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Accuracy of DHS-II Demographic Data: Gains and Losses in Comparison with Earlier Surveys

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Introduction

From its inception, the Demographic and Health Surveys (DHS) Program has emphasized the collection of accurate data on demographic events and indicators. During its three phases over the last decade, the scope of data collection has increased tremendously. Beginning with a preexisting substantial questionnaire based on the World Fertility Survey (WFS) that included a full birth history, a contraceptive history, and many other topics, a great expansion of the survey instruments has occurred. These additions include large numbers of questions for young children, anthropometric measurements of mothers and young children, new and expanded sections on women's work and occupation, reproductive health, AIDS, substantial increases in the number of questions on the household schedule, the addition of sizeable questionnaire modules such as maternal mortality, separate surveys of men, etc. Moreover, given the desire to satisfy needs for data at lower levels, sample sizes have increased in some countries up to fourfold. These expansions have placed increased burdens on interviewers, respondents, and training and supervisory staff—burdens which may affect the accuracy of the demographic data collected by the surveys.

The purpose of this paper is to examine the accuracy of two basic demographic measures, current fertility rates and current infant mortality rates, as measured in the second round of DHS surveys (DHS-II). The accuracy of these measures can be affected by such phenomena as distortion of women's ages at the boundaries of eligibility for the individual interview, respondents' knowledge of dates of vital events, and interviewers' motivations to either do a good job or to ease their interviewing loads. Improvements in questionnaire design and survey design can enhance the quality of data collected. Data from DHS-II countries are compared to data collected in the earlier WFS and DHS-I programs in an effort to measure any improvements in the probable accuracy of demographic measures, as well as to detect any problem areas where quality may have deteriorated, or not changed.

This paper draws heavily on prior work by Rutstein (1985a) concerning the quality of age reporting in the WFS; by Rutstein and Bicego (1990) on the same topic for DHS-I surveys; by Arnold (1990) on the quality of DHS-I birth history data and displacement of birth dates; and by Rutstein (1983, 1984 and 1985b) and Sullivan, Bicego and Rutstein (1990) on the quality of WFS and DHS-I mortality data, respectively.

Eligibility for Interview

Both the WFS and DHS programs have employed national probability samples of dwellings or households. The samples are generally selected in two stages. The first stage involves selecting geographical units with probability proportional to estimated size (often census enumeration areas). All of the households (or dwellings) in the selected areas are then listed, and the appropriate number of households is selected from each unit by applying a selection interval which gives each household a finite and known probability of inclusion in the sample. After the selected households have been identified, a list is made of all persons who are usual members of the household, as well as all current visitors. From a responsible adult in each household, information is obtained on the age and sex of each person and whether or not he/she spent the previous night in the dwelling. This information is then used to determine eligibility for the individual interview.

In most WFS and DHS (-I and -II) surveys, women are eligible for the survey if they are between the ages of 15 and 49 and have slept in the dwelling during the previous night (de facto residence). However, there are several exceptions to this rule: in some countries, a de jure residence standard is used; in others, the lower age limit is 20 rather than 15, or the upper limit is 44 rather than 49. The most general exception has been the use of an ever-married criterion of eligibility by countries in the Asia/Near East/North Africa region.

Since, in all surveys, age is the principal criterion used to determine eligibility for the women's individual interview, it is important to assess the quality of age reporting in connection with the household interview. Earlier studies of WFS and DHS-I surveys have indicated that age misreporting occurs more frequently for age groups at the boundaries of eligibility. The most probable explanation is that when interviewers are responsible for both the household and individual questionnaires, those interviewers who want to reduce their workloads may push women out of the eligible age range in order to reduce the number of women that have to be interviewed.

The temptation is undoubtedly greater to misreport the ages of women who are near the upper limit of age eligibility than of those near the lower limit. Older women, who generally have less education, often do not know their exact ages. Furthermore, they are likely to have had many children, some of whom will have died, which will complicate filling in the birth history.[1]

On the other hand, there can also be motives for excluding young teenagers. Often they are away from home when the interviewer calls; by misclassifying them as ages 13 or 14 years, the interviewer can avoid a callback. In addition, some interviewers may be reluctant to interview the often sexually inactive younger adolescent daughters of respondents whom they have already interviewed, especially if the parents are present.

Distortions at the Boundaries of Age Eligibility

There are several ways to detect age misreporting. The approach used here is to compare the age and sex structure of the household population at the two extremes of eligibility for the individual questionnaire. Looking at the age ratios of women, if young women are pushed out of the eligible age range into ages 12-14, there will be too many 10-14 year-olds in comparison with 15-19 year-olds. The age ratio at 10-14 is calculated as the number of 10-14 year-old girls divided by one-half the sum of 5-9 year-olds plus 15-19 year-olds. Similarly, the ratio at 15-19 is the number of 15-19 year-old girls divided by one-half the sum of 10-14 year-olds plus 20-24 year-olds. A high age ratio at 10-14 in conjunction with a low ratio at 15-19 is very suggestive of displacement. Likewise, a high age ratio among women at 50-54 in conjunction with a low ratio at 45-49 is indicative of displacement.

If a difference in age ratios of 10 points or more between adjacent age groups is taken as a criterion for displacement, then there is not much displacement at the lower boundary of age eligibility for the WFS (see Table 1). Apart from sub-Saharan Africa, the DHS-I and DHS-II surveys fared about as well as the corresponding WFS surveys. However, there is an indication of substantial displacement at the lower boundary for the sub-Saharan surveys in both DHS-I and DHS-II.

At the upper boundary of age eligibility, there has been substantial displacement from the 45-49 age group into the 50-54 age group in all three survey programs, and in each case, the problem has been most serious in the sub-Saharan region, with differences of 50 or more points. If anything, the amount of displacement has increased over time in this region. In the other two regions (Asia/Near East/North Africa and Latin America/Caribbean), there is no clear trend, but displacement clearly persists.

A complementary approach to examining displacement, though not as discriminating, is to look at the sex ratios of the four age groups defining the boundaries of eligibility. A high sex ratio (males divided by females times 100) at ages just within the bounds of eligibility coupled with a low sex ratio at ages just outside the bounds of eligibility would be suggestive of displacement. The sex ratios presented in Table 1 tend to confirm the

[1]An additional impetus for misclassification comes from the tendency to report age on preferred digits since age 50 contains the two most preferred digits.

conclusions drawn from the age ratios of women. At the lower bound of eligibility, displacement is evident for sub-Saharan Africa in both DHS-I and DHS-II. At the upper bound of eligibility, it is evident for all three regions in all three survey programs.

Table 1 Indicators of the quality of age reporting in the household questionnaire, World Fertility Survey (WFS) and Demographic and Health Surveys (DHS), 1974-1993

	Age ratio among women				Sex ratios			
Survey and region	10-14	15-19	45-49	50-54	10-14	15-19	45-49	50-54
WFS Surveys								
Sub-Saharan Africa	93	93	82	137	105	96	110	76
Asia/Near East/North Africa	103	101	94	112	106	98	106	96
Latin America/Caribbean	107	99	94	126	98	99	101	85
DHS-I Surveys								
Sub-Saharan Africa	105	86	82	146	97	106	109	65
Asia/Near East/North Africa	102	102	89	123	103	99	104	84
Latin America/Caribbean	102	99	87	124	102	100	105	89
DHS-II Surveys								
Sub-Saharan Africa	108	88	72	144	96	105	103	72
Asia/Near East/North Africa	103	99	89	119	108	100	108	86
Latin America/Caribbean	105	100	90	112	101	93	96	88

Note: For those countries where the limiting age groups for eligibility were other than 15-19 and 45-49, the appropriate ratios have been substituted. Figures are unweighted means of ratios for countries in each region.

Distortions in Reporting De Facto Status

As stated previously, in most WFS and DHS surveys, women who have slept in the sample dwelling the night prior to the interviewer's visit are eligible for interview (de facto criterion). In the latter stages of the WFS program, a suspicion arose that one of the causes of persistent shortfalls in the number of eligible women could be the misclassification by interviewers of otherwise eligible women as having "slept away from home" the night prior to the visit (Marckwardt, 1984). Theoretically, the number of usual residents who sleep away from home should be nearly offset by the number of visitors to the household. This theme was investigated by Rutstein and Bicego (1990) for DHS-I surveys. They found a net loss of potential respondents for 18 of 19 surveys which use a de facto criterion, ranging from 1 percent for some Latin American countries to over 10 percent for one sub-Saharan country.

As a result of this finding, a change in field procedures was adopted for the DHS-II program and continues presently for the DHS-III program. The change was simply to define as eligible all women who slept in the household the night prior to the interviewer's visit *as well as* usual residents who did not spend the night there. For purposes of tabulation, the de facto criterion was retained to eliminate possible double-counting biases; but interviewers were unaware of this. The purpose of this change, of course, was to reduce the temptation for interviewers to misclassify women in order to lighten their workloads.

As illustrated in Table 2, the payoff has been remarkable in the four countries where it is possible to compare results from a DHS-I survey with a DHS-II or DHS-III survey. The probable net loss of respondents (column

C) which in these countries ranged from 2 percent to 8 percent for DHS-I, dropped to a range of 0 percent to under 3 percent for the latter survey. This is clearly a case where a simple change in procedures can lead to improved survey data.

Table 2 Improvements in the reporting of household de facto status, Demographic and Health Surveys, 1986-1993

Country	Percent of resident women age 15-49 who slept outside the dwelling the night before the household interview	Ratio of overnight visitors to residents[1] for women 15-49	Estimated percentage of resident women with misrecorded overnight presence[2] (Column 1-Column 2)
Ghana (1988)	11.2	3.0	8.2
Ghana (1993)	4.5	1.9	2.6
Senegal (1986)	10.3	4.0	6.3
Senegal (1992/93)	6.6	3.7	2.9
Morocco (1987)	6.6	3.6	3.0
Morocco (1992)	3.2	1.7	1.5
Dominican Republic (1986)	5.2	3.4	1.8
Dominican Republic (1991)	4.8	4.8	0.0

[1]The ratio of overnight visitors to residents, expressed as a percentage.

[2]The misrecording of "sleeping away" status indicates those women who were excluded (DHS-I) or would have been excluded (DHS-II and DHS-III) from interview eligibility. This estimate results from the percentage of resident women sleeping away (Column 1) minus the percentage of visiting women sleeping in the household (Column 2).

Probable Effects on the Measurement of Vital Rates

What are the probable effects of misreporting of ages at the boundaries of eligibility or of misreporting the overnight presence of women on the measurement of vital rates? From a theoretical standpoint, one would assume that the effect of displacement at the boundaries of age eligibility would be quite small, since fertility levels for all-women samples at ages 15-19 and 45-49 are generally low. And since, as shown earlier, displacement is much worse at the upper age boundary than at the lower boundary, and because fertility is so low for the 45-49 year age group, the probable effect would be almost negligible. With respect to the misreporting of "de facto" status, the possible consequences are less predictable and potentially more serious, since all age groups are about equally affected (Rutstein and Bicego, 1990: Table 2.4).

Based on DHS-I data, Rutstein and Bicego (1990) carried out simulations to estimate the effect of lower boundary, upper boundary, and "sleeping away" exclusions on the total fertility rate and the under-five mortality rate. Only under the most extreme scenarios of combined age and "sleeping away" exclusions were the results noteworthy, and even then only in some sub-Saharan countries. "Noteworthy " results are defined as under- or overestimations by at most 3 to 5 percent which, according to sampling error tabulations (Curtis, 1995; Lê, forthcoming), are well within the relative standard errors of fertility and mortality rates. More importantly, from the standpoint of this paper, the simulated effects of the "sleeping away" exclusions were 2 to 5 times greater than those of the age exclusions.

The significance of the simulations just described is that the gains made in DHS-II in the reporting of "de facto" status (i.e., in reducing "sleeping away" exclusions) probably far outweigh the effects of increasing displacement

at the borders of age eligibility. In this respect, vital rates calculated from DHS-II surveys are undoubtedly less subject to bias than those calculated from DHS-I surveys or WFS surveys.

Dates of Birth of Children

The quality of data collected in the birth history section of the individual interview is of enormous importance for the calculation of levels and trends of fertility and infant and child mortality. At the start of the World Fertility Survey Program back in the early 1970s, many experts felt that it would be impossible to collect data of sufficient reliability in developing countries to merit a birth history approach. They pushed for the use of simple Brass-type questions to measure parity and fertility, and to expand average proposed sample sizes from 5,000 to 20,000 women. Perhaps one of the most important legacies of the WFS program was the demonstration that reliable data on fertility and mortality can be collected through use of a birth history in surveys in developing countries, including eight sub-Saharan nations. As a result, and after having experimented with some alternatives, the DHS program chose to proceed with the collection of full birth histories.

Knowledge of Dates

One of the ways of evaluating the accuracy of information on children's birth dates is to examine how completely these dates were reported in the birth histories, and how many birth date responses were missing information that had to be imputed. In the WFS and DHS surveys, when complete information on month and year of birth is not reported, the dates are assigned by imputation. In this process, first a logical range of possible values is constructed for each birth, and then a value is randomly assigned to produce a uniform distribution within that range. While it is assumed that the imputation process introduces no bias into the distribution of births over time, it is obviously preferable when respondents are able to report both the month and year of birth.

How has the completeness of information provided by respondents on the birth dates of their children varied over time? Table 3 displays the percentage of births for which both month and year of birth were provided by region for WFS, DHS-I and DHS-II. Details for each DHS-II survey are provided in Appendix Tables 1, 2, and 3.

Table 3 Completeness of date of birth reporting in the birth history, World Fertility Survey (WFS) and Demographic and Health Surveys (DHS), 1974-1993

	Percentage of births for which month and year of birth were given		
Region	WFS	DHS-I	DHS-II
Sub-Saharan Africa	54	79	77
Asia/Near East/North Africa	65	77	81
Latin America/Caribbean	92	97	98

Note: Figures are unweighted means of percentages for countries in each region.

Reporting of birth dates has clearly improved in all regions, most likely as a consequence of the rising levels of female education. An increase in documentary recording of birth dates on health cards may be another

contributing factor.[2] The gains in completeness are particularly notable for sub-Saharan Africa. (The slight dip for DHS-II is a result of the particular mix of countries participating in the program, and not a reversal of the trend.)

Distortion at the Five-year Window

The DHS questionnaire contains many questions in Section 4 on fertility planning, health, and breastfeeding that are asked only about children who were born after a fixed cutoff date, usually January of the fifth year before the year of interview. The number of such questions nearly doubled in DHS-II in comparison with DHS-I. Interviewers wanting to decrease their workload may be inclined to change the birth dates of selected children so that the children will not be included in that section of the questionnaire. When such displacement occurs, various estimates of fertility and mortality may be biased.

Arnold (1990) reviewed the amount of displacement of births from the fifth year prior to the survey to the sixth year that occurred in DHS-I surveys. He found the amount of displacement to be highest in sub-Saharan countries, somewhat lower in North African and Asian countries, and to be least in the Latin American and Caribbean countries. In all three regions, the amount of displacement of dead children was significantly greater than of living children. Given that the number of questions in Section 4 was to increase dramatically in DHS-II, Arnold predicted that the problem of displacement would increase.

Was Arnold's prediction correct? To find out, Table 4 presents a comparison of birth-year ratios centered on five and six years preceding the survey. The birth-year ratio is equal to the number of births x years before the survey divided by one-half of the sum of the number of births in years x-1 and x+1 prior to the survey. If there is no displacement, the ratios for both years five and six will be close to 100. If there is displacement backward in time (from year five to year six), the ratio for year five will be less than 100 while that for year six will be greater than 100. The difference between the ratios can be taken as an indication of the magnitude of the displacement. Appendix Tables 4 and 5 show the number of births by calendar year and birth-year ratios by survival status, respectively, for individual surveys. Appendix Table 6 compares the birth-year ratios for DHS-I and DHS-II for selected countries.

Table 4 shows that, overall, there was slightly more displacement in DHS-II than in DHS-I. The disparity between ratios centered on six and five years prior to the survey grew from 15 (109-94) to 24 (114-90) points. However, displacement did not increase in sub-Saharan Africa, nor did it in the Latin America/Caribbean region. Only in the Asia/Near East/North Africa region did the amount of displacement grow significantly; however, this increase was almost entirely the result of the inclusion of Pakistan and Yemen in the set of DHS-II surveys in the region. Once again, as in DHS-I, displacement was greater for dead children than for living children.

One may well ask why the displacement was not even greater, given the growth in the number of questions in Section 4 of the questionnaire. One answer could be that the burden imposed by questions pertaining to under-five children in the DHS-I Survey was already sufficient to induce certain interviewers to cheat when estimating or recording children's ages. As a result, the additional burden in the DHS-II Survey did not cause additional interviewers to do so.

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[2]Complete reporting does not necessarily mean accurate reporting. Indeed some of the difference between WFS and DHS completeness is due to the insistence in the DHS that interviewers should get month and year of birth whenever possible, estimating in the field if necessary. In the WFS, interviewers were allowed to note the number of years ago that the birth occurred if the birth date was unknown.

Table 4 Birth year ratios, Demographic and Health Surveys, 1974-1993

ALL CHILDREN				
	Centered on five years		Centered on six years	
Region	DHS-I	DHS-II	DHS-I	DHS-II
Sub-Saharan Africa	87	87	120	117
Asia/Near East/North Africa	94	88	105	116
Latin America/Caribbean	97	98	104	105
All regions	94	90	109	114
CENTERED ON FIVE YEARS				
	Dead children		Living children	
Region	DHS-I	DHS-II	DHS-I	DHS-II
Sub-Saharan Africa	81	78	89	89
Asia/Near East/North Africa	87	76	95	88
Latin America/Caribbean	79	90	99	99
All regions	85	80	95	91

Note: Figures are unweighted means of ratios for countries in each region.

Another more charitable explanation may be the increased attention being paid to the problem by DHS country monitors, and new procedures set in place in DHS-II to counter the problem. One of these procedures involved a reinterview with the household questionnaire by a supervisor at two households in each cluster. The supervisor was to check for displacement of both women at the borders of eligibility (15 and 49 years) and of children at ages 4 to 6 years. Interviewers were made aware of these reinterviews and of their purpose. Another procedure was to run "field-check" tables as data came in from the field. These tables were specifically designed to check for displacement and heaping. Interviewers and supervisors were made aware of the results during fieldwork. This strategy appears to have had dividends in several countries. Even further steps are being taken in the DHS-III round of surveys. In tabulations not presented here, it is shown that the displacement evident in the birth history is also manifested in the ages of children obtained during the listing of household members. In DHS-III, the household schedule interview and the individual interview are being done by different interviewers since presumably the household schedule interviewer has no incentive to displace children. The household listing can then be used as an immediate check on the recording of birth dates during the individual interview, at least for children living at home.

Probable Effects of Displacement of Birth Dates

The probable effects of displacement of birth dates on demographic estimates depend on the magnitude of the displacement, the timing of the survey, and the period or periods for which estimates are made. The problem will obviously be less serious if births are being moved backward in time by a few months rather than a whole year.

The effects will also be less serious for surveys conducted near the end of a year than for those carried out early in the year (see Arnold, 1990: 93). In DHS surveys (as in the WFS), the practice has been to use a three-year reference period for the estimation of current fertility, and five-year reference periods for the presentation of trends.

The three-year total fertility rate should be virtually unaffected by birth displacement since the displaced births are from children born more than three years ago. On the other hand, displacement could have the effect of slightly underestimating the rate for the 0-4 year period prior to the survey and slightly overestimating the 5-9 year rate, thereby somewhat overstating recent fertility decline.[3] With respect to infant and child mortality rates, five-year periods are used to study trends, and a 10-year reference period is used to study differentials. As with fertility, displacement of the type discussed here will bring about a slight overstatement of recent mortality declines, and a slight underestimate of mortality for the most recent 0-4 year period.[4]

Omission versus Displacement

The same motivation that drives interviewers to displace children out of the reference period for Section 4 of the questionnaire could also tempt them to omit a recent birth altogether. The consequences would be much more serious. While it is fairly easy to detect displacement and to adjust the reporting periods of vital rates accordingly, there is no way to salvage the complete omission of a birth in the five years preceding the year of interview. Is there any evidence of omission of births in DHS-II surveys?

Figure 1 displays a typical curvilinear appearance of the number of annual births plotted against the sequential calendar year prior to the year of the survey under three circumstances: no observable evidence for displacement or omission, illustrated by Colombia; evidence for displacement but not omission, illustrated by Nigeria and Burkina Faso; and evidence for probable omission, illustrated by Indonesia. Displacement causes a peak at the sixth year, followed by an immediate return to the average number of annual births. Omission is evidenced by a sudden drop at year five before the survey but no recovery in the nearer years. Although these matters are highly subjective, the authors' opinion is that among the 25 DHS-II surveys, three show evidence of large displacement (Kenya, Nigeria, and Burkina Faso), nine show evidence of substantial displacement (Nigeria, Sudan, Madagascar, Malawi, the Dominican Republic, Cameroon, Senegal, and Bolivia), four show evidence of moderate displacement (Namibia, Peru, Zambia, and Egypt), six show evidence of little or no displacement (Jordan, Rwanda, Colombia, Morocco, Paraguay, and Northeast Brazil), and three show evidence of substantial omission (Pakistan, Yemen and Indonesia).

Figure 2 displays the curves of the three surveys where omission is suspected. For Indonesia, the mean number of births recorded for years 1 to 5 prior to the survey was 2,945, a 14-percent drop from the 3,416 recorded for years 6 to 10. For Pakistan, the mean number of births for years 1 to 5 was 1,268, a 24-percent drop from the 1,668 for years 6 to 10.[5] The drop in Yemen for the most recent period was intermediate, a fall of 19

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[3]Because these rates span a relatively large number of years, the effect of displacement is diluted. See Arnold (1990).

[4]The same dilution of effect occurs for mortality rates as for fertility rates. See Sullivan et al. (1990).

[5]After the main DHS survey, Pakistan had a reinterview survey which did not include a specific section for children under five. Both surveys show evidence of omission of living children, but less so in the reinterview survey, which also did not show evidence of transference of birth. For dead children, there is evidence of transference in both surveys, but less or no omission in the reinterview survey. See Curtis and Arnold (1994). Earlier surveys in Pakistan also show omission of young children (Retherford and Alam, 1985).

Figure 1: Number of Births by Calendar Year Prior to Survey for Selected DHS-II Surveys

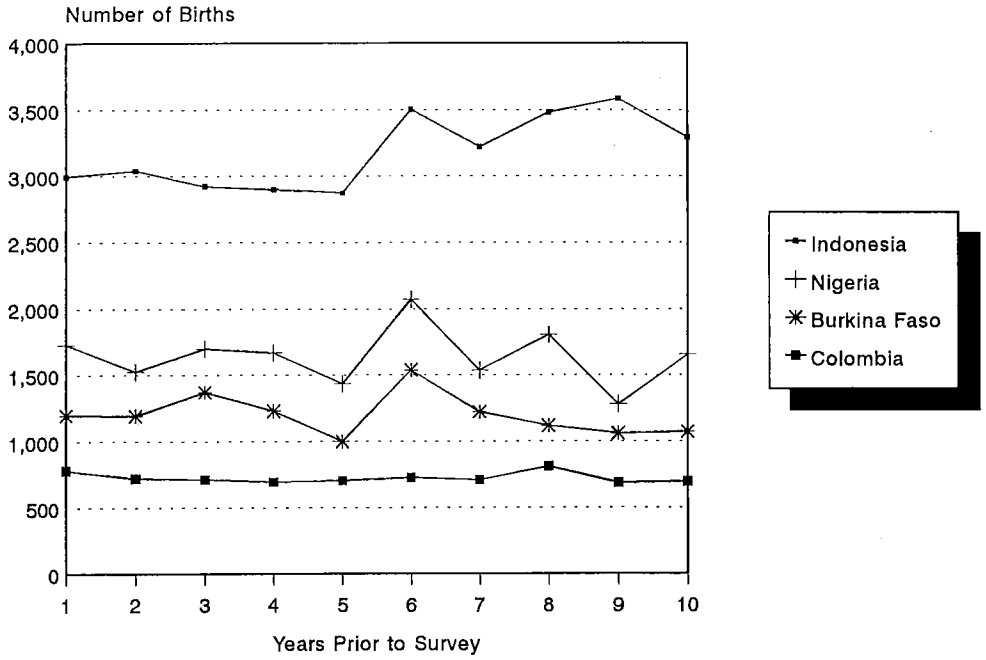
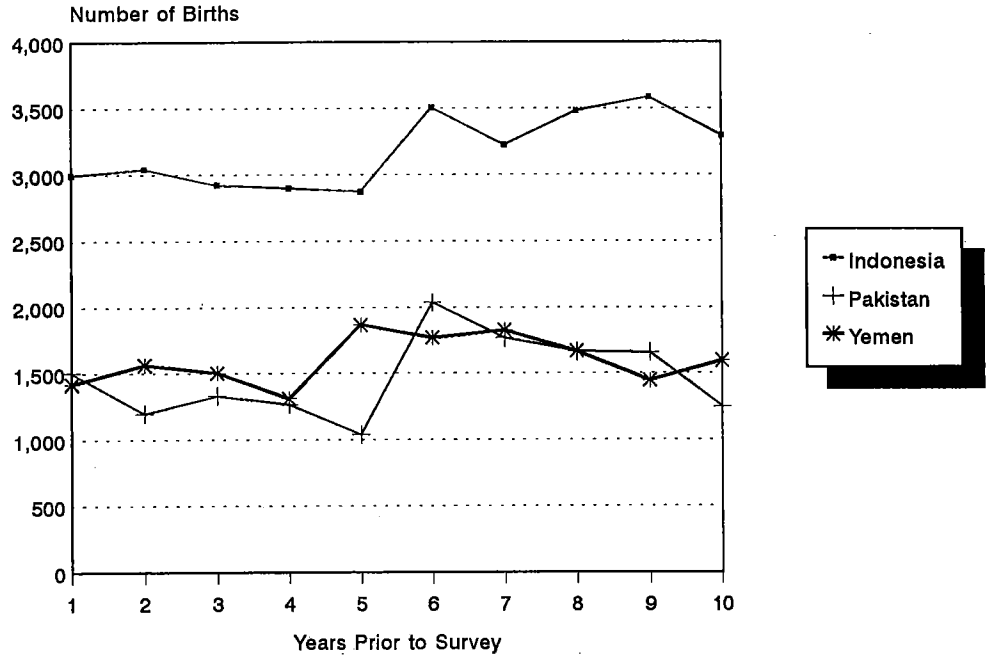


Figure 2: Number of Births by Calendar Year Prior to Survey for Selected DHS-II Surveys



percent.[6] Because of the apparent omission of recent births in the surveys of these three countries, a great deal of caution must be exercised in interpreting the evolution of total fertility rates. To the extent that the omissions are selective of dead children, the evolution of child mortality must also be suspect. Appendix Table 7 gives information on sex ratio at birth by survival status for individual countries which can also be used to assess selective omission.

The Calculation of Infant Mortality Rates

One of the principal advantages of utilizing a full birth history in demographic surveys is the opportunity it provides for the direct measurement of rates and trends of infant and child mortality. During most of the period in which the WFS was carried out, direct measurement was spurned, and most country reports presented only indirect estimates of mortality. It was only near the end of the WFS program, thanks in large part to the comparative work of Rutstein and his colleagues, Hobcraft and McDonald, that the utility and robustness of direct estimates came to be fully appreciated.[7] Since the inception of the DHS program, all country reports routinely contain a chapter on infant and child mortality presenting direct estimates of trends and differentials.

Perhaps the most serious problem with a direct measure of infant mortality, and the source of the original skepticism in this respect, is the tendency of respondents to round the age of death to 12 months. Since infant deaths are tallied only for those dying during months 0-11 following birth, any rounding up to the 12th month will cause infant mortality to be underestimated and early child mortality to be overestimated.[8] However, under-five mortality rates will be unaffected. An index of heaping can be calculated with the numerator equal to 4 times the deaths recorded at 12 months, and the denominator consisting of deaths recorded at months 10, 11, 13 and 14. Ideally, this index, called the "age ratio," should equal unity. In fact, in many surveys its value exceeds 10, and even exceeds 20 in some cases. Among DHS-I surveys, the age ratio exceeded 20 in four of the 10 sub-Saharan surveys. This posed the following problem for analysts when preparing the mortality chapter for most DHS-I reports: should any adjustment or smoothing of the distribution be made? The responses varied. In some reports no adjustment was made, while in others both unadjusted and adjusted estimates were prepared, and in others the problem was relegated to an appendix.

To alleviate this problem, a change was made to the birth history in the design of the DHS-II core questionnaire. A series of interviewer check boxes was introduced at the bottom of the birth history instructing the interviewer to go back and check the following: for each birth, the year of birth is recorded; for each living child, current age is recorded; for each dead child, age at death is recorded; and for age at death 12 months, *probe to determine exact number of months*. Both interviewers and supervisors were instructed that a response of 12 months was not to be accepted at face value—probing was needed to determine whether the child died before or after his/her first birthday.

Did this questionnaire design change have an impact? Table 5 shows quite clearly that it did. The impact is particularly noticeable for sub-Saharan countries where the amount of heaping on 12 months was cut by 75 percent. Significant gains were made in the other regions as well. Figures 3 and 4 illustrate the improvement in

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[6]In Yemen, interviewers were asked to collect information on children born in the last five years, rather than including children through the fifth calendar year as in other DHS surveys. Consequently, the boundary for Yemen is between years 4 and 5 rather than years 5 and 6 prior to the survey.

[7]See Rutstein (1983, 1984, and 1985b) and Hobcraft, McDonald and Rutstein (1983 and 1984).

[8]To the extent that the heaping on 12 months is due to rounding down of age at death, which is a clear possibility given the nature of reporting units, the infant and early child mortality rates will be unaffected by the heaping.

Senegal and Morocco, respectively between DHS-I and DHS-II. In Morocco, heaping of deaths at both age 12 and 18 months decreased, while in Senegal only the heaping on 12 months decreased, clearly a result of the new probe. The lessening of the heaping of deaths is an excellent illustration of how innovations in questionnaire design can help to improve the quality of data collected. For a more extensive evaluation of the quality of data for estimating infant and child mortality rates, see Curtis (1995).

Table 5 Heaping of age at death of children at 12 months, World Fertility Survey (WFS) and Demographic and Health Surveys (DHS), 1974-1993

	Age ratios[1] at 12 months for age at death		
	WFS	DHS-I	DHS-II
Sub-Saharan Africa	10.0	19.1	4.8
Asia/Near East/North Africa	14.2	14.7	9.2
Latin America/Caribbean	U[2]	7.3	3.4

Note: Figures are unweighted means of ratios for countries in each region.
[1]The age ratio is calculated as $4 \times D_{12} / (D_{10} + D_{11} + D_{13} + D_{14})$, where D_x is the number of deaths at x months of age.
[2]Latin American countries in the WFS utilized a one-digit grouping of age at death. Hence, the amount of heaping in responses cannot be measured.
U = Unknown

Figure 3: Heaping of Age at Death in Senegal DHS-I vs. DHS-II

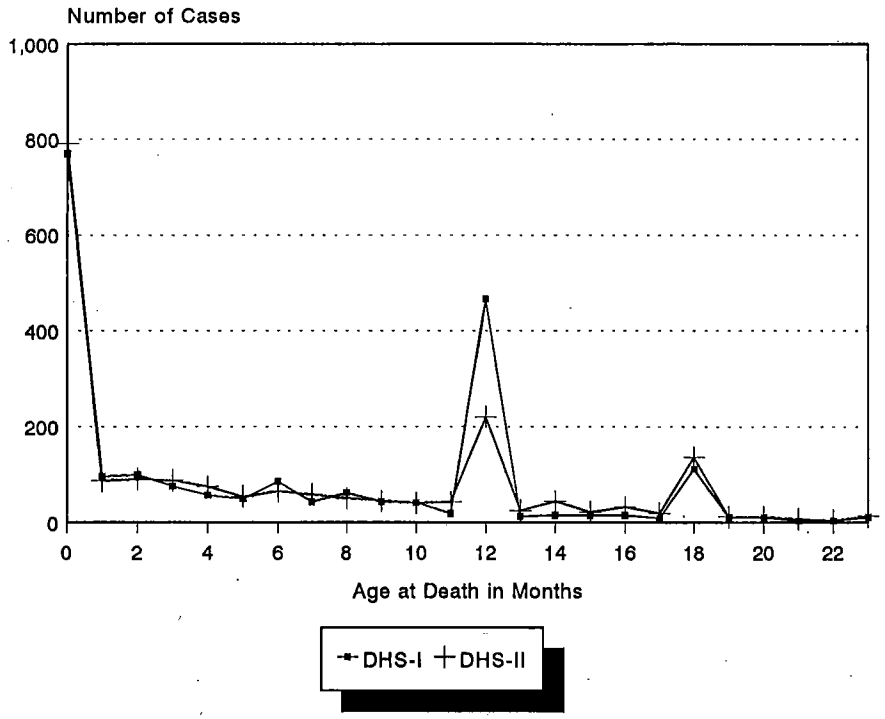

Figure 4: Heaping of Age at Death in Morocco DHS-I vs. DHS-II

Conclusions

An overall assessment would clearly be on the side of gains rather than losses in the accuracy of DHS-II demographic data with respect to earlier surveys. Two of the most intractable problems, the age displacement of women at the borders of eligibility and the displacement of birth dates of children just outside the window of eligibility, remain unsolved. These issues are being attacked with new initiatives in DHS-III that separate the collection of age data for household members from the collection of individual interview data by using different interviewers. On the positive side, a change in field procedures has substantially cut the number of women excluded from interview because they were mistakenly classified as having "slept away" from home. The ability of respondents to provide full birth dates for their children has improved over time. Finally, a simple alteration to the questionnaire has dramatically cut the amount of heaping at 12 months in the reported age at death of children.

A cautionary note: in several places in this report, it has been noted that the amount of displacement of both women's and children's birth dates is greater in sub-Saharan Africa. This comparison should not be interpreted that sub-Saharan interviewers are less motivated than their counterparts in other regions, but rather they are forced to make more estimation of ages and birth dates, providing them with greater opportunities to lessen workloads.

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Appendix

Table A.1 Percent distribution of completeness of reporting in birth history, Demographic and Health Surveys, 1989-1993

Region and country	Year, month, and age	Year and age	Year only	Age only	Other partial information	No information given	Total
Sub-Saharan Africa							
Burkina Faso	69.4	17.9	10.3	0.2	1.9	0.2	100.0
Cameroon	64.0	24.5	10.6	0.2	0.5	0.3	100.0
Kenya	96.2	2.4	0.8	0.3	--	0.3	100.0
Madagascar	76.6	0.2	7.2	1.3	12.8	1.8	100.0
Malawi	94.4	2.3	3.0	0.0	--	0.2	100.0
Namibia	93.2	0.1	0.7	0.0	1.7	4.2	100.0
Niger	54.6	1.7	16.5	0.1	27.0	0.1	100.0
Nigeria	81.9	0.5	5.9	0.0	11.6	0.1	100.0
Rwanda	90.2	4.0	4.0	--	0.1	1.7	100.0
Senegal	52.8	8.6	14.1	1.0	22.9	0.6	100.0
Sudan	53.8	2.8	1.2	4.2	37.9	0.2	100.0
Tanzania	77.0	16.1	6.2	0.1	--	0.5	100.0
Zambia	97.2	1.0	1.3	0.0	0.4	0.2	100.0
Near East/North Africa							
Egypt	84.3	9.5	6.1	0.0	--	0.1	100.0
Jordan	98.3	--	0.6	--	1.0	--	100.0
Morocco	96.5	2.4	0.8	0.0	0.3	--	100.0
Yemen	41.5	0.0	30.2	25.0	2.4	0.9	100.0
Asia							
Indonesia	77.6	15.6	6.8	--	--	0.1	100.0
Pakistan	90.6	6.3	2.1	0.2	0.7	0.1	100.0
Latin America/ Caribbean							
Bolivia	94.6	1.0	2.2	0.2	0.3	1.7	100.0
Brazil (NE)	96.6	1.2	1.5	0.0	0.1	0.6	100.0
Colombia	98.4	0.7	0.6	0.1	0.1	0.1	100.0
Dominican Republic	96.0	0.5	1.5	--	1.9	0.2	100.0
Paraguay	99.9	--	0.1	--	--	--	100.0
Peru	98.3	0.4	0.9	--	0.1	0.3	100.0

-- Less than 0.05 percent

Table A.2 Percentage of children with complete birth date information by years since birth and survival status, Demographic and Health Surveys, 1989-1993

	Years since birth					Survival status	
Region and country	0-4	5-9	10-14	15-19	20+	Alive	Dead
Sub-Saharan Africa							
Burkina Faso	86.2	67.0	61.8	60.5	56.3	73.9	54.4
Cameroon	83.2	63.4	57.1	53.4	44.2	69.5	38.1
Kenya	98.5	96.6	96.1	94.5	92.5	96.8	90.7
Madagascar	91.7	76.3	70.7	69.0	61.2	82.0	52.9
Malawi	98.4	95.8	93.9	92.2	87.1	96.7	88.2
Namibia	96.5	93.3	91.8	92.2	88.8	93.9	87.6
Niger	80.8	51.5	39.4	38.6	40.3	57.7	48.1
Nigeria	89.9	80.0	78.9	77.7	76.8	84.7	71.2
Rwanda	97.3	92.0	88.6	83.8	77.2	93.6	76.6
Senegal	82.7	50.3	40.7	37.0	30.3	59.7	23.9
Sudan	73.2	52.6	47.1	45.3	38.7	57.1	34.2
Tanzania	94.7	80.1	70.3	65.8	57.2	80.3	61.3
Zambia	98.9	98.0	97.4	96.2	93.0	98.2	92.3
Near East/North Africa							
Egypt	99.9	87.3	79.1	77.1	70.8	88.7	59.3
Jordan	100.0	98.9	98.4	97.4	94.9	98.9	88.3
Morocco	99.9	97.6	95.7	95.1	92.7	96.9	93.6
Yemen	74.8	32.5	26.5	26.6	28.4	44.4	28.0
Asia							
Indonesia	99.6	86.3	74.1	68.1	54.7	82.0	48.8
Pakistan	96.1	90.5	89.6	87.9	83.5	94.6	84.0
Latin America/ Caribbean							
Bolivia	98.5	96.4	94.6	91.8	85.5	98.5	75.1
Brazil (NE)	99.8	97.5	95.6	96.1	93.1	98.5	85.7
Colombia	100.0	99.1	98.3	98.0	96.2	99.1	87.1
Dominican Republic	100.0	97.8	95.2	93.4	91.2	97.4	80.7
Paraguay	100.0	99.9	99.9	100.0	99.5	100.0	98.1
Peru	100.0	99.0	98.1	97.2	95.9	99.4	89.5

Table A.3 Percentage of children with complete birth date information by place of residence and mother's educational level, Demographic and Health Surveys, 1989-1993

	Residence		Mother's educational level			
Region and country	Urban	Rural	None	Primary	Secondary	Higher
Sub-Saharan Africa						
Burkina Faso	75.0	68.4	68.4	74.0	95.0	*
Cameroon	73.0	58.8	41.3	87.6	97.5	*
Kenya	97.9	96.0	93.7	97.6	99.0	*
Madagascar	88.7	74.5	52.0	82.5	96.5	100.0
Malawi	NA	NA	92.7	96.5	99.5	*
Namibia	94.8	92.4	88.5	93.8	97.0	98.9
Niger	65.3	52.8	53.6	67.6	93.8	*
Nigeria	89.2	80.0	77.4	91.3	97.4	99.6
Rwanda	94.5	90.0	87.4	93.3	98.0	*
Senegal	71.3	43.4	47.2	80.4	94.5	*
Sudan	70.5	44.3	41.5	76.9	93.8	97.7
Tanzania	85.1	74.9	64.4	90.3	93.4	97.0
Zambia	98.6	96.0	92.7	98.4	99.3	100.0
Near East/North Africa						
Egypt	90.1	80.3	79.9	87.1	99.1	99.4
Jordan	98.7	97.3	96.3	99.2	99.7	99.8
Morocco	97.5	95.9	96.2	97.9	99.7	100.0
Yemen	51.4	39.2	39.7	64.4	86.2	*
Asia						
Indonesia	84.8	71.7	58.8	80.3	95.8	99.2
Pakistan	89.8	90.9	89.8	92.7	95.5	97.6
Latin America/ Caribbean						
Bolivia	97.1	92.2	89.6	95.7	99.2	99.7
Brazil (NE)	97.2	95.9	94.3	97.7	99.1	98.9
Colombia	98.8	97.8	96.3	98.5	98.9	100.0
Dominican Republic	97.0	94.5	91.1	95.5	99.6	99.2
Paraguay	99.9	99.9	99.2	99.9	100.0	100.0
Peru	98.8	97.2	94.4	98.4	99.6	100.0

NA = Not available

Note: An asterisk indicates that a figure is based on fewer than 50 unweighted cases and has been suppressed.

Table A.4 Number of births by calendar year preceding survey, Demographic and Health Surveys, 1989-1993

Region and country	Calendar year preceding survey									
	1	2	3	4	5	6	7	8	9	10
Sub-Saharan Africa										
Burkina Faso	1198	1194	1372	1230	1000	1538	1222	1118	1061	1074
Cameroon	719	661	667	729	621	728	674	625	625	512
Kenya	1410	1542	1274	1432	1222	1662	1098	1490	1239	1218
Madagascar	1207	1167	1085	1110	961	1124	993	1001	898	957
Malawi	940	887	859	856	800	968	864	892	774	814
Namibia	838	841	721	671	676	741	619	630	583	618
Niger	1504	1414	1422	1454	1274	1595	1462	1437	1213	1229
Nigeria	1730	1527	1700	1668	1434	2072	1536	1806	1279	1654
Rwanda	1153	1093	1161	1131	1211	1268	1160	1097	1018	989
Senegal	1060	1116	1133	1130	962	1202	1255	987	987	1020
Sudan	1228	1331	1376	1267	1217	1520	1388	1219	1231	1181
Tanzania	1766	1622	1504	1498	1375	1580	1393	1375	1194	1162
Zambia	1459	1300	1264	1094	1102	1217	1111	1049	985	1031
Near East/North Africa										
Egypt	1707	1694	1774	1964	1884	2008	1751	1766	1902	1817
Jordan	1654	1683	1664	1613	1631	1691	1550	1606	1516	1538
Morocco	1020	1070	984	1067	1082	1070	1063	1038	1070	1034
Yemen	1421	1564	1504	1312	1866	1768	1824	1667	1446	1594
Asia										
Indonesia	2995	3040	2921	2898	2871	3505	3220	3480	3584	3293
Pakistan	1505	1199	1332	1267	1038	2005	1766	1665	1657	1249
Latin America/ Caribbean										
Bolivia	1249	1172	1173	1122	1005	1230	1263	1169	1209	1093
Brazil (NE)	649	696	720	678	792	774	800	790	793	844
Colombia	777	730	716	694	706	726	712	810	688	701
Dominican Republic	872	788	735	725	667	771	651	693	658	711
Paraguay	795	815	820	758	785	789	805	758	706	711
Peru	1573	1691	1824	1750	1609	1762	1641	1727	1657	1598

Table A.5 Birth year ratios by survival status of the child, Demographic and Health Surveys, 1989-1993

Region and country	Centered on five years before survey			Centered on six years before survey		
		Survival status			Survival status	
	All children	Alive	Dead	All children	Alive	Dead
Sub-Saharan Africa						
Burkina Faso	72	74	66	138	131	165
Cameroon	85	87	75	112	110	125
Kenya	79	80	65	143	141	173
Madagascar	86	88	79	115	109	143
Malawi	88	93	71	116	106	152
Namibia	96	94	111	114	116	100
Niger	84	89	74	117	105	141
Nigeria	77	81	62	140	132	175
Rwanda	101	104	87	107	104	124
Senegal	83	84	73	108	105	126
Sudan	87	91	68	117	110	158
Tanzania	89	95	62	114	107	155
Zambia	95	96	94	110	108	117
Near East/North Africa						
Egypt	95	97	76	110	109	125
Jordan	99	100	68	106	106	121
Morocco	100	99	106	101	100	114
Yemen	78	77	83	121	123	109
Asia						
Indonesia	90	92	67	115	113	135
Pakistan	63	65	54	143	142	152
Latin America/Caribbean						
Bolivia	85	86	84	108	105	133
Brazil (NE)	109	112	88	97	95	119
Colombia	99	99	100	102	103	88
Dominican Republic	89	90	81	117	115	142
Paraguay	101	102	93	99	99	112
Peru	92	92	86	108	107	120

Note: The birth year ratio is equal to the number of births x years before the survey, divided by one-half the sum of births in year x-1 and year x+1. The critical years for most countries are five and six years prior to the survey year. Exceptions are Morocco at six and seven years, and Yemen at four and five years.

Table A.6 A comparison of birth year ratios, Demographic and Health Surveys, 1989-1993

Country and survey	Centered on five years before survey			Centered on six years before survey		
		Survival status			Survival status	
	All children	Alive	Dead	All children	Alive	Dead
Senegal						
DHS-I	84	85	78	120	118	128
DHS-II	83	84	73	108	105	126
Morocco						
DHS-I	92	91	96	105	105	109
DHS-II	100	99	106	101	100	114
Indonesia						
DHS-I	110	110	115	93	93	88
DHS-II	90	92	67	115	113	135
Colombia						
DHS-I	96	96	106	101	101	106
DHS-II	99	99	100	102	103	88
Dominican Republic						
DHS-I	100	103	72	93	90	123
DHS-II	89	90	81	117	115	142
Peru						
DHS-I	99	102	80	105	103	120
DHS-II	92	92	86	108	107	120

Note: The birth year ratio is equal to the number of births x years before the survey, divided by one-half the sum of births in year x-1 and year x+1. The critical years for most countries are five and six years prior to the survey year. An exception is Morocco (DHS-II) at six and seven years.

Table A.7 Sex ratio at birth by years since birth and survival status, Demographic and Health Surveys, 1989-1993

Region and country	All	Years since birth					Survival Status	
		0-4	5-9	10-14	15-19	20+	Alive	Dead
Sub-Saharan Africa								
Burkina Faso	105.2	102.9	105.4	104.7	107.6	109.2	103.0	113.0
Cameroon	103.0	102.1	100.3	100.8	101.1	117.0	100.9	113.7
Kenya	101.6	98.1	102.8	97.6	107.2	107.8	100.7	109.7
Madagascar	103.0	103.7	107.3	101.9	99.9	98.3	101.2	111.2
Malawi	100.3	101.8	103.7	89.6	103.6	105.7	98.7	104.9
Namibia	98.3	95.7	99.0	98.9	96.4	105.2	97.4	106.9
Niger	105.6	108.5	101.5	104.7	107.2	108.6	107.1	102.5
Nigeria	106.2	98.8	105.9	98.6	121.9	126.2	103.9	115.9
Rwanda	99.0	101.1	99.9	94.3	102.6	96.5	95.7	113.3
Senegal	101.1	94.6	103.5	101.3	103.6	108.2	99.0	110.6
Sudan	104.0	104.9	100.1	105.6	101.4	109.9	102.4	113.9
Tanzania	103.2	102.6	99.5	104.7	108.1	103.6	101.9	109.6
Zambia	98.5	100.3	95.5	97.1	98.7	102.4	97.8	102.3
Near East/North Africa								
Egypt	105.2	107.3	100.4	103.1	109.1	108.7	105.3	104.5
Jordan	108.2	104.0	105.9	111.2	113.2	110.0	108.6	101.5
Morocco	105.7	105.3	104.5	110.2	106.5	101.4	105.1	109.7
Yemen	107.2	105.6	103.5	115.7	101.9	112.5	105.2	117.0
Asia								
Indonesia	106.5	110.2	108.1	105.2	102.6	105.4	104.3	121.9
Pakistan	105.6	106.0	102.6	103.9	110.1	111.6	105.9	104.0
Latin America/Caribbean								
Bolivia	107.6	101.2	111.6	105.9	103.9	120.9	105.1	121.0
Brazil (NE)	106.6	105.6	114.9	99.2	102.3	112.3	101.1	145.8
Colombia	101.2	97.7	95.8	110.5	98.7	104.8	100.1	120.1
Dominican Republic	102.8	109.4	103.2	99.7	95.9	103.5	101.1	123.3
Paraguay	104.0	106.2	107.2	102.3	93.1	108.5	103.3	115.9
Peru	103.2	105.2	100.5	105.7	102.5	101.4	102.1	112.1

Table A.8 Percentage of women who had their first birth before age 20 by current age, Demographic and Health Surveys, 1989-1993

Region and country	Current age					
	20-24	25-29	30-34	35-39	40-44	45-49
Sub-Saharan Africa						
Burkina Faso	62.4	63.3	66.3	59.3	57.5	53.4
Cameroon	66.8	65.2	64.6	65.1	64.4	56.1
Kenya	58.4	67.5	69.5	67.5	64.6	54.1
Madagascar	52.9	53.3	60.0	57.3	60.0	61.1
Malawi	63.3	65.8	70.3	59.7	56.6	46.8
Namibia	41.6	38.9	44.5	39.6	37.9	28.0
Niger	75.0	74.1	73.1	65.8	62.5	59.5
Nigeria	53.5	53.9	57.4	49.1	49.1	48.7
Rwanda	24.6	27.9	27.4	31.3	35.5	43.5
Senegal	51.7	57.2	61.1	56.4	53.8	53.6
Sudan	26.2	36.3	44.8	53.6	60.5	52.8
Tanzania	56.8	56.4	65.6	66.8	65.3	60.1
Zambia	61.3	64.5	71.8	75.8	67.8	69.7
Near East/North Africa						
Egypt	28.7	37.0	40.5	38.9	40.1	46.1
Jordan	20.8	29.9	40.3	45.5	44.1	42.0
Morocco	19.2	23.4	30.1	34.5	39.2	45.5
Yemen	41.0	50.9	54.2	42.6	35.1	38.1
Asia						
Indonesia	36.3	46.2	50.1	50.7	51.4	49.5
Pakistan	30.5	42.1	41.7	38.2	37.5	32.9
Latin America/Caribbean						
Bolivia	37.1	44.4	41.5	37.5	33.6	37.7
Brazil (NE)	33.3	40.9	39.1	34.0	31.9	32.0
Colombia	30.5	30.8	33.1	28.9	36.6	36.9
Dominican Republic	33.1	37.2	40.9	46.8	51.4	53.0
Paraguay	37.1	35.8	33.7	31.2	34.4	35.4
Peru	26.9	33.1	36.0	36.0	36.0	35.7

Note: Table includes all women, regardless of marital status.

Table A.9 Mean number of children ever born by current age of mother, Demographic and Health Surveys, 1989-1993

Region and country	Current age						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Sub-Saharan Africa							
Burkina Faso	0.3	1.6	3.2	4.8	6.2	7.2	7.7
Cameroon	0.4	1.8	3.3	4.6	5.7	6.2	6.3
Kenya	0.3	1.6	3.5	5.0	6.5	7.4	7.6
Madagascar	0.3	1.5	2.9	4.6	5.9	6.5	7.2
Malawi	0.3	1.7	3.2	4.9	5.9	6.9	7.3
Namibia	0.2	1.0	2.1	3.4	4.6	5.6	5.8
Niger	0.4	2.1	3.8	5.3	6.5	7.1	8.0
Nigeria	0.3	1.4	3.0	4.6	5.5	6.3	6.8
Rwanda	0.1	0.8	2.4	4.2	5.8	7.5	8.1
Senegal	0.3	1.4	2.9	4.7	5.9	7.0	7.4
Sudan	0.1	0.8	2.2	4.1	6.0	7.0	7.5
Tanzania	0.3	1.4	2.9	4.4	5.8	6.9	6.9
Zambia	0.3	1.6	3.1	4.8	6.4	7.4	8.1
Near East/North Africa							
Egypt	0.1	0.9	2.4	3.7	4.7	5.5	6.0
Jordan	0.1	0.8	2.5	4.8	6.6	7.9	8.3
Morocco	0.1	0.6	1.6	3.3	4.6	6.0	7.1
Yemen	0.2	1.3	3.3	5.3	6.7	7.7	8.1
Asia							
Indonesia	0.1	0.8	2.0	3.1	4.0	4.6	5.1
Pakistan	0.2	1.0	2.6	4.3	5.5	6.3	6.4
Latin America/Caribbean							
Bolivia	0.2	1.1	2.6	3.7	4.5	5.4	5.9
Brazil (NE)	0.1	1.0	2.2	3.6	4.6	5.1	6.2
Colombia	0.1	0.8	1.6	2.6	3.1	4.1	5.5
Dominican Republic	0.2	1.0	2.1	2.9	3.9	4.5	5.7
Paraguay	0.2	1.0	2.2	3.2	4.2	5.1	5.4
Peru	0.1	0.8	1.9	3.0	4.1	4.9	5.4

Note: Table includes all women, regardless of marital status.

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