Latin America/Caribbean		
Bolivia	15.9	148
Brazil (NE)	4.6	169
Colombia	18.1	153
Dominican Republic	33.7	159
Paraguay	18.3	125
Peru	13.4	154

Note: An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

5.8 CONCORDANCE BETWEEN DPT AND POLIO VACCINES

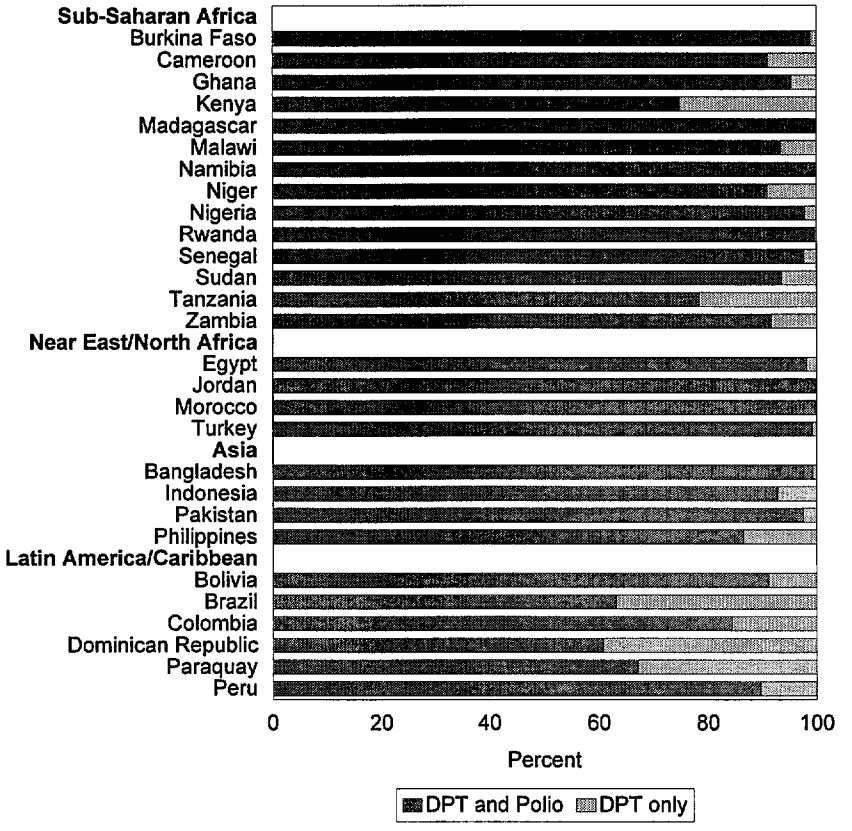
Twelve countries (Bangladesh, Burkina Faso, Egypt, Jordan, Madagascar, Morocco, Namibia, Nigeria, Pakistan, Rwanda, Senegal, and Turkey) show a strong concordance between the date of vaccination for DPT and polio (Table 5.8 and Figure 5.3), with almost all children (98-100 per-

Table 5.8 Dual vaccination of DPT and polio

Percent distribution of children with valid dates for DPT and polio vaccination by whether or not they received DPT and polio vaccination on the same day, Demographic and Health Surveys, 1990-1994

Country	DPT and polio vaccine	DPT only	Total	Number of children
Sub-Saharan Africa				
Burkina Faso	98.9	1.1	100.0	3,126
Cameroon	91.1	8.9	100.0	1,194
Ghana	95.4	4.6	100.0	1,204
Kenya	74.8	25.2	100.0	3,222
Madagascar	99.8	0.2	100.0	2,448
Malawi	93.4	6.6	100.0	2,396
Namibia	100.0	0.0	100.0	1,844
Niger	91.0	9.0	100.0	1,380
Nigeria	97.9	2.1	100.0	1,763
Rwanda	99.6	0.4	100.0	3,804
Senegal	97.7	2.3	100.0	2,349
Sudan	93.6	6.4	100.0	1,940
Tanzania	78.4	21.6	100.0	4,584
Zambia	91.7	8.3	100.0	3,280
Near East/ North Africa				
Egypt	98.2	1.8	100.0	3,454
Jordan	100.0	0.0	100.0	4,388
Morocco	100.0	0.0	100.0	2,554
Turkey	99.2	0.8	100.0	1,002
Asia				
Bangladesh	99.3	0.7	100.0	1,319
Indonesia	92.8	7.2	100.0	2,886
Pakistan	97.6	2.4	100.0	1,171
Philippines	86.6	13.4	100.0	2,304
Latin America/ Caribbean				
Bolivia	91.2	8.8	100.0	909
Brazil (NE)	63.1	36.9	100.0	1,951
Colombia	84.4	15.6	100.0	1,643
Dominican Republic	60.7	39.3	100.0	1,232
Paraguay	67.1	32.9	100.0	1,496
Peru	89.7	10.3	100.0	3,289

Figure 5.3 Percentage of children with valid immunization dates for DPT1 according to whether a polio vaccination was received on the same day, Demographic and Health Surveys, 1990-1994



cent) receiving polio and DPT vaccines on the same day. In contrast, there are eight countries where DPT and polio vaccine often are not given together; in these countries, between 10 and almost 40 percent of children vaccinated with DPT were not given polio vaccine at the same time. Aside from Kenya, the Philippines, and Tanzania, all of these countries are in Latin America, probably reflecting the fact that the drive to eradicate poliomyelitis in Latin America often employs campaigns in which only polio vaccine is administered; hence many children are given DPT at another time (without polio vaccine). In Northeast Brazil, the Dominican Republic, and Paraguay one-third or more of the children were not given polio vaccine at the same time as they were given DPT. In Colombia and Peru, the proportions are somewhat lower: 16 and 10 percent, respectively. Intermediate percentages of children (5 to 9 percent) not receiving polio vaccine when they are given DPT are seen in the remaining 8 countries (Bolivia, Cameroon, Ghana, Indonesia, Malawi, Niger, Sudan, and Zambia).

5.9 DROP-OUT RATES FOR MULTIPLE DOSE VACCINES

Table 5.9 shows the drop-out rates for DPT and polio. The drop-out rate is calculated as the percentage point difference between successive doses of a vaccine, expressed as a percentage of the first dose: (DPT1 - DPT2)100 / DPT1. In Burkina Faso, for example, the difference between DPT1 and DPT2 coverage is 14 percentage points (79 percent minus 65 percent), which gives a drop-out rate of 18 percent.

The drop-out rate between the first and third doses of a vaccine indicates the proportion of children who initiated, but did not complete, the series of vaccinations. The drop-out rate between the first and third doses for both DPT and polio vaccines is less than 10 percent in only three countries: Jordan, Malawi, and Rwanda. High drop-out rates of 25 to 50 percent are seen in 10 countries (Bolivia,

Burkina Faso, Cameroon, the Dominican Republic, Madagascar, Niger, Nigeria, Pakistan, Paraguay, and Peru). Intermediate drop-out rates of 10 to 25 percent for at least one of the two vaccines are seen in the remaining 15 countries.

Drop-out rates for DPT are generally similar to those for polio. The largest difference between the drop-out rates for DPT and polio vaccines is seen in Northeast Brazil, where the drop-out rate between the first and third doses of DPT is 24 percent, compared with 18 percent for polio. Not surprisingly, the drop-out rate between the second and third doses of the vaccines is always greater than the drop-out rate between the first and second doses, with the exception of Niger.

Table 5.9 Drop-out rates for DPT and polio

Percentage of children age 12-23 months who receive a given vaccination but who do not go on to receive the subsequent dose, Demographic and Health Surveys, 1990-1994

	Drop-out rates[1]						
	DPT			Polio			Number of children
Country	1-2	2-3	1-3	1-2	2-3	1-3	
Sub-Saharan Africa							
Burkina Faso	17.9	37.4	48.6	18.2	38.1	49.3	1,104
Cameroon	15.6	19.9	32.4	14.4	22.4	33.5	663
Ghana	10.5	14.7	23.7	9.9	15.4	23.8	651
Kenya	3.4	6.2	9.4	3.1	7.2	10.2	1,124
Madagascar	13.2	18.8	29.6	13.3	18.8	29.7	1,072
Malawi	2.7	6.1	8.6	2.8	6.4	9.1	774
Namibia	11.0	15.6	24.9	11.0	15.6	24.9	788
Niger	33.3	16.1	44.0	32.0	17.5	43.9	1,087
Nigeria	25.8	29.3	47.5	25.9	29.5	47.8	1,380
Rwanda	0.9	4.4	5.3	0.9	4.4	5.3	1,010
Senegal	10.6	14.5	23.6	11.3	14.4	24.1	959
Sudan	10.6	13.5	22.6	9.6	12.1	20.5	1,150
Tanzania	4.1	11.7	15.3	4.9	13.5	17.8	1,616
Zambia	6.7	12.2	18.1	6.4	13.2	18.7	1,123
Near East/ North Africa							
Egypt	5.7	13.0	17.9	5.1	12.4	16.9	1,594
Jordan	0.8	2.0	2.7	0.7	1.9	2.6	1,615
Morocco	5.8	8.2	13.5	5.8	8.2	13.5	985
Turkey	6.6	12.1	17.9	6.9	12.1	18.2	716
Asia							
Bangladesh	7.5	14.8	21.3	8.0	14.2	21.1	1,174
Indonesia	9.9	14.7	23.2	9.9	14.2	22.7	2,670
Pakistan	10.7	28.8	36.4	10.8	29.0	36.7	1,215
Philippines	3.6	9.1	12.4	5.3	9.3	14.1	1,742
Latin America/ Caribbean							
Bolivia	21.6	28.6	44.1	19.3	28.1	42.0	1,111
Brazil (NE)	9.9	15.8	24.2	5.5	13.2	17.9	579
Colombia	7.5	9.7	16.5	7.2	9.2	15.7	748
Dominican Republic	11.1	24.0	32.5	9.7	23.7	31.1	815
Paraguay	14.2	30.6	40.5	14.2	29.9	39.9	791
Peru	11.0	17.1	26.2	8.2	18.7	25.4	1,509

[1] Drop-out rate:
Between DPT1 and DPT2: (DPT1 - DPT2) * 100 / DPT1
Between DPT2 and DPT3: (DPT2 - DPT3) * 100 / DPT2
Between DPT1 and DPT3: (DPT1 - DPT3) * 100 / DPT3

6 Differentials in Vaccination Coverage

Tables 6.1 through 6.6 show socio-demographic differentials in six different measures of vaccination coverage: the percentage of children who received BCG, the first dose of polio vaccine, the third dose of polio vaccine, measles vaccine, full vaccination, and no vaccinations. The tables show the differences in coverage rates according to urban-rural place of residence, mother's education, mother's age at the time of delivery, child's birth order, child's sex, length of the preceding birth interval, and presence of a radio in the household.

6.1 URBAN-RURAL RESIDENCE

The *de facto* place of residence is used in the analyses presented here. Because urban-rural place of residence reflects the classification used by the census organization in each country, the size of cities and towns defined as urban may differ from country to country. Urban-rural place of residence is not available for analysis of the Malawi data.

Urban children have a clear advantage over rural children with regard to vaccination coverage rates. This holds true for almost all vaccinations across all countries. There is only one exception: in Colombia, the measles vaccination rate is 8 percentage points lower in urban than in rural areas. Not surprisingly, the urban advantage tends to be greater when national, or overall, coverage rates are lower. Generally, the largest differences are seen for the third dose of polio vaccine, measles vaccine, and/or full vaccination.

In five countries (Jordan, Kenya, Namibia, the Philippines, and Rwanda), there is only a small urban advantage, and differences are relatively modest (less than 10 percentage points) for all six measures of vaccination coverage. Large differences, ranging from 20 to about 60 percentage points, are seen for at least one measure of vaccination coverage in 11 countries (Burkina Faso, Ghana, Indonesia, Morocco, Niger, Nigeria, Pakistan, Paraguay, Peru, Senegal, and Turkey). Urban-rural differences are intermediate in size, reaching from 10 to 20 percentage points for at least one measure of vaccination coverage, in the remaining 10 countries (Bolivia, Northeast Brazil, Cameroon, Colombia, the Dominican Republic, Egypt, Madagascar, Sudan, Tanzania, and Zambia).

The proportion of children who have received no vaccinations is higher in rural than in urban areas in almost all of the surveys. In 14 countries, at most 3 percent of urban children reportedly never received any vaccinations. In the remaining countries, 5 to 16 percent of urban children were never vaccinated. In contrast, the proportion of rural children who were never vaccinated is very high in many countries, especially in Niger, where two out of every three rural children have never been vaccinated; in Nigeria, where two out of every five rural children have received no vaccines; and in Pakistan, where one out of every three rural children has never been vaccinated. Between 14 and 30 percent of rural children have never received any vaccinations in 10 countries (Bangladesh, Bolivia, Burkina Faso, Cameroon, Ghana, Indonesia, Madagascar, Paraguay, Senegal, and Sudan). In the rural areas of the remaining countries, between 1 and 9 percent of children were never vaccinated (Northeast Brazil, Colombia, the Dominican Republic, Egypt, Jordan, Kenya, Morocco, Namibia, Peru, the Philippines, Rwanda, Tanzania, Turkey, and Zambia).

More than three-quarters of urban children are fully vaccinated in only six countries: Egypt, Kenya, Jordan, Morocco, Rwanda, and Tanzania. In a further four countries, one in Asia (Pakistan) and three in Latin America (Bolivia, the Dominican Republic, and Paraguay), less than half of urban children have received all the vaccinations. In the remaining 17 countries, between half and three-quarters of children are fully vaccinated. The situation in rural areas is quite different. Three-quarters or more of rural children are fully vaccinated only in Jordan, Kenya, and Rwanda. Between half and three-quarters of rural children are fully vaccinated in nine countries (Bangladesh, Colombia, Egypt, Morocco, Namibia, the Philippines, Tanzania, Turkey, and Zambia), while less than half of rural children have received all vaccinations in the remaining 15 countries.

6.2 MOTHER'S LEVEL OF EDUCATION

The mother's level of education is examined because it is expected that vaccination levels would be higher among children of better educated mothers. Four education categories are used: (i) those who received no formal schooling; (ii) those who began but did not complete their primary

Table 6.1 Immunization coverage of BCG by background characteristics

Percentage of children age 12-23 months who were vaccinated with BCG, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	95.8	83.6	84.6	88.5	88.5	100.0	87.7	86.8	84.6	83.1	87.6	85.8	81.8	83.5	87.4	84.6	83.8	85.9	86.1	80.3	90.3	1,104
Cameroon	85.3	68.8	58.2	79.0	85.9	91.1	79.7	78.6	75.4	69.3	75.7	75.8	73.6	76.4	74.6	70.7	75.5	75.8	73.7	65.2	80.8	663
Ghana	93.4	78.6	73.4	81.7	89.9	100.0	88.0	83.3	85.3	73.7	82.0	84.7	76.3	84.6	81.4	68.1	77.4	82.8	90.0	78.6	88.9	651
Kenya	98.9	95.8	89.0	96.9	98.8	98.0	96.1	97.6	99.0	91.9	94.3	97.4	92.1	96.6	95.9	96.8	96.1	95.8	96.6	95.0	97.2	1,124
Madagascar	87.5	73.2	63.7	75.3	87.5	82.4	81.2	75.9	73.8	71.2	75.6	75.4	72.6	78.7	71.1	73.0	77.3	70.0	70.5	71.1	82.5	1,072
Malawi	U	U	95.4	98.5	99.0	100.0	99.6	98.5	96.3	94.8	97.6	97.4	95.1	95.8	98.3	97.2	96.2	97.0	95.7	95.9	98.5	774
Namibia	92.9	90.4	82.2	90.9	95.0	94.9	90.6	91.6	89.8	92.8	87.1	92.1	91.7	91.7	90.7	89.2	91.6	94.3	91.3	88.9	92.3	788
Niger	89.4	29.3	36.8	59.8	100.0	94.7	44.3	44.1	36.4	37.0	40.4	39.6	40.6	38.0	42.2	31.8	44.5	37.7	38.9	32.8	49.1	1,087
Nigeria	81.3	55.0	46.2	74.1	81.2	91.9	58.4	62.9	63.5	57.0	52.6	62.7	60.9	59.5	61.7	62.0	64.3	57.3	57.8	49.0	70.0	1,380
Rwanda	98.5	96.8	96.4	96.7	99.4	100.0	98.8	97.9	96.4	95.2	98.3	96.9	96.3	97.5	96.3	96.5	97.4	96.7	93.6	95.5	99.2	1,010
Senegal	93.3	78.3	81.3	87.7	95.7	97.9	88.8	86.9	80.3	80.9	80.1	85.1	81.0	81.0	86.5	75.0	84.9	81.0	85.3	77.1	86.0	959
Sudan	85.3	71.0	67.4	79.9	82.8	92.4	85.6	77.3	74.8	69.8	79.6	76.6	70.1	77.5	74.7	73.5	72.0	79.2	72.7	65.7	83.8	1,150
Tanzania	99.3	94.4	90.9	94.7	98.7	100.0	97.5	96.4	94.8	93.0	98.9	95.3	91.8	95.5	95.4	97.6	95.2	95.0	92.0	94.0	97.7	1,616
Zambia	98.3	92.4	87.1	93.6	97.8	99.2	97.1	96.4	95.1	92.0	95.2	95.5	92.5	95.7	94.5	91.8	94.2	96.6	95.3	92.0	98.8	1,123
Near East/ North Africa																						
Egypt	94.0	86.7	85.0	88.3	98.1	97.3	94.7	91.6	88.1	80.8	92.3	90.2	81.6	89.0	89.9	87.7	87.5	86.6	89.8	86.8	91.2	1,594
Jordan	20.4	8.3	14.4	19.0	18.3	16.8	16.4	16.8	16.7	17.0	19.3	16.3	17.5	16.8	16.8	17.0	16.3	21.2	13.4	16.4	16.8	1,615
Morocco	99.7	90.2	91.7	100.0	100.0	100.0	92.7	95.7	92.9	91.7	94.8	94.1	90.8	94.4	92.4	93.9	92.6	93.7	94.7	91.0	93.9	985
Turkey	93.2	83.2	72.6	91.8	96.0	99.1	91.9	92.1	79.1	79.4	85.7	90.3	83.5	87.0	91.6	82.6	85.2	86.4	93.8	83.1	91.3	716
Asia																						
Bangladesh	91.3	84.9	80.3	89.2	92.6	96.0	87.7	86.4	86.2	79.0	83.7	86.1	86.0	88.5	82.5	82.5	84.0	87.8	84.3	83.7	91.4	1,174
Indonesia	86.2	68.0	54.2	66.0	77.8	90.1	82.0	76.5	68.5	54.8	75.9	74.0	68.0	74.8	72.4	65.0	64.7	69.8	76.5	66.1	79.7	2,670
Pakistan	84.2	62.9	62.9	81.8	94.1	93.1	76.6	71.4	65.4	66.4	62.0	71.7	63.4	72.8	66.7	69.0	71.0	62.5	66.7	65.7	76.4	1,215
Philippines	93.0	89.4	51.2	83.1	92.1	95.0	96.2	93.6	89.2	83.1	91.1	91.9	87.7	91.5	90.8	89.6	87.7	91.6	91.5	a	a	1,742
Latin America/ Caribbean																						
Bolivia	86.3	67.2	61.6	74.7	66.3	85.9	84.1	80.7	71.6	67.2	76.3	78.9	68.2	78.7	75.2	76.3	71.9	73.0	78.1	65.4	80.2	1,111
Brazil (NE)	84.3	67.1	60.8	77.2	93.5	96.1	90.0	78.0	68.2	65.5	81.7	78.4	63.9	78.3	73.7	70.5	72.1	70.7	73.8	69.8	80.0	579
Colombia	94.3	94.5	89.8	94.5	97.0	93.7	95.1	95.6	88.7	95.6	92.2	94.8	94.6	94.9	93.8	94.2	96.8	92.0	92.4	90.9	95.3	748
Dominican Republic	77.7	58.5	46.0	67.5	80.5	73.6	75.9	72.8	63.6	43.6	66.1	70.4	66.8	66.2	73.1	69.3	62.8	64.0	69.0	63.5	74.4	815
Paraguay	86.0	52.0	33.7	50.7	76.8	89.6	80.5	73.0	60.3	52.1	62.0	70.2	59.6	67.4	67.3	61.2	60.2	56.5	73.8	50.5	71.2	790
Peru	95.5	83.2	78.0	82.8	87.8	96.8	93.0	93.1	90.8	80.5	88.4	91.6	87.5	90.3	90.9	89.3	88.3	89.5	91.6	83.4	92.3	1,509

U = Unknown (not available)
[a] Question not asked in the Philippines

Table 6.2 Immunization coverage of polio1 by background characteristics

Percentage of children age 12-23 months who were vaccinated with polio1, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	92.4	79.0	80.2	79.3	87.4	98.6	80.4	83.1	80.8	79.3	76.7	83.1	76.7	79.1	82.9	81.5	80.2	80.6	83.5	75.6	86.3	1,104
Cameroon	81.9	67.3	55.1	78.1	85.1	87.5	78.7	77.6	71.4	65.9	74.2	74.3	65.2	73.6	72.8	71.9	73.8	70.2	67.6	64.3	77.8	663
Ghana	92.4	77.3	70.7	79.3	90.7	97.8	87.3	83.3	81.4	72.9	77.5	84.3	74.2	82.3	81.4	66.0	76.3	80.6	89.3	77.0	88.2	651
Kenya	98.6	94.8	87.0	95.7	98.3	98.4	96.5	97.2	96.9	90.5	94.1	96.4	91.1	95.2	95.7	94.8	96.0	92.6	95.7	93.6	96.8	1,124
Madagascar	86.3	75.1	62.8	77.6	87.5	83.9	84.2	75.5	76.2	72.8	75.2	77.3	74.8	79.0	73.8	74.1	75.9	72.2	76.0	72.5	84.0	1,072
Malawi	U	U	94.8	99.1	99.0	100.0	99.6	98.5	96.3	94.6	97.6	97.8	93.8	95.8	98.2	97.2	95.9	97.6	95.3	95.8	98.5	774
Namibia	93.3	92.1	83.6	92.7	95.0	95.8	92.8	93.2	93.7	89.7	90.2	93.4	91.2	92.5	92.5	87.3	95.5	94.2	91.8	89.7	94.1	788
Niger	79.5	26.5	32.4	57.6	100.0	96.2	40.4	41.2	33.9	30.9	36.1	36.0	34.5	33.5	38.6	29.4	39.7	32.6	34.8	28.8	44.8	1,087
Nigeria	83.7	57.4	49.6	75.4	81.7	92.8	59.7	64.5	66.1	61.1	55.2	64.9	64.3	61.4	64.6	66.3	65.1	60.4	61.5	51.7	72.2	1,380
Rwanda	97.8	96.2	95.4	96.6	99.4	97.9	97.0	97.9	96.4	94.4	98.3	96.3	95.7	97.0	95.6	96.5	97.3	96.7	91.8	95.0	98.8	1,010
Senegal	90.1	71.6	75.2	80.0	95.7	100.0	85.0	82.9	73.6	74.4	77.9	78.4	77.7	76.5	80.0	71.7	79.2	73.3	80.0	67.6	82.1	959
Sudan	86.0	71.3	67.2	80.3	82.8	94.8	86.5	78.9	73.6	70.1	78.9	77.0	71.5	77.0	76.2	74.3	72.5	78.6	72.7	66.7	83.8	1,150
Tanzania	97.2	92.9	88.4	93.3	97.5	100.0	95.7	96.0	91.3	91.3	97.5	93.8	89.1	94.7	92.8	93.1	93.4	93.8	92.2	92.1	96.6	1,616
Zambia	96.4	91.8	85.4	91.1	97.4	99.2	97.0	95.9	93.3	89.9	95.3	94.2	90.2	95.1	92.8	88.5	94.5	93.4	93.1	91.0	97.5	1,123
Near East/ North Africa																						
Egypt	96.7	93.9	93.0	94.9	99.2	98.0	98.4	95.5	95.0	89.8	95.9	95.3	92.0	95.1	94.8	95.0	90.9	94.3	97.2	93.6	95.8	1,594
Jordan	97.8	97.7	95.1	95.0	99.5	99.0	97.7	99.5	98.0	96.5	98.0	98.3	95.6	97.4	98.2	98.2	97.0	98.0	98.4	95.6	98.2	1,615
Morocco	99.7	87.8	89.6	100.0	100.0	100.0	90.5	94.4	91.6	89.9	89.6	93.0	88.5	93.4	90.2	92.8	90.1	93.7	93.5	88.2	92.5	985
Turkey	94.3	94.5	87.4	95.6	97.3	98.6	95.0	97.2	87.1	90.1	92.2	95.0	92.6	94.4	94.4	90.4	94.2	94.5	97.0	93.1	94.9	716
Asia																						
Bangladesh	91.0	84.1	79.2	88.4	92.8	95.9	87.2	85.8	85.4	77.5	84.3	85.0	83.9	87.5	82.0	80.6	81.8	88.6	84.1	82.3	92.4	1,174
Indonesia	85.7	66.8	55.9	67.2	73.6	88.6	81.4	75.1	69.2	51.8	73.7	73.7	63.7	73.1	72.1	66.3	61.3	69.1	75.8	64.9	78.9	2,670
Pakistan	84.2	60.2	60.5	86.0	93.8	91.7	72.5	69.3	67.3	63.2	60.1	69.7	62.8	70.3	65.4	71.6	66.4	63.5	64.0	63.8	75.1	1,215
Philippines	92.9	89.1	51.2	83.0	92.3	94.6	95.6	93.0	89.6	83.6	91.2	91.9	86.5	91.0	91.0	90.2	88.0	91.0	90.2	a	a	1,742
Latin America/ Caribbean																						
Bolivia	87.3	70.5	66.3	75.0	72.6	90.7	82.8	82.6	77.1	70.6	77.2	81.6	69.3	82.2	76.0	77.1	77.7	76.8	79.7	73.0	80.8	1,111
Brazil (NE)	96.9	93.3	88.5	97.3	100.0	98.9	98.5	95.5	97.5	90.1	94.9	96.2	91.8	95.7	94.7	93.0	93.8	92.2	97.4	93.9	96.0	579
Colombia	98.7	98.8	93.6	98.3	98.9	99.6	98.9	99.2	98.0	97.9	97.4	99.0	99.4	98.7	98.8	100.0	97.9	97.4	98.7	97.6	99.1	748
Dominican Republic	97.7	96.4	84.3	98.7	98.5	98.0	98.0	97.6	96.9	92.6	98.0	97.6	88.2	96.3	98.1	96.4	94.9	96.2	99.7	96.7	97.6	815
Paraguay	95.4	83.2	67.5	82.3	93.0	97.8	90.8	92.3	84.8	85.0	89.4	88.6	88.8	87.7	89.9	86.3	86.4	88.2	93.1	85.5	89.5	790
Peru	96.8	88.8	86.5	87.9	93.2	97.3	96.4	95.4	92.4	86.4	94.1	94.2	90.1	94.3	93.0	93.3	92.3	92.2	92.1	89.9	94.6	1,509

U = Unknown (not available)
[a] Question not asked in the Philippines

Table 6.3 Immunization coverage of polio3 by background characteristics

Percentage of children age 12-23 months who were vaccinated with polio3, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	73.0	35.4	38.2	40.9	67.9	90.1	44.0	42.5	38.7	39.4	37.9	42.8	37.1	39.6	42.5	32.7	40.9	39.2	45.9	32.6	48.5	1,104
Cameroon	60.2	40.8	28.9	52.2	55.4	69.3	57.4	53.4	43.0	41.6	47.9	49.4	46.0	49.9	47.4	43.0	51.4	42.2	41.2	38.7	53.8	663
Ghana	79.2	55.1	49.2	52.4	73.1	91.1	70.7	64.8	58.3	52.5	60.7	64.1	55.7	63.4	61.2	40.4	57.1	61.9	67.1	57.8	68.2	651
Kenya	92.5	84.5	71.5	85.1	91.1	92.1	89.2	89.9	88.1	74.6	83.9	87.8	75.4	86.2	85.2	87.0	84.9	80.8	85.3	82.7	88.1	1,124
Madagascar	70.8	51.4	37.4	53.2	63.8	67.8	62.7	55.4	48.9	50.3	50.8	54.1	56.1	57.4	50.0	44.8	58.5	53.2	47.0	47.0	66.8	1,072
Malawi	U	U	83.7	91.3	96.7	100.0	91.1	91.6	90.0	82.1	88.2	89.7	83.1	87.8	88.6	88.7	87.3	87.6	86.9	85.8	91.4	774
Namibia	71.7	68.4	60.1	69.6	74.3	72.4	68.7	71.3	68.7	68.3	63.4	69.7	74.6	68.6	70.4	65.5	71.3	66.5	73.4	68.2	70.2	788
Niger	62.5	11.0	17.1	38.0	76.5	78.4	25.3	20.9	20.9	16.7	20.9	21.0	14.2	18.5	22.1	15.7	22.3	19.6	16.1	14.1	28.2	1087
Nigeria	58.3	26.0	18.8	37.7	48.4	73.8	30.9	35.8	34.2	29.7	29.6	33.9	32.0	33.1	32.7	31.8	44.2	25.0	23.8	20.9	42.5	1,380
Rwanda	95.6	91.0	89.3	91.8	97.4	95.8	91.5	94.5	90.6	88.6	91.7	91.5	90.1	91.6	90.8	92.7	92.2	91.8	85.7	90.0	94.3	1,010
Senegal	76.6	49.8	54.1	66.2	85.7	97.9	68.8	60.6	57.2	55.3	55.9	58.8	63.6	57.1	61.7	55.0	58.1	55.9	59.3	45.8	64.2	959
Sudan	73.0	54.0	48.4	62.8	72.1	86.7	71.2	63.7	58.5	52.9	61.9	61.9	53.3	62.2	59.4	59.4	55.7	61.3	59.4	47.3	70.7	1,150
Tanzania	87.5	74.3	67.1	79.5	82.9	83.7	76.2	80.7	74.8	75.0	77.8	77.0	76.3	75.2	78.9	76.4	76.7	77.3	78.9	74.8	81.7	1,616
Zambia	83.8	70.0	58.8	67.6	83.6	90.9	83.9	79.9	77.1	65.8	80.6	77.0	66.2	77.0	75.8	70.4	77.0	74.5	69.7	68.9	85.1	1,123
Near East/ North Africa																						
Egypt	87.4	74.0	71.4	83.3	89.8	87.9	85.2	79.2	79.3	70.4	75.9	80.0	74.1	80.1	77.6	76.4	76.8	74.3	80.6	73.6	82.3	1,594
Jordan	95.3	95.2	88.8	93.7	97.9	97.3	96.1	97.1	96.3	93.1	96.1	95.9	91.9	95.0	95.6	95.0	95.0	95.6	95.5	93.0	95.7	1,615
Morocco	97.0	70.5	74.6	98.3	98.2	96.7	80.4	82.5	78.8	75.9	75.3	81.0	75.7	80.5	78.3	79.4	72.8	84.5	85.9	72.9	80.6	985
Turkey	85.9	64.9	61.3	78.0	83.2	89.6	80.1	80.0	71.3	63.3	64.6	79.7	75.2	77.5	76.9	67.0	71.8	79.0	83.5	74.1	78.3	716
Asia																						
Bangladesh	79.3	65.5	60.3	68.3	76.3	83.0	67.4	70.9	62.6	62.2	63.9	68.2	64.5	69.0	64.8	63.2	65.7	66.2	70.2	63.3	78.3	1,174
Indonesia	73.9	48.2	33.1	49.2	57.9	76.8	67.3	58.6	49.7	35.0	56.5	57.0	49.8	56.8	55.5	49.6	43.6	50.2	59.0	46.0	64.3	2,670
Pakistan	55.4	37.2	38.2	44.7	59.0	61.7	39.7	43.0	44.6	43.6	28.9	45.1	41.4	45.8	40.3	46.6	42.8	45.9	40.6	39.8	48.4	1,215
Philippines	81.2	75.2	46.1	68.0	77.6	82.8	84.8	81.2	74.1	69.4	77.0	79.3	73.5	77.9	78.4	74.8	74.8	82.2	76.9	a	a	1,742
Latin America/ Caribbean																						
Bolivia	42.2	35.5	33.5	35.0	39.0	42.4	43.6	37.1	35.6	39.4	34.1	40.4	36.7	42.7	35.2	41.1	31.9	37.3	43.1	35.2	40.0	1,111
Brazil (NE)	80.6	75.4	67.4	78.5	91.2	93.3	85.3	76.0	77.8	74.6	76.6	78.7	77.4	78.8	77.4	79.8	74.2	65.0	76.6	71.3	82.4	579
Colombia	87.2	75.4	67.6	73.5	89.4	89.0	85.9	83.1	76.2	83.5	72.9	84.4	89.7	82.0	84.6	79.4	78.9	82.4	84.9	78.5	84.4	748
Dominican Republic	71.0	61.6	36.7	63.2	63.7	77.0	69.9	69.2	58.2	61.1	51.0	70.1	69.9	64.2	69.9	67.4	55.9	65.8	74.7	62.9	70.3	815
Paraguay	64.7	44.0	38.5	41.4	55.4	73.3	55.5	56.6	54.0	46.8	45.1	54.8	53.4	52.2	54.7	52.0	49.0	49.7	60.4	40.7	56.3	790
Peru	78.5	56.8	55.5	55.5	68.2	78.8	75.9	74.5	65.4	53.8	63.4	71.5	67.6	70.5	69.3	67.6	62.4	65.1	74.5	61.9	71.9	1,509

U = Unknown (not available)
[a] Question not asked in the Philippines

Table 6.4 Immunization coverage against measles by background characteristics

Percentage of children age 12-23 months who were vaccinated with measles, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	77.4	56.4	58.0	54.0	75.8	95.7	65.9	58.8	60.6	55.3	53.9	61.3	58.2	58.0	61.1	52.3	61.2	54.2	59.8	50.9	67.5	1,104
Cameroon	63.2	51.0	35.2	61.0	66.4	74.6	64.2	60.5	53.9	46.8	58.3	55.2	55.8	58.0	53.8	47.3	53.0	63.5	52.7	45.2	61.5	663
Ghana	80.2	57.5	52.3	59.8	72.4	93.3	73.3	67.8	59.0	53.4	64.0	65.6	58.8	62.5	66.4	51.1	59.9	58.2	70.0	59.5	70.7	651
Kenya	84.0	83.7	68.8	81.5	88.4	93.7	89.9	89.6	83.3	70.5	86.0	84.6	74.8	83.2	84.4	82.7	81.0	80.8	84.9	78.5	87.8	1,124
Madagascar	66.7	52.2	41.3	53.6	66.2	64.2	65.0	56.5	48.7	48.5	54.4	55.9	45.9	55.5	52.4	48.9	56.0	51.2	46.2	47.0	67.3	1,072
Malawi	U	U	79.7	90.8	96.7	98.2	96.5	88.5	83.4	79.6	90.3	86.8	78.9	86.3	85.4	84.2	81.9	87.1	83.3	78.9	86.0	774
Namibia	77.8	74.4	59.6	74.8	80.2	83.0	80.3	80.2	73.2	63.3	79.2	75.6	71.9	76.8	74.3	72.0	73.3	76.7	73.9	69.3	78.5	788
Niger	63.5	20.2	25.2	43.8	61.7	78.4	34.9	31.6	27.2	22.2	32.6	27.4	23.4	25.5	30.6	21.8	29.1	28.5	26.0	23.9	33.1	1,087
Nigeria	67.7	39.7	33.8	50.0	61.3	77.3	44.4	47.0	51.9	39.5	40.8	46.6	47.8	45.1	46.2	45.7	49.6	40.7	44.0	34.3	54.7	1,380
Rwanda	94.1	89.6	87.5	90.8	91.3	99.3	92.7	92.6	88.1	86.8	90.1	90.8	86.6	90.3	89.3	91.2	88.6	91.3	85.7	87.9	94.1	1,010
Senegal	70.5	49.9	52.4	66.2	80.0	91.5	65.0	58.6	58.2	52.1	53.7	57.3	59.8	55.7	58.9	50.8	54.5	54.9	63.3	44.3	61.9	959
Sudan	69.9	56.3	50.3	63.2	68.9	84.8	73.4	64.7	58.1	52.0	65.3	60.9	59.1	62.2	60.1	58.6	56.3	61.3	58.7	49.8	69.5	1,150
Tanzania	91.6	78.5	70.5	81.7	88.0	93.8	88.2	83.7	75.6	76.7	84.2	80.9	79.0	81.3	81.1	79.0	78.1	80.5	80.4	79.4	84.6	1,616
Zambia	81.3	73.4	68.2	70.4	79.0	90.4	84.9	79.8	75.7	68.6	80.8	78.0	66.1	77.2	76.9	71.0	75.8	74.3	76.0	72.0	83.0	1,123
Near East/ North Africa																						
Egypt	87.7	77.9	74.9	82.5	88.6	91.8	87.4	85.1	79.4	70.4	80.1	82.8	74.2	81.7	81.2	78.8	79.1	83.1	78.8	77.0	84.4	1,594
Jordan	88.5	91.6	84.8	88.0	92.9	90.7	91.4	91.0	87.8	88.2	90.1	89.8	87.1	89.4	89.5	88.1	88.4	92.5	91.9	83.7	90.4	1,615
Morocco	93.7	72.8	76.0	94.9	94.6	93.4	83.8	82.1	78.3	75.9	81.8	81.2	74.8	79.7	79.9	81.1	75.6	78.2	83.5	78.5	80.1	985
Turkey	82.1	71.9	63.0	77.1	83.5	89.3	81.6	82.4	64.5	62.7	73.3	79.2	72.9	77.8	78.0	74.7	71.4	73.3	81.0	74.9	78.9	716
Asia																						
Bangladesh	77.9	67.7	61.0	72.3	77.7	87.2	72.7	71.4	65.3	60.8	69.1	68.4	72.3	72.4	65.1	65.7	66.0	70.6	67.7	64.8	81.7	1,174
Indonesia	74.0	50.2	34.1	51.8	59.8	76.0	66.5	61.4	52.0	35.3	61.6	57.4	52.6	57.0	58.0	52.3	46.1	52.1	60.9	39.6	55.4	2,670
Pakistan	64.6	43.6	43.6	73.2	61.1	76.5	57.0	50.6	48.4	46.5	41.2	52.9	41.4	54.6	46.1	54.2	49.0	43.3	45.5	45.1	59.2	1,215
Philippines	83.7	79.2	48.2	70.9	81.1	86.2	86.5	84.2	78.2	74.3	77.4	82.7	77.5	81.4	81.5	77.9	81.0	82.6	80.6	a	a	1,742
Latin America/ Caribbean																						
Bolivia	60.4	51.1	40.2	48.0	49.2	68.4	63.1	58.9	50.5	46.5	53.4	58.4	45.2	60.4	51.1	56.2	48.7	50.8	59.0	43.9	59.1	1,111
Brazil (NE)	87.1	78.8	79.3	81.9	79.8	96.3	93.2	82.9	74.8	79.3	88.9	83.0	79.1	80.5	86.1	77.1	80.5	71.3	88.7	79.7	85.2	579
Colombia	79.7	87.7	76.2	82.0	92.3	79.2	86.0	83.6	78.0	68.9	83.8	83.6	71.5	81.7	83.1	79.3	76.6	84.9	81.4	82.0	82.5	748
Dominican Republic	75.9	61.2	53.4	62.3	64.4	80.6	78.6	72.3	52.3	56.6	75.1	69.3	59.1	66.1	73.4	66.2	60.7	64.1	71.3	64.2	73.9	815
Paraguay	65.0	52.4	31.8	50.3	61.4	71.1	67.7	58.0	56.5	49.7	59.2	58.2	56.7	55.5	61.2	55.7	51.2	51.5	59.3	52.8	59.3	790
Peru	78.9	66.4	66.2	65.4	75.0	78.4	79.0	77.1	70.8	61.6	65.9	76.4	68.4	72.4	75.6	71.0	72.6	69.1	73.3	67.8	75.5	1,509

U = Unknown (not available)
[a] Question not asked in the Philippines

Table 6.5 Full immunization coverage by background characteristics

Percentage of children age 12-23 months fully vaccinated, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	64.9	29.3	32.1	27.9	62.1	85.8	38.0	33.9	34.0	33.5	27.8	36.2	34.7	33.8	35.4	28.4	35.3	30.2	39.1	26.7	41.6	1104
Cameroon	50.5	32.9	17.9	45.8	47.3	60.8	50.8	46.2	32.4	31.4	41.5	39.7	38.6	41.3	38.6	29.6	40.8	38.0	34.4	29.2	45.5	663
Ghana	71.1	47.8	42.2	43.9	64.9	86.7	64.7	57.3	48.7	45.8	52.8	56.8	47.4	53.2	56.7	36.2	52.5	50.0	57.1	50.3	60.7	651
Kenya	80.9	77.7	62.7	75.4	84.0	88.4	84.9	84.3	77.9	63.7	80.5	79.4	65.8	78.1	78.2	79.1	75.7	70.2	79.3	72.6	82.5	1124
Madagascar	57.9	41.4	29.3	42.5	48.8	56.8	49.6	47.6	38.8	38.8	40.9	44.8	40.7	44.4	42.4	37.0	46.9	43.8	37.6	36.2	57.1	1072
Malawi	U	U	76.3	84.9	95.9	96.3	89.8	85.3	81.5	74.6	85.3	83.0	75.0	81.8	81.9	81.2	79.0	82.2	79.6	78.9	86.0	774
Namibia	59.6	57.0	44.2	57.1	60.8	64.5	60.9	60.8	55.5	50.7	55.3	58.4	57.9	58.2	57.5	54.0	53.7	58.5	60.8	53.5	60.0	788
Niger	53.7	9.6	14.6	34.0	61.7	69.3	21.7	18.6	19.4	13.3	18.5	18.2	11.6	16.3	18.7	13.5	18.9	18.0	14.2	12.5	24.0	1087
Nigeria	51.4	22.9	16.4	28.8	42.7	68.7	25.8	32.9	30.8	25.0	26.0	29.7	29.4	30.0	28.0	28.0	39.4	22.3	21.4	17.5	38.2	1380
Rwanda	92.6	86.0	84.1	87.2	89.3	95.1	86.6	89.2	85.7	84.1	86.8	87.0	84.0	86.5	86.2	89.1	86.2	87.6	82.2	84.1	92.0	1010
Senegal	64.9	40.4	43.6	58.5	74.3	89.4	58.8	49.0	50.0	44.1	45.6	48.7	53.3	46.2	52.3	44.2	46.4	46.2	52.7	35.9	53.8	959
Sudan	60.5	46.5	40.2	53.1	60.7	75.7	62.9	54.1	49.6	43.0	55.8	51.2	49.6	52.9	50.2	47.0	46.8	52.0	53.1	38.4	61.1	1150
Tanzania	83.8	67.9	60.0	73.2	78.0	79.2	72.2	74.5	67.7	68.7	72.3	70.9	71.0	69.2	73.1	70.2	69.9	70.2	73.8	68.7	75.8	1616
Zambia	74.4	60.0	49.3	58.5	71.7	83.6	75.4	70.5	66.4	55.3	71.2	67.4	55.0	66.3	66.9	58.3	66.7	64.6	61.5	59.5	74.9	1123
Near East/ North Africa																						
Egypt	77.1	61.7	59.6	66.7	75.7	81.0	75.1	69.9	66.1	55.2	64.1	69.3	57.5	68.9	65.7	64.3	66.5	64.6	63.9	61.7	71.0	1594
Jordan[1]	86.8	90.4	82.1	87.8	91.3	89.2	89.3	89.2	87.4	86.5	87.1	88.6	85.0	87.7	88.0	86.4	87.0	91.0	91.5	81.3	88.9	1615
Morocco	93.7	66.7	71.2	94.9	92.9	91.2	78.8	78.1	74.8	71.9	72.7	77.5	71.1	75.5	76.0	75.6	69.2	78.2	82.9	71.5	76.5	985
Turkey	73.9	50.4	45.8	58.0	70.6	81.9	67.9	66.7	54.6	52.9	54.2	66.1	63.1	62.6	66.2	54.1	58.1	64.9	70.4	61.1	65.3	716
Asia																						
Bangladesh	70.4	57.8	51.9	59.4	67.2	79.0	61.9	61.6	55.7	52.8	57.0	59.7	60.8	61.9	56.2	56.3	57.0	58.5	60.2	54.6	73.3	1174
Indonesia	65.2	40.9	25.9	41.7	50.7	67.4	59.5	51.4	39.9	28.2	50.8	48.5	43.9	48.4	48.3	42.8	36.3	40.9	51.0	39.6	55.4	2670
Pakistan	45.6	30.2	31.4	39.0	39.0	53.7	33.5	33.8	36.8	36.2	24.3	37.2	31.4	39.1	31.3	36.4	35.9	34.1	34.7	33.1	38.6	1215
Philippines	73.2	69.9	43.0	60.7	72.4	75.6	77.5	74.4	68.5	62.9	67.7	73.0	66.5	71.0	72.1	67.5	69.7	76.6	69.7	a	a	1742
Latin America/ Caribbean																						
Bolivia	35.1	27.1	22.8	26.1	33.9	34.9	33.8	31.9	28.3	29.5	25.4	32.8	29.4	34.3	28.1	32.7	24.5	30.5	38.4	22.0	33.8	1111
Brazil (NE)	63.5	47.6	38.5	56.5	60.2	86.2	69.2	57.9	46.5	46.8	62.3	56.8	48.2	56.4	55.5	48.6	54.1	46.8	57.1	49.9	59.6	579
Colombia	69.2	66.7	61.7	61.7	82.6	67.7	72.9	70.4	57.2	58.1	61.4	69.8	67.7	68.1	68.6	62.8	63.3	67.6	68.4	66.8	71.9	748
Dominican Republic	45.1	25.2	8.5	29.8	35.3	48.3	44.3	40.5	23.5	15.8	27.8	38.9	31.5	31.8	41.9	37.5	22.2	34.1	40.0	31.0	41.2	815
Paraguay	44.9	25.5	20.2	22.3	36.6	53.7	43.6	33.1	38.4	23.4	29.3	35.0	34.6	31.1	37.9	31.1	25.3	29.6	39.1	25.1	36.3	790
Peru	65.1	46.4	46.0	44.9	58.3	64.7	65.3	62.9	49.9	41.6	50.5	59.6	54.5	56.8	58.7	51.3	51.7	55.2	61.0	50.5	59.4	1509

Note: Children who are fully vaccinated comprise those who have received BCG, measles vaccine, and three doses of DPT and polio vaccine.
U = Unknown (not available)
[1] BCG is not included in the calculation of full vaccination in Jordan.
[a] Question not asked in the Philippines

Table 6.6 Lack of immunization coverage by background characteristics

Percentage of children age 12-23 months who received no vaccinations, based on health card information and maternal recall, by selected background characteristics, Demographic and Health Surveys, 1990-1994

Country	Residence		Education				Birth order				Mother's age at delivery			Sex		Birth interval (months)				Radio		Number of children
	Urban	Rural	None	Less than primary	Pri-mary	Second-ary or higher	1	2-3	4-5	6+	<20	20-34	35+	Male	Female	<24	24-35	36-47	48+	No	Yes	
Sub-Saharan Africa																						
Burkina Faso	3.4	14.8	13.7	10.7	11.5	0.0	12.3	10.7	12.9	16.0	12.2	12.0	18.2	15.0	11.1	11.8	14.3	12.7	12.6	18.2	8.1	1,104
Cameroon	14.5	26.5	37.2	17.6	13.4	8.1	18.3	18.8	20.5	27.9	21.7	21.6	21.4	20.4	22.9	24.2	22.3	22.2	22.1	31.3	16.6	663
Ghana	6.1	19.2	24.6	15.9	8.6	0.0	10.0	15.0	14.1	23.7	15.7	13.8	21.6	14.0	16.6	29.8	20.9	16.4	7.9	19.5	9.6	651
Kenya	1.1	3.7	10.7	2.6	1.0	1.3	3.5	1.9	0.8	7.4	5.3	2.1	7.9	3.1	3.5	3.2	2.8	4.2	3.4	4.8	2.1	1,124
Madagascar	10.0	21.4	31.1	19.1	12.5	13.8	13.6	19.5	20.3	24.2	19.7	19.7	21.8	16.7	23.5	22.5	19.2	24.1	21.6	23.2	13.9	1,072
Malawi	U	U	4.3	0.7	1.0	0.0	0.4	1.5	3.7	3.7	2.4	1.8	4.9	3.4	1.5	2.8	2.9	1.9	4.3	3.4	1.3	774
Namibia	5.1	4.6	8.8	4.8	1.7	3.8	4.9	3.6	5.5	5.9	8.2	4.1	4.5	4.4	5.2	9.7	2.7	3.1	4.2	5.1	4.7	788
Niger	8.4	69.6	61.9	39.8	0.0	3.8	54.3	54.2	63.1	61.5	58.2	59.4	57.0	61.0	56.1	67.6	54.6	60.5	57.9	65.4	50.3	1,087
Nigeria	15.7	41.4	50.2	19.3	17.7	5.2	39.0	35.0	32.0	38.2	43.2	34.0	35.7	37.8	34.0	33.2	33.0	38.8	38.3	47.1	26.9	1,380
Rwanda	1.5	3.0	3.6	2.8	0.6	0.0	0.6	1.7	3.6	4.8	1.7	2.7	3.7	2.1	3.7	3.5	2.3	3.3	6.4	4.1	0.8	1,010
Senegal	5.8	20.4	17.4	12.3	4.3	0.0	10.6	12.4	18.3	17.6	18.4	14.2	16.3	17.2	13.1	20.0	14.5	18.5	14.0	22.5	12.6	959
Sudan	11.8	26.3	29.7	18.4	14.8	3.8	11.8	18.7	24.0	27.3	17.7	20.7	27.0	20.0	22.2	23.7	24.9	18.5	24.5	30.4	14.3	1,150
Tanzania	2.8	5.8	10.5	5.9	1.3	0.0	3.1	3.4	7.2	7.4	1.8	5.1	9.4	4.3	6.1	5.9	5.2	4.9	7.4	6.6	2.7	1,616
Zambia	1.5	6.3	11.7	5.6	1.0	0.8	1.6	2.8	4.4	7.3	2.6	4.0	6.7	3.5	4.7	7.9	4.7	3.4	3.9	6.7	1.0	1,123
Near East/ North Africa																						
Egypt	2.5	4.6	5.6	3.4	0.0	1.4	1.4	2.5	4.0	8.8	2.7	3.5	7.0	3.5	4.2	3.2	6.6	4.4	2.7	4.9	3.1	1,594
Jordan[a]	2.2	1.9	4.9	5.0	0.5	0.8	1.6	0.5	2.0	3.5	2.0	1.6	4.4	2.5	1.7	1.8	3.0	2.0	1.6	4.4	1.7	1,615
Morocco	0.3	9.2	7.8	0.0	0.0	0.0	6.1	4.0	7.1	7.9	5.2	5.5	8.7	5.0	7.4	5.6	7.1	6.3	5.3	9.0	5.6	985
Turkey	2.4	3.9	8.9	4.4	0.3	0.0	2.5	1.5	7.1	6.0	2.1	3.0	5.6	3.9	2.0	4.2	3.3	5.5	1.5	3.6	2.9	716
Asia																						
Bangladesh	9.0	15.6	20.5	11.6	7.2	3.5	12.4	13.9	14.2	22.5	15.3	14.7	16.1	12.4	17.6	18.3	18.2	10.9	15.9	17.3	7.6	1,174
Indonesia	11.4	29.6	41.0	30.2	21.5	8.5	16.0	21.4	27.3	43.6	22.3	23.2	31.4	23.3	24.6	31.4	33.2	27.9	20.9	31.5	17.9	2,670
Pakistan	14.0	34.8	34.8	14.0	3.5	6.8	21.1	26.7	31.4	32.2	37.1	26.3	32.7	25.3	30.9	27.2	28.0	32.7	33.1	32.3	21.3	1,215
Philippines	4.9	8.6	46.8	12.6	5.6	3.7	3.0	5.2	8.2	12.2	7.8	6.0	9.8	6.4	7.1	8.0	8.7	6.5	7.2	a	a	1,742
Latin America/ Caribbean																						
Bolivia	7.1	23.4	25.8	17.8	21.9	6.8	10.5	12.7	17.7	22.1	13.8	13.9	21.9	13.6	16.5	15.8	18.2	17.6	14.0	22.9	12.8	1,111
Brazil (NE)	2.1	4.2	7.9	1.4	0.0	1.1	0.0	3.3	2.0	6.5	0.9	2.7	6.2	3.2	3.0	4.3	4.5	5.0	2.6	4.7	2.1	579
Colombia	1.0	1.2	6.4	1.3	0.7	0.4	0.8	0.6	2.0	2.1	1.8	0.9	0.6	1.1	1.0	0.0	2.1	2.6	1.0	2.4	0.8	748
Dominican Republic	0.2	1.6	6.2	0.1	0.0	0.5	0.1	1.1	1.1	1.0	0.2	0.8	2.4	1.2	0.4	0.6	3.2	0.0	0.0	1.3	0.4	815
Paraguay	3.2	14.0	28.7	14.4	5.4	1.5	6.1	7.3	12.3	12.1	10.1	8.8	9.3							10.3	7.7	790
Peru	1.6	7.9	10.7	8.3	4.6	1.1	2.4	3.4	4.2	8.4	4.2	3.6	6.6	4.0	4.1	3.8	5.0	5.3	5.2	6.9	3.4	1,509

U = Unknown (not available)
[a] Question not asked in the Philippines

education; (iii) those who completed the primary level of education but did not progress further; and (iv) those who attended school at the secondary level or beyond. Primary education was defined as the number of years of schooling prescribed by the country for this level of education; in most countries, this corresponds to five to seven years of schooling.

There is a strong association between maternal education and children's vaccination coverage. Children of uneducated mothers have the lowest vaccination coverage levels; the only exceptions are Burkina Faso and Peru where full vaccination levels are lowest among children whose mothers have incomplete primary education. In a few instances, vaccination coverage levels are equally low among children of mothers with some primary education and among children of mothers with no education. In most countries, however, all six measures of vaccination coverage are lowest among children of uneducated mothers followed by children of mothers with some primary education. The highest vaccination coverage levels are found either among children whose mothers have completed primary school or among children whose mothers have gone on to secondary school. Coverage differentials by mother's education are almost always largest for measles, polio3, and/or full vaccination.

Differences in vaccination coverage levels by mother's education generally are large; in 25 of 28 surveys, more than 20 percentage points separate the groups with the lowest and highest coverage for at least one measure of vaccination. Differences are smallest in Jordan (less than 10 percentage points) and in Malawi and Rwanda (a maximum difference of 10-20 percentage points). In 10 of the remaining countries (Bangladesh, Burkina Faso, Cameroon, the Dominican Republic, Ghana, Indonesia, Niger, Nigeria, Senegal, and Sudan), the differentials exceed 40 percentage points.

Among children whose mothers have no education, one-third to one-quarter have never been vaccinated in Bolivia, Cameroon, Ghana, Madagascar, Pakistan, Paraguay, and Sudan. In Indonesia, Niger, Nigeria, and the Philippines, an even higher proportion of these children have not received any vaccinations: from two-fifths to two-thirds. In the remaining 17 countries, between 4 and 21 percent of children of uneducated mothers have never been vaccinated. In contrast, the proportion who have never been vaccinated among children of the educational group with the highest coverage rates ranges from less than 1 to 14 percent.

6.3 MOTHER'S AGE AT DELIVERY

The mother's age at delivery is calculated from the dates of birth of the mother and the child. Three categories are used: under 20 years, 20-34 years, and 35 years or older. There does not appear to be a strong relationship between the mother's age at delivery and vaccination coverage levels, although there is a trend towards higher coverage levels among children whose mothers are in the two younger age groups. The lowest coverage levels tend to be among children born to women age 35 years or older and sometimes among those with mothers below 20 years. Only in a few instances are the lowest levels seen among children of mothers in the middle age group (20-34 years of age).

Differentials by mother's age tend to be relatively small; they are less than 20 percentage points for all measures of vaccination coverage in all countries. In 11 countries, the differences are less than 10 percentage points for every measure of vaccination coverage. In the remaining 17 countries, at least one measure shows a differential of 10 to 20 percentage points, although most measures in most of these countries have differentials of less than 10 percentage points.

6.4 SEX OF CHILD

The child's gender is included as an independent variable in order to assess whether there is differential treatment of boys and girls. Child's gender, however, shows smaller differentials in vaccination coverage than any of the other socioeconomic and bio-demographic variables examined here. Seen across all surveys and all six measures of vaccination coverage, there are generally very small differences in vaccination coverage among girls compared to boys.

Across all the countries there might be a slight tendency for vaccination coverage to be somewhat higher among girls than among boys. There are nine countries where differences between boys and girls reach as high as 5 to 10 percentage points. In about half of these countries (Bangladesh, Northeast Brazil, Bolivia, Madagascar, and Pakistan), vaccination coverage levels are higher for boys than girls, while the reverse is true in the other countries (the Dominican Republic, Niger, Paraguay, and Senegal).

6.5 BIRTH ORDER OF CHILD

Birth order is divided into four categories: (i) first, (ii) second or third, (iii) fourth or fifth; and (iv) sixth or higher. There are several possible explanations for differences in vaccination coverage by birth order. On the one hand, mothers may be more concerned about first-born children and hence more likely to see that they are vaccinated; also mothers with many children may have less time to make sure that their children are vaccinated properly. On the other hand, more experienced mothers—as reflected in a higher birth order for the child—may be more aware of recommended childhood vaccinations and hence more likely to obtain them. Aside from these considerations, children of higher birth order are more likely to be of lower socioeconomic status than children of the lowest birth orders.

In most countries, vaccination coverage levels tend to be lowest for children of higher birth orders and higher for children of lower birth orders. This pattern is particularly clear for measles vaccination and full vaccination coverage, for which, with only a few exceptions, first-born children have the highest coverage levels while children of birth order six or more have the lowest coverage levels. Birth order differentials in vaccination coverage between the categories with the lowest and highest levels are below 10 percentage points in only three countries: Jordan, Morocco, and Rwanda. In 17 countries, these differentials range from 10 to 20 percentage points, and they exceed 20 percentage points in the remaining nine surveys (Northeast Brazil, the Dominican Republic, Indonesia, Kenya, Malawi, Paraguay, Peru, Sudan, and Zambia).

6.6 LENGTH OF THE PRECEDING BIRTH INTERVAL

The length of the birth interval preceding each child's birth is derived from the birth history given by the mother. While the birth interval *per se* probably does not influence vaccination coverage rates, it may serve as another indicator of how occupied the mother is in caring for small children.

There is no consistent pattern in vaccination coverage levels according to the length of the preceding birth interval. In some countries and for some measures of vaccination, however, there is a tendency toward higher vaccination coverage levels among children born after longer intervals. Only in Ghana and Nigeria do the differentials between the categories with the lowest and highest coverage rates ever exceed 20 percentage points. In 14 countries, the difference in at least one measure of vaccination falls between 10 and 20 percentage points, while in the remaining 12 countries the differences for all measures are less than 10 percentage points.

6.7 RADIO IN THE HOUSEHOLD

Vaccination coverage is also examined according to whether the child lived in a household with a radio. The presence of a radio is related to socioeconomic status, but, over and above this, mothers who live in a household with a radio may be exposed to messages about the importance of vaccinating their children. If the child's mother was a visitor in the household, she was asked whether there was a radio in her usual household of residence and this information was used rather than the information about the household in which she was interviewed.

As expected, children from households with a radio consistently have higher vaccination coverage rates than children from households without a radio. This relationship holds true across all six measures of vaccination and across all countries. In most countries, larger differences are seen for polio3, measles and full vaccination. In 10 countries (Colombia, Egypt, Jordan, Malawi, Morocco, Namibia, Peru, Rwanda, Tanzania, and Turkey), the difference between children from households with and without a radio is less than 10 percentage points for all six measures of vaccination coverage. In four countries (Madagascar, Nigeria, Sudan, and Paraguay), the differential exceeds 20 percentage points for at least one of the six measures. In the remaining 13 countries, differences range from 10 to 20 percentage points.

7 Secular Trends in Vaccination Coverage

Eight of the countries included in this report had a previous DHS survey about five years before the current survey. Table 7.1 and Figure 7.1 compare the coverage rates from the previous survey to the findings presented in this report for BCG, the third doses of DPT and polio vaccines, measles vaccine, full immunization, and whether the interviewer saw a health card. Coverage rates increased for all these measures in all countries with two exceptions: measles vaccination in Bolivia, which fell by 2 percentage points, and health cards shown to the interviewer in Egypt, which dropped by 6 percentage points. Kenya shows the smallest improvement, with increases in coverage ranging from 3 percentage points for BCG to 15 percentage points for full vaccination. This is not surprising since Kenya already had relatively high levels of vaccination coverage at the time of the first survey. Senegal shows the greatest change, with increases of 18 percentage points in measles vaccination coverage and 45 percentage points in the third doses of DPT and polio.

Table 7.1 Immunization trends

Percentage of children age 12-23 months who received specific vaccinations by the time of the survey for selected countries with two DHS surveys, Demographic and Health Surveys, 1986-1994

Country	Survey phase and year	BCG	DPT3	Polio3	Measles	All	Percent with card	Number of children
Sub-Saharan Africa								
Ghana	DHS-I 1988	69	42	41	51	31	40	782
	DHS-III 1993	83	62	62	64	55	68	651
Kenya	DHS-I 1988/89	93	82	82	72	63	61	1,315
	DHS-III 1993	96	87	86	84	78	69	1,124
Senegal	DHS-I 1986	54	14	12	39	10	30	791
	DHS-II 1992/93	84	59	59	57	49	64	959
Near East/North Africa								
Egypt	DHS-I 1988/89	70	66	66	76	54	61	1,579
	DHS-II 1992	90	76	79	82	67	55	1,594
Morocco	DHS-I 1987	83	63	63	58	53	50	1,101
	DHS-II 1992	93	79	79	80	76	65	985
Latin America/Caribbean								
Bolivia	DHS-I 1989	55	28	38	58	18	23	1,108
	DHS-III 1994	77	43	39	56	31	35	1,111
Colombia	DHS-I 1986	85	72	72	64	54	55	556
	DHS-II 1990	94	82	83	82	68	59	748
Peru	DHS-I 1986	57	58	57	72	36	43	526
	DHS-II 1991/92	91	68	70	74	58	51	1 509

Figure 7.1 Trends in immunization coverage and percentage of cards seen by an interviewer among children age 12-23 months for countries with two DHS surveys, Demographic and Health Surveys, 1990-1994

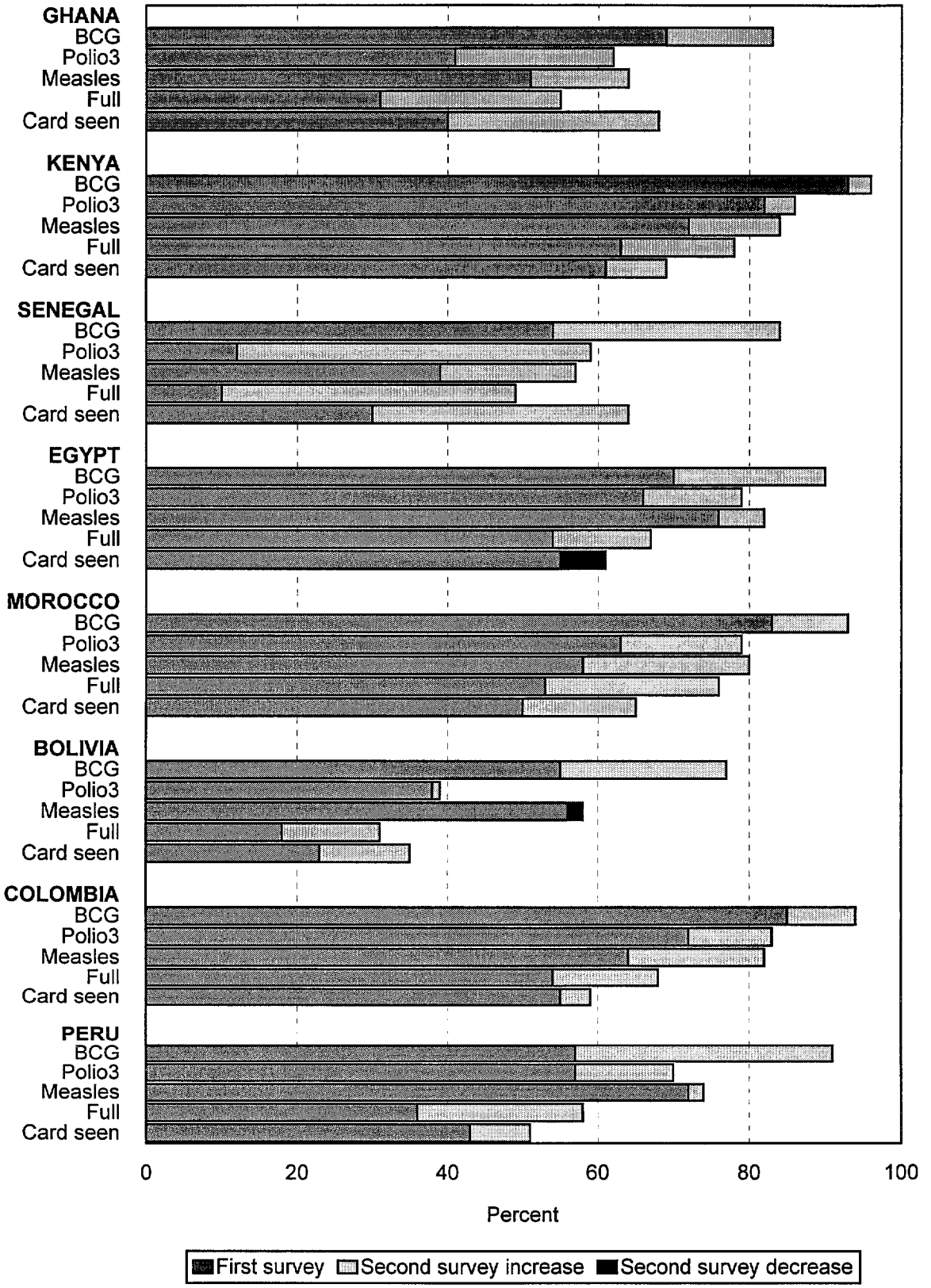


Table 7.2 summarizes changes in vaccination by the first birthday for BCG, polio3, and measles vaccine. Increases in BCG coverage range from 11 percentage points in Kenya to 36 percentage points in Peru. In Bolivia, there are only small increases in the polio3 coverage rate (7 percentage points) and measles coverage rate (1 percentage point). In other countries, improvements are larger, peaking in an increase of 43 percentage points for polio3 in Senegal.

Table 7.2 Immunization trends for infants

Percentage of children age 12-23 months who received specific vaccinations in the first year of life for selected countries with two DHS surveys, Demographic and Health Surveys, 1986-1994

Country	Survey phase and year		Vaccination received			Number of children
			BCG	Polio3	Measles	
Sub-Saharan Africa						
Ghana	DHS-I	1988	64	32	35	782
	DHS-III	1993	81	57	51	651
Kenya	DHS-I	1988/89	84	75	60	1,315
	DHS-III	1993	95	84	76	1,124
Senegal	DHS-I	1986	49	12	24	791
	DHS-II	1992/93	80	55	45	959
Near East/ North Africa						
Morocco	DHS-I	1987	77	54	45	1,101
	DHS-II	1992	92	74	67	985
Latin America/ Caribbean						
Bolivia	DHS-I	1989	37	20	33	1,108
	DHS-III	1994	71	27	34	1,111
Colombia	DHS-I	1986	76	57	45	556
	DHS-II	1990	92	75	68	748
Peru	DHS-I	1986	52	35	38	526
	DHS-II	1991/92	88	60	51	1,509

8 Summary and Conclusions

DHS surveys provide a dependable source of vaccination coverage information for developing countries; they use a consistent approach to provide comparable results across countries and over time. The surveys provide nationally representative estimates of vaccination coverage using rigorous sampling techniques in the selection of respondents. In addition to providing overall vaccination coverage rates, the information collected also allows analyses to identify subgroups of children who are at high risk of not being vaccinated or of receiving suboptimal vaccination services. Some of these possible analyses of the DHS data are presented here, focusing on differences between children according to urban-rural residence, mother's level of education, the sex of the child, the length of the preceding birth interval, and the child's birth order.

The vaccination information in this report is derived from the child's written vaccination record or health card whenever the mother could show this to the interviewer. The mother's recall of a child's vaccinations is used when she could not show a card to the interviewer. Most of the coverage levels are reported for children age 12-23 months. Overall rates are calculated both for vaccination coverage by the time of the survey and for vaccinations received before the child's first birthday. There are large differences in coverage rates across countries. For example, vaccination against measles in the first year of life exceeds 75 percent in three countries: Jordan, Kenya, and Rwanda. In contrast, only one-third to one-half of children in Bolivia, Burkina Faso, Cameroon, the Dominican Republic, Indonesia, Madagascar, Pakistan, Paraguay, Senegal, and Sudan received measles vaccine before their first birthday. Coverage rates are even lower in Niger and Nigeria, where only 20 percent and 30 percent of children, respectively, were vaccinated against measles during the first year of life.

An examination of secular trends indicates that vaccination coverage rates are increasing. In all eight of the countries included in this report that have had a previous DHS survey, there has been a clear increase in immunization coverage levels. The smallest increase is seen in Kenya, where coverage levels were already relatively high in the previous survey, while the largest change took place in Senegal. There coverage rates have increased dramatically, although there continues to be room for further improvement.

There are clear differentials in coverage in most countries, with urban children having higher coverage rates than their rural counterparts. Children from households with a radio also tend to have higher coverage rates than children from households without one, primarily reflecting differences in socioeconomic status but possibly also reflecting differential exposure to broadcast messages about the importance of childhood vaccinations. The largest differentials are associated with the mother's level of education. Children whose mothers have no formal schooling consistently have lower vaccination coverage levels than do children of mothers who have at least completed primary education. There are much smaller differentials according to the child's birth order or the length of the preceding birth interval, with children of lower birth order and born after longer intervals tending to have somewhat better vaccination coverage rates. The smallest differences are seen for the child's gender; there do not appear to be consistent differences in vaccination coverage rates between boys and girls.

The following recommendations will facilitate recommended vaccinations for young children and will allow continued monitoring of the performance of vaccination services:

- In countries with high or relatively high coverage rates, continuing support for vaccination services will ensure continued high coverage rates for most children. Particular emphasis should be placed on reaching children at high risk of not being vaccinated and extending vaccination services to underserved population subgroups.

- Countries with low or relatively low vaccination coverage levels need increased support for vaccination services, with the primary emphasis on reaching all children with vaccination services.

- The need to expand the list of recommended vaccines for young children should be explored.

- For countries that already are succeeding in providing vaccination services to infants, the next step is to expand the emphasis of vaccination programs beyond the first year of life.

- Vaccination coverage rates should be monitored with consistent methodology.

- Survey results should report at least the following minimal information:

  (i) Percent of children age 12-23 months for whom a written vaccination record was seen by the interviewer.

  (ii) Percent of all children age 12-23 months who received each of the following vaccinations by the time of the survey: BCG; DPT1, DPT2, and DPT3; polio1, polio2, and polio3; and measles vaccine.[5]

  (iii) Percent of all children age 12-23 months who received each of the following vaccinations by their first birthday: BCG; DPT1, DPT2, and DPT3; polio1, polio2, and polio3; and measles vaccine.[5]

Attaining the goal of the World Summit for Children—90 percent vaccination coverage by the year 2000—is a realistic possibility for a handful of the countries included in this report. For many of the countries, it represents an enormous challenge which can only be met if a large effort is made to make this goal a reality.

[5] It is important to include both of these measures of vaccination status when reporting the results of coverage surveys. Vaccination status by the time of the survey is simple to calculate from the survey data. Vaccination by the first birthday gives an indication of the timeliness of vaccinations, but the calculations are more complex and require a number of assumptions to be made.

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Appendix A

Summary of DHS-I, DHS-II, and DHS-III Surveys, 1985-1996

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		FC, M, MM
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,354	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA

Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA
DHS-III						
Benin	Jun-Aug 1996	Institut National de la Statistique	AW 15-49	5,000	2,000 Men 15-59	AIDS, CA, MA, MM, SAI
Central African Republic	Sep-Mar 1994/95	Direction des Statistiques Démographiques et Sociales	AW 15-49	5,884	1,729 Men 15-59	AIDS, CA, CD, MA, MM, SAI
Comoros	Apr-Jun 1996	Centre National de Documentation et de la Recherche Scientifique	AW 15-49	3,160	1,100 Men 15-64	CA, MA
Côte d'Ivoire	Jun-Nov 1994	Institut National de la Statistique	AW 15-49	8,099	2,552 Men 15-59	CA, MA, SAI
Eritrea	Sep-Jan 1995/96	National Statistics Office	AW 15-49	5,054	1,114 Men 15-59	AIDS, CA, MA, MM, SAI
Ghana	Sep-Dec 1993	Ghana Statistical Service	AW 15-49	4,562	1,302 Men 15-59	CA, MA
Kenya	Feb-Aug 1993	National Council for Population and Development	AW 15-49	7,540	2,336 Men 20-54	AIDS, CA, MA, SAI
Malawi (KAP)[a]	Jun-Sep 1996	National Statistical Office	AW 15-49	2,000	1,800 Men 15-54	AIDS
Mali	Nov-Apr 1995/96	CPS/MSSPA et DNSI	AW 15-49	9,704	2,474 Men 15-59	AIDS, CA, MA, MM, SAI
Tanzania (KAP)[a]	Jun-Oct 1994	Bureau of Statistics, Planning Commission	AW 15-49	4,225	2,097 Men 15-59	AIDS, PC
Tanzania (In-depth)	Jun-Oct 1995	Bureau of Statistics, Planning Commission	AW 15-49	2,130		Adult and childhood mortality estimation
Tanzania	Jul-Nov 1996	Bureau of Statistics, Planning Commission	AW 15-49	9,000	2,500 Men 15-59	AIDS, CA, MA, MM
Uganda	Mar-Aug 1995	Statistics Department, Ministry of Finance and Economic Planning	AW 15-49	7,070	1,996 Men 15-54	AIDS, CA, MA, MM, SAI
Uganda (In-depth)	Oct-Jan 1995/96	Institute of Statistics and Applied Economics, Makerere University	AW 20-44	1,750	1,356 Partners	Negotiating reproductive outcomes
Zambia	Jul-Nov 1996	Central Statistics Office	AW 15-49	8,000	2,500 Men 15-59	AIDS, CA, MA, MM
Zimbabwe	Jul-Nov 1994	Central Statistical Office	AW 15-49	6,128	2,141 Men 15-54	AIDS, CA, MA, MM, PC, SAI
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, WS
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,466 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,461		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI

DHS-III						
Egypt	Nov-Jan 1995/96	National Population Council	EMW 15-49	14,779		CA, FC, MA, WS
Morocco (Panel)	Apr-May 1995	Ministère de la Santé Publique	AW 15-49	4,753		SAI
ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,884		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		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, NFPCB/MOH	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
DHS-III						
Bangladesh	Nov-Mar 1993/94	Mitra & Associates/NIPORT	EMW 10-49	9,640	3,284 Husbands	PC, SAI, SM
Indonesia	Jul-Nov 1994	Central Bureau of Statistics/ NFPCB/MOH	EMW 15-49	28,168		MM, PC, SAI, SM
Kazakstan	May-Aug 1995	Institute of Nutrition, National Academy of Sciences	AW 15-49	3,771		CA, MA
Nepal	Jan-Jun 1996	Ministry of Health/New ERA	EMW 15-49	8,429		CA, MA, MM
Philippines	Apr-Jun 1993	National Statistics Office	AW 15-49	15,029		MM, SAI
Turkey	Aug-Oct 1993	General Directorate of MCH/FP Ministry of Health	EMW <50	6,519		CA, MA
Uzbekistan	Jun-Sep 1996	Research Institute of Obstetrics and Gynecology	AW 15-49	4,000		CA, MA
LATIN AMERICA/CARIBBEAN						
DHS-I						
Bolivia	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, S, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, S, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		CA, NFP, S, SAI, family planning communication
Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		S, SAI
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment

El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		CA, S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		CA, S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar, Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment, cost of family planning
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI
DHS-III						
Bolivia	Nov-May 1993/94	Instituto Nacional de Estadística	AW 15-49	8,603[b]		AIDS, CA, CD, MA, MM, S, SAI
Brazil	Mar-Jun 1996	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	16,500	3,000 Men 15-59	AIDS, CA, MA, MM, PC, S
Colombia	Mar-Jun 1995	PROFAMILIA	AW 15-49	11,140		AIDS, CA, MA, PC
Dominican Republic	Aug-Oct 1996	CESDEM/PROFAMILIA	AW 15-49	8,500	2,000 Men 15-55	CA, MA
Guatemala	Jun-Dec 1995	Instituto Nacional de Estadística	AW 15-49	12,403		AIDS, CA, MA, MM, S
Haiti	Jul-Jan 1994/95	Institut Haitien de l'Enfance	AW 15-49	5,356	1,610 Men 15-59	AIDS, CA, CD, MA, SAI
Peru	Aug-Nov 1996	Instituto Nacional de Estadística e Informática	AW 15-49	33,000	2,500 Men 15-59	CA, MA, MM

[a] No health or birth history section in questionnaire.
[b] Household questionnaire was administered in 26,144 households.

AIDS acquired immune deficiency syndrome
AW all women
CA child anthropometry
CD causes of death (verbal reports of symptoms)
CMW currently married women
EMW ever-married women
FC female circumcision
M migration
MA maternal anthropometry
MM maternal mortality
NFP natural family planning
PC pill compliance
S sterilization
SAI service availability information
SM social marketing
TBH truncated birth history
VC value of children
WE women's employment
WS women's status