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Assessment of the Quality of Data in 41 WFS Surveys: A Comparative Approach

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The World Fertility Survey (WFS) is an international research programme whose purpose is to assess the current state of human fertility throughout the world. This is being done principally through promoting and supporting nationally representative, internationally comparable, and scientifically designed and conducted sample surveys of fertility behaviour in as many countries as possible.

The WFS is being undertaken, with the collaboration of the United Nations, by the International Statistical Institute in co-operation with the International Union for the Scientific Study of Population. Financial support is provided principally by the United Nations Fund for Population Activities and the United States Agency for International Development. Substantial support is also provided by the UK Overseas Development Administration.

For information on Country Reports, WFS publications, and WFS depository libraries, write to the Publications Office, International Statistical Institute, 428 Prinses Beatrixlaan, PO Box 950, 2270 AZ Voorburg, Netherlands. For information on the WFS generally, write to the Information Office, World Fertility Survey, International Statistical Institute, 35-37 Grosvenor Gardens, London SW1W 0BS, UK.

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L'EMF est entreprise, en collaboration avec les Nations Unies, par l'Institut International de Statistique, qui coopère avec l'Union internationale pour l'étude scientifique de la population. Le financement de ce programme est essentiellement assuré par le Fonds des Nations Unies pour les activités en matière de population et par l'Agence des Etats-Unis pour le développement international. Une contribution importante est aussi faite par le Département pour le développement des pays d'outre-mer du Royaume-Uni.

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La Encuesta Mundial de Fecundidad (EMF) es un programa internacional de investigación cuyo propósito es determinar el estado actual de la fecundidad humana en el mundo. Para lograr este objetivo, se están promoviendo y financiando encuestas de fecundidad por muestreo en el mayor número posible de países. Estas encuestas son diseñadas y realizadas científicamente, nacionalmente representativas y comparables a nivel internacional.

El proyecto está a cargo del Instituto Internacional de Estadística, contando con la colaboración de las Naciones Unidas y en cooperación con la Unión Internacional para el Estudio Científico de la Población. Es financiado principalmente por el Fondo de las Naciones Unidas para Actividades de Población y por la Agencia para el Desarrollo Internacional de los Estados Unidos. La Oficina Británica para el Desarrollo de Países Extranjeros proporciona también un gran apoyo financiero.

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1 Introduction

That the evaluation of data should be a required step preceding their use is a fundamental premise which few would question. This becomes even more necessary when the data are from retrospective surveys, in the less developed countries. Very early in its development, the World Fertility Survey (WFS) recognized this need, and commissioned research on the techniques of evaluating retrospective fertility surveys. Because this was the first time a large number of such surveys had been carried out in developing countries, knowledge of the particular problems that might arise, and of the techniques for detecting them, was limited. The very existence of this set of surveys, therefore, greatly stimulated the development of methods of evaluating data quality.

The WFS policy was to have an evaluation study done for each survey. Because of the time which was taken in preparing the basic illustrative reports on techniques of evaluation, however, a few early surveys were unable to carry out an evaluation study. In addition, the earlier evaluation reports varied greatly in their coverage even of the basic topics (age, fertility, nuptiality and infant mortality) because it took time for some degree of standardization in techniques and coverage to emerge. The evaluation workshops, six in all, with each covering 3–5 countries and the first taking place in 1979, were the principal mechanisms for trying out techniques and evantually selecting a battery of essential tests, developing a somewhat standard approach for evaluation reports. They were also the main means of ensuring that these evaluations were carried out, although a few were done independently by individual researchers. This report draws heavily upon the national evaluation reports, but also uses the results of the recent WFS cross-national summaries which are in press or unpublished manuscripts, since these contain uniform tables for all WFS surveys.

Two other comparative reports, which review WFS data quality generally, have been published. The first in 1980 (Chidambaram, Cleland and Verma) was a preliminary effort, looking for common types of error, drawing on the illustrative analyses of data quality, on existing evaluation reports and cross-national summary statistics, and covering some 19 countries. The second, published by the United Nations (1983), concentrated on fertility levels and trends, but also looked briefly at the other main demographic topics. The approach of this report was to carry out national-level evaluations, devoting 8–10 pages per country, and then to summarize these in a comparative chapter. This country-specific approach certainly has some advantages over the wholly comparative one taken here, and is complementary to this report. Again, however, coverage was limited to about half of WFS surveys, partly because of the availability of data tapes at the time the study was conducted. It is intended to expand it to cover all WFS countries.

Evaluations of data quality should include comparisons with external sources as well as internal consistency checking. External comparisons are needed both at the time of the survey, as a check on current or recent estimates, and over time, to evaluate the data on trends obtained from the retrospective histories of events used in these surveys. In this report internal evaluation receives more emphasis, however, chiefly because the constraints of time and resources available to produce this report precluded the major effort that would have been needed to consult and evaluate all external source data for the 41 countries. Nevertheless, we recognize that external comparisons are very compelling, and we included as much of these as was feasible: checking of recent estimates was covered quite adequately, but it is in the comparison of trend data that this report is less strong. Nevertheless, this report has the advantage of summarizing in one document the important internal consistency checks and external comparisons with recent data, for all 41 of the WFS surveys. In addition, this comparative approach, as opposed to a more country-specific approach, facilitates identification of those errors which are common to a large number of countries, and which may therefore be caused by the common instruments or methodology used by WFS surveys.

A few general types of error may be recognized. The first is *omission*, of events for the respondent (eg live births or unions) or of individuals (eg members of the household or eligible respondents for the individual survey). The second important type of error is misreporting of dates of events (eg age of household members or of the respondent, dates of children's births and deaths, and dates of starting and ending marriages). If such misreporting is not random, but is systematic, it will produce biases. Thus, while omission is a fundamental problem, misreporting of dates will only become a serious issue when it produces biases, or displaces events in particular directions. These two types of error are, to some extent, to be expected because these are retrospective surveys, depending upon the recall of events and dates of events in the past, sometimes in the distant past. Moreover, they will be exaggerated among populations where low literacy and, in general, a low level of modernization mean that knowledge of dates of vital events is of little relevance, and where there are no other cultural factors requiring knowledge of dates to counterbalance this.

A further source of error is sample design. Although all possible precautions are taken to design representative samples, errors may still arise, and these are very difficult to detect, although comparison with external data can show up this type of defect. The fact that inevitably only surviving women can be in the sample

may itself produce an unavoidable bias in the analysis of earlier periods.

Yet another source of error lies in the questions themselves: if they are poorly worded, or if insufficient probing is allowed for, or if mistranslations occur, the data obtained may not be what was intended. Even the manner in which recording and coding of information is done can result in unforeseen errors. Often these kinds of mistake are only learnt by trial and error. A final potential source of error in dating is imputation. The imputation program which was specially developed for use by WFS has proved in general very useful. However its correct use depends on knowledge of the form of reporting which is common in a given society (reporting in rounded, completed and projected years) and a wrong assumption can cause errors where the percentage of imputed dates is high and varying over time, as in Bangladesh (Chidambaram and Pullum 1981). Although simulation experiments showed that imputation made less difference to general substantive conclusions than to quantitative results, it seems that any uniform approach to imputation does not accurately mimic reproductive behaviour in the real world, and it would be advisable to switch to an imputation algorithm that more nearly reflects real reproductive behaviour to avoid the introduction of systematic bias (Trussell forthcoming).

The approach we take here is to apply a battery of tests to identify common errors that exist in the data. These fall into two basic types, internal consistency tests and validation of WFS data against external sources. Although a further mechanism for evaluation, the post-enumeration survey, exists, we do not deal with this, since it will be covered by papers in the forthcoming *World Fertility Survey: an Assessment of its Contribution* (Cleland and Scott). We do not attempt to explain in any depth why these errors occurred. The above discussion is our main contribution in this regard.

This report deals with segments or topics separately, with chapters on age reporting, nupitality, fertility and infant and child mortality, each covering all countries. This approach has the advantage of being able to reveal parallels or common patterns across countries, but is not the best means for finding out what is the whole situation in any particular country. The reader who is interested in an in-depth evaluation of particular countries is referred to the WFS evaluation reports in the *Scientific Reports* series and to the very useful country summaries in the UN report (1983) and its forthcoming updated version. This split by topic means that an attempt has to be made to accommodate interactions between topics. The interaction of age misreporting with fertility and nuptiality measures are the two most important such areas, and we include discussion of these in the fertility and nuptiality chapters, respectively.

2 Assessment of the Quality of Age Reports for Eligibility and Analysis

By Shea Oscar Rutstein

2.1 INTRODUCTION

The purpose of this chapter is to summarize findings evaluating the quality of the demographic data of the WFS surveys. We concentrate on potential biases in the production of estimates of demographic parameters due to errors of sample selection and age reporting.

The World Fertility Survey was concerned from its beginning with the quality of the information it sought to obtain. Careful consideration was given to all the stages of the survey in order to obtain the best information possible: questionnaires were scrutinized and pretested to ensure that questions would not be misinterpreted. Also for this reason, they were translated into the principal languages used by the respondents. In many cases, questions were asked in order to provide checks on crucial data. The need for accurate information was heavily stressed to interviewers, and they were especially cautioned not to accept illogical and inconsistent responses. After the interview, the questionnaires were subject to field scrutiny to ensure that all appropriate information had been collected. However, responses to questions used as checks on one another were not to be changed, so that later testing of quality could be done. Finally, in the central office both human and machine editing and imputing were carried out to eliminate inconsistencies and provide reasonable estimates for missing information in order to provide the 'cleanest' possible dataset for analysis.

Several procedures were also carried out in order to test the quality of the data. In a number of countries, respondents were re-interviewed in order to ascertain the reliability of their responses (O'Muircheartaigh and Marckwardt 1981). In other countries, interviews were tape recorded to compare the procedures of questioning and response with the results on the questionnaires (see Thompson *et al* 1982 for Bangladesh.)

The quality of the demographic data has been an especially important consideration for the World Fertility Survey since one of its principal aims was to provide reliable estimates of the current levels and recent trends of fertility, as well as of nuptiality and infant and child mortality. To this end, a series of studies was commissioned to devise a methodology and to evaluate specific surveys. The WFS set up a programme of workshops to evaluate most of the surveys, bringing researchers from the countries concerned to London in order to facilitate the work, to instruct them in the techniques of evaluation and to benefit from their knowledge of their country's demographic and social situation and its history. The reports of the evaluations have been published in the *WFS Scientific Reports*; a few remain as WFS unpublished manuscripts.

The findings presented in this chapter come principally from the evaluation reports of the various surveys, as well as from several other reports. New comparative tabulations also have been produced.

This chapter attempts to answer the following questions:

I **Was there a sample selection bias?**
A How well did the household survey represent the population?
B Were the characteristics used for eligibility for the individual survey well reported?
  1 Was age well reported among women?
  2 Was marital status well reported?

II **Was age reported well in the individual survey?**
A Did women know and report their ages?
B Were estimates of ages biased?
  1 Were there too many or too few women in an age group?
  2 Were erroneous age reports selective for study variables?
  3 Does age heaping affect trend analysis?

C **In surveys of ever-married women, are estimates of all women biased?**
  1 Was there differential age reporting at crucial ages?

Question IA is probably impossible to answer in most developing countries since the true facts are not known and census and survey data are likely to be substantially biased. Question IB2 is reported on in chapter 3. We attempt to answer the remaining questions in this chapter.

2.2 ELIGIBILITY

In all countries, current age and residence were used as criteria in the selection of women for the individual questionnaire. In about half the countries, only ever-married women were eligible, and other criteria were used in a few countries.

The selection of respondents for the individual questionnaire was based on the results of the household schedule administered to an adult member of the household. For each person resident in the household and for over-night visitors, this schedule collected the information needed to establish which women were eligible for the individual interview, as well as collecting other data.

Biases arise if genuinely eligible women were omitted or excluded or if ineligible women were included. Given that the individual survey collected more detailed information on age and marital status, the inclusion of ineligible women is less likely to be a problem than the

Table 1 Selected indicators of the quality of the household data for determining women's eligibility for the individual interview

Country	% Non resp.	Myers Index	UN Composite Index	Age Ratios				Sex Ratios			
				10-	15-	45-	50-	10-	15-	45-	50-
AFRICA											
Benin	na	35.0	67.1	74	72	101	110	120	103	83	90
Cameroon	6.2	15.4	75.3	84	102	70d	189d	103	95	118d	52d
Ghana	1.8	23.5	64.4	102	90	80	158	104	96	110	66
Ivory Coast	2.5	14.1	61.6	85	93	73c	144c	110	91	136c	85c
Kenya	7.2	15.2	55.5	117	81	103c	107c	93	105	102c	87c
Lesotho-maxi	0.3	12.4	35.0	100	100	88	90	96	90	98	84
Lesotho-mini	na	na	na	98	103	62	127	98	91	114	63
Senegal	na	7.4	36.4	91	107	87	126	105	89	105	91
Egypt	2.6	35.0	30.4	103	106	92	102	111	110	107	95
Mauritania	1.4	50.9	52.8	92	100	82c	143c	111	90	93c	72c
Morocco	3.3	35.7	49.3	99	106	99c	115c	105	93	91c	97c
Sudan	4.8	59.1	69.9	100	103	107c	94c	102	95	117c	117c
Tunisia	3.8	13.7	49.5	107	104	82	129	105	98	114	88
AMERICAS											
Colombia	4.2	11.4	39.9	110	99	104	102	96	93	92	87
Ecuador	3.8	12.0	29.5	103	100	88	127	101	93	105	92
Paraguay	4.5	na	35.1	103	104	103	120	100	89	88	82
Peru	3.8	15.5	27.3	101	103	104	102	98	95	103	95
Venezuela	3.1	9.4	39.3	106	106	88b	114b	92	92	98b	96b
Costa Rica	1.7	5.6	37.3	109a	88a	110	117	99a	111a	92	91
Domin. Rep.	5.3	17.1	37.8	104	102	105	108	99	93	105	104
Mexico	4.0	12.6	25.9	107	100	100	107	99	97	102	89
Panama	0.7	7.4	69.3	103a	86a	72	163	95a	111a	112	68
Guyana	2.4	na	na	na	na	na	na	na	na	na	NA
Haiti	10.4	19.9	60.2	110	92	84	153	95	121	108	66
Jamaica	7.1	9.4	23.3	111	104	80	156	102	97	103	67
Trin. & Tob.	3.9	5.1	60.5	113	109	84	142	100	101	102	85
ASIA											
Jordan	3.8	48.7	44.8	108	97	89	113	110	100	119	110
Syria	3.8	15.9u 22.1r	36.3	110	100	106	100	109	107	104	111
Turkey	14.8	23.8	44.1	103	108	89	132	101	89	115	86
Yemen A. R.	1.8	83.5	76.8	83	95	84c	131c	124	97	102c	88c
Bangladesh	1.8	15.8	55.2	106	90	108	79	107	97	106	124
Nepal	5.2	33.6	46.6	100	86	78	132	110	101	100	95
Pakistan	0.6	34.2	104.1	105	97	113c	57c	109	98	101c	206c
Sri Lanka	0.3	16.9	33.6	112	97	117	85	96	102	99	117
Fiji	5.8	10.2	62.7	109	103	74	145	107	97	139	86
Indonesia	3.3	23.2	56.8	98	107	80	144	103	91	114	79
Korea, Rep.	1.5	3.8	45.2	111	103	93	107	106	104	90	87
Malaysia	0.2	19.0	32.1	109	102	99c	97c	94	98	98c	92c
Philippines	1.5	4.8	32.2	101	107	89	123	105	100	98	84
Thailand	1.3	5.4	28.1	104	111	98	103	101	97	102	94
EUROPE											
Portugal	19.9	3.8	43.4	97	115	84	126	112	104	102	79

Notes:
a Lower age groups are 15-19 and 20-24.
b Upper age groups are 40-44 and 45-49.
c Women of 50 included as eligible, not adjusted for in table.
d Upper age groups are 50-54 and 55-59.

u Urban areas
r Rural areas

1 Excluding vacant, destroyed and unlocated dwellings. Source: Marckwardt, 1984.

omission of eligible women. In this section, we investigate the extent of omission of households, and age and marital status misreporting that could have led to errors of selection. Table 1 shows the eligibility criteria used in each of the countries.

Omission of households

Since the household schedule was used to identify women eligible for individual interview, women who were members of omitted or non-responding households had no possibility of being interviewed. If the level of omission was high and the households had characteristics which differed from those of the households included, biases are likely to result. Households were likely to be omitted or not to respond for several reasons: an incomplete sampling frame (unlisted dwellings), distant, difficult or unsafe access, no adult member at home, refusal or inability to be interviewed. Of these reasons, the most likely to cause serious biases are the first and the third, since families with no recent births are likely to be omitted. Table 1 shows the extent of household omission for the surveys, excluding the omission of households from the frame and excluding vacant, destroyed and unlocated buildings. Nine countries have omission rates, based on this restricted measure, above five per cent. In decreasing order of omission they are Portugal, Turkey and Haiti (all above ten per cent), Jamaica, Kenya, Cameroon, Fiji, Dominican Republic and Nepal.

Age

If a household was interviewed, a responsible adult was asked about his/her own age and that of other household members. To investigate whether age is well reported, Myers' index and the United Nations combined index are used to measure conformity to expected age structures. Myers' index measures digit preference (heaping) and the UN index measures discrepancy from smooth trends of five-year age–sex groupings. Nine countries have values exceeding 60 on the UN index, indicating very poor reporting of the age–sex structure: Pakistan, Cameroon, Sudan, Panama, Ghana, Fiji, Ivory Coast and Trinidad and Tobago, in decreasing order (table 1). Pakistan with its value of 104 seems to be a special case (see below).

Although large-scale international migration and a large population living outside households can raise the value of the index, this seems to be the case only for Trinidad and Tobago. Only five countries, Syria, Thailand, Peru, Mexico and Jamaica, have index values less than 30, and all are above 20, indicating some distortion of the age–sex structure.

For eligibility, all countries used an upper age limit. In most cases this limit was 49 years (age at last birthday), but in several surveys the limit was set at 50 in order to include women who would be heaped on this age. Two countries had different upper boundaries: Cameroon took women up to age 54 and Venezuela took women up to 44. The lower age limit in most countries was 15 years; however, several countries which also covered only ever-married women used no lower age bound and some used 10 or 12 years. Costa Rica and Panama used 20 years as the lower age limit for eligibility and the Caribbean countries of Guyana, Jamaica and Trinidad and Tobago excluded from eligibility women aged 15–19 who were full-time students.

Given that age was used as a criterion for eligibility in all WFS surveys, the erroneous report of women's age in the household schedule near the boundaries could lead to biases due to the exclusion of potentially eligible women. In order to get an idea of the amount of exclusion, age and sex ratios were calculated for the five-year age groups straddling the boundary ages. If women had been displaced in the age distribution to the age groups immediately outside the age boundaries, the age ratios for these groups would be high and the sex ratios would be low. If they had come, as is thought likely, from the neighbouring age group, then the age and sex ratios just inside the boundaries would be low and high, respectively. If there were no boundary effect, then the age and sex ratios would be similar across the boundaries.

Upper boundary effect

Almost all surveys give indications of a boundary effect at the upper age limit of eligibility: out of 40 surveys, only 6 (Colombia, Dominican Republic, Kenya, Malaysia, Peru and Thailand) show little evidence of a boundary effect. Twenty-five countries show a very strong effect of a transfer of women to above the upper age boundary and in four the effect is not as strong. In four countries, Bangladesh, Pakistan, Sri Lanka and Syria, there is a strong effect of a shift into the eligible age range.

Why has such a transfer occurred? Was it only because of heaping on age 50? There are several indications that in most countries the household interviewer deliberately transferred women above the age limit in order to avoid the effort needed to interview the older women, who are less educated and have longer birth histories. There were two countries where the upper limit was not either 49 or 50 years. The boundary effect also occurs strongly in both Cameroon with an upper age limit of 54 and in Venezuela with a limit of 44.

Sex ratios also indicate that in most countries the transfer over the boundary has been selective for women. In 28 countries, sex ratios are more than five points lower for the age group just below the boundary than for the group just above. Only 6 countries, Bangladesh, Benin, Morocco, Pakistan, Sri Lanka and Syria, show higher sex ratios for the lower age group, indicating an inward shift of women. In only 2 of these countries, Benin and Morocco, do the age ratios show a contradictory direction.

Perhaps the strongest evidence of an interviewer bias comes from Lesotho, where first a large household survey was done (the 'maxi'). From a random subsample of the maxi households, a 'mini' household survey was conducted from which women eligible for the individual interview were determined. The maxi survey shows no anomaly in the age ratios (see table 1), and only a relatively small difference in sex ratios at the upper bound. However, the mini tells a different story: there

are very strong indications of a boundary effect from both age and sex ratios. Jordan and Morocco conducted both maxi and mini household surveys, but only the maxi data were available for tabulation in London.

Boundary effects at the lower age limit

The misreporting of age at the lower boundary appears to occur much less frequently than at the upper boundary. In only seven countries, Bangladesh, Benin, Costa Rica, Ghana, Kenya, Nepal and Panama, is the age ratio for the group just inside the boundary less than 90, the lowest being 72 for Benin, and only two countries, Portugal and Thailand, show ratios over 110.

If there had been a transfer across the boundary, the age ratio for the lower age group should deviate in the opposite direction from the upper age group. Thus taking into account the difference in the age ratios (upper minus lower) would give us a better indication of a transfer. Using the joint criteria of a deviation of ten points or greater for the group above the boundary and a difference in ratios of ten points or greater, neither Benin nor Thailand appear to have a lower boundary effect. The largest transfer out of the eligible ages has occurred in Kenya, followed by Costa Rica and Panama, the only countries where the lower limit was 20 years of age. According to these criteria, only Portugal appears to have transferred extra women into the eligible ages. The sex ratios of the neighbouring age groups indicate that in Kenya, Costa Rica, and Panama, the transfer out of the eligible age range happened more for women than for men. In Bangladesh, Nepal and Ghana, however, the sex ratios appear to indicate more transfer of men than of women.

Discussion

The use of age and sex ratios to detect and measure the transference across age boundaries depends on the assumption that the true age–sex distribution of the population is fairly smooth. If there are large distortions in this distribution, say because of international migration, large changes in birth rates or a large section of the population at certain ages not residing in a household (eg because of army service), then the boundary effects indicated may well not be present. As regards the WFS countries, however, we believe that truly jagged distributions would only be present at the lower boundary, where most countries show little distortion, and indeed may have only affected the conclusion on the lower age boundary for Portugal.

There would seem to be greater incentive as well as greater scope for an interviewer to produce biased estimates of current age for women near the upper limit of eligibility than for women near the lower limit. The women around the upper limit are less educated, and therefore many would not be certain of their age. They have had more children, and more of their children will have died and moved away. Their interviews would therefore entail lengthy and complicated birth histories, and dates would be difficult to obtain because of the women's low levels of education. Women at the lower limit are just opposite and thus easy to interview in a short time. Only the increased absence of unmarried, student or employed women at these ages would be a slight incentive for interviewers to misclassify age in order to avoid returning at another time to do the individual interview.

In order to classify surveys as to the degree of distortion resulting from the boundary effect, indexes were defined by

$$U = [SR(i) - SR(o)] - [AR(i) - AR(o)] \text{ for the upper bound}$$
$$L = [AR(i) - AR(o)] - [SR(i) - SR(o)] \text{ for the lower bound, and}$$
$$T = |L| + |U|$$

where AR(i) is the age ratio of the group just inside the boundary,
AR(o) is the age ratio for the group just outside, and SR(i) and SR(o) are similarly defined for the sex ratios. T is an overall index by just summing the absolute values of L and U. A positive value of L or U indicates a shift into the eligible age range and a negative value indicates a shift out. Table 2 shows the values for the various surveys.

On the basis of the T index, we have the following classification of the boundary effect.

Little (T < 25)	Some (24 < T < 50)	Strong (49 < T < 100)	Very strong (T > 99)
Dom. Rep.†	Mexico†	Bangladesh	Yemen AR†
Peru	Egypt	Ecuador	Jamaica
Colombia†	Venezuela†	Philippines	Indonesia*
Malaysia	Morocco*	Nepal	Ghana
Benin†	Jordan*	Kenya*	Fiji
Syria†	Paraguay	Sri Lanka	Lesotho
Sudan†	Costa Rica	Tunisia	Haiti
Korea, Rep. of†		Trin. and Tob.	Ivory Coast
Thailand*		Senegal†	Pakistan
		Turkey	Panama
		Portugal	
		Mauritania	Cameroon†

In the countries marked †, an expanded household survey was done. In the countries marked *, the household survey was either an external survey or a maxi survey was done to determine eligible women. In either case, the rankings are based on all households in the survey and therefore may not indicate the true classification. In general, the bias would move the survey into a better class. Lesotho is not marked since it is classified on the basis of the mini household survey.

2.3 COLLECTION OF INFORMATION ON AGE

The concept of age

A person's age is defined by demographers as the cumulated amount of time lived since birth. Thus a respondent's age at interview (usually referred to as 'current age') would be the interval between the birth of the respondent and the interview. As is usual in Western culture, the World Fertility Survey has taken age to mean the number of 'completed' years since birth (ie age

Table 2 Indexes of age eligibility distortion

Country	Index value			Independence of survey
	Lower bound L	Upper bound U	Overall T	
AFRICA				
Benin	15	-2	17	Multi-round (1st round)
Cameroon	26	-185	211	Expanded survey
Ghana	-4	-122	126	
Ivory Coast	27	-122	149	
Kenya	-48	-19	67	External survey
Les-Maxi	6	-16	22	Maxi
Les-Mini	12	-126	138	
Senegal	32	-53	85	Multiround
Egypt	4	-22	26	
Mauritania	13	-82	95	Expanded
Morocco	19	-10	29	Maxi
Sudan	10	-13	23	Expanded
Tunisia	4	-73	77	
AMERICAS				
Colombia	-8	-3	11	Expanded
Ecuador	5	-52	57	
Paraguay	12	-23	35	
Peru	5	-6	11	
Venezuela	0	-28	28	
Costa Rica	-33	-8	41	
Dominican Rep.	4	-4	8	Expanded
Mexico	-5	-20	25	
Panama	-33	-135	168	
Guyana	na	na	na	
Haiti	-37	-106	143	
Jamaica	-2	-112	114	
Trin. & Tob.	-5	-75	80	
ASIA				
Jordan	-1	-33	34	Maxi
Syria	-8	13	21	
Turkey	17	-72	89	
Yemen A. R.	39	-61	100	Expanded
Bangaldesh	-6	47	53	
Nepal	-5	-59	64	
Pakistan	3	161	164	
Sri Lanka	-21	50	71	
Fiji	4	-124	128	
Indonesia	29	-99	120	Multi-round
Korea, Rep. of	-6	-17	23	Expanded
Malaysia	-11	-4	15	
Philippines	11	-48	59	
Thailand	11	-13	24	External
EUROPE				
Portugal	26	-65	91	

Notes: Overall is the absolute value of the sum of lower and upper indexes

A positive value indicates that women were shifted into the eligible age range

A negative value indicates that women were shifted out of the eligible age range

See text for definition of the indexes.

Type of survey:

Expanded—Selection for the individual survey was done in a subset of households, the indexes may be lower than the true boundary effects.

Maxi—Index represents results from the "Expanded" household survey. A smaller screening survey was taken of selected household to identify eligible women for the individual survey. Except for Lesotho, these surveys are not available in London.

External and Multi-round—the individual survey was one stage of a multi-round survey.

at last birthday). Other forms of calculating age are possible, however, such as age at next birthday or age at nearest birthday ('rounded' ages). The actual form in which age is reported in a survey may vary according to the general practice of the society and may also vary according to the age of the person in question. Chidambaram and Pullum (1981) have demonstrated the possible effect (on birth rates) of 'completed' versus 'rounded' reporting.

Other starting points for reckoning age may also be prevalent in a given culture, such as reckoning age as the time since conception rather than birth, or since the beginning of the calendar year of birth, or as the time since undergoing a common ceremony given at a nominal age (eg puberty rites).

Questions used to determine age: household schedule

The *WFS Basic Documentation* no 1, 'Core Questionnaires' (1974) called for age to be determined in the household schedule by asking for each usual resident and visitors, 'How old is (he/she)?' (Q 6). The interviewers' instructions state that the completed years of age are wanted. Interviewers were instructed to try to obtain age from the person herself in the case of women around the upper age limit of eligibility, and to try also to obtain documentary evidence. If age was unknown, the interviewer was instructed to try to relate the woman's age to that of some other member whose age was known. An example given of calculating a woman's age uses the age of a son (who was at the heaped age of 30 in the example) and asks, 'How old was she when she had that son?' The instructions also state, 'Even if age is unknown, it is very important to obtain an estimate, however rough, whenever possible'.

Twenty-three countries followed the recommendations of 'Core Questionnaires' on age, although about half indicated either completed years or age at last birthday in the question. Bangladesh, Ghana and Kenya asked first for month and year of birth, then age if the date was not known. Korea, Malaysia, Philippines, Sri Lanka and Thailand asked for both data and age, with Korea asking the 'animal year' of birth and the type of calendar used. Senegal used an age–event chart for the household schedule. Ghana and Kenya probed extensively on age.

Questions used to determine age: individual questionnaire

The individual core questionnaire obtained the respondent's age by asking, 'In what month and year were you born?' (Q 107), and if she did not know, the interviewer was to ask, 'How old are you?' (Q 108). The interviewer was instructed to 'record the best estimate'. Subsequently, the individual core questionnaire was modified always to ask age, in the form of

'How old are you? ____ (YEARS)' and
'Can you tell me in what month and year you were born?
_____, 19____'
(MONTH) (YEAR)

and the interviewer was told to 'probe and correct any inconsistency' (*WFS Basic Documentation* no 10, 'Modifications to the WFS Core Questionnaires and Related Documents', 1977).

'Modifications' noted that it was very important to collect both pieces of information, although the question on age could be asked after the birth history. Both the interviewers' and supervisors' instructions stress the importance of checking the consistency of dates of events and ages during the interview and specifically of checking that the respondent was at least 12 years old when she had her first live birth, first pregnancy or entered her first marital union. If a woman was found to be below the age limit for eligibility (or never married for surveys of ever-married women), the interviewer was to mark the questionnaire with 'ineligible'.

Most countries followed the recommended procedures. However, in countries where ages and dates were thought to be difficult to obtain, they were recorded on an age–event chart and historical calendars were used. Age–event charts were used in Benin, Ghana, Ivory Coast, Kenya, Senegal, Egypt, Mauritania, Morocco, and Sudan in Africa, in Haiti in the Americas, and in Indonesia, Syria, Turkey and Yemen Arab Republic in Asia. Calendar charts were used in Korea, Malaysia and Nepal. In Ghana, Mauritania, and Senegal extensive probing was used. See Singh (1984a) for further information on the collection of current age data.

In many countries, the coding scheme used lost some relevant information on date of birth. If year of birth was not known, age was recorded in the coding boxes for year of birth and month of birth was given a special code to indicate that this had occurred. This coding practice was used even if the woman could give a month of birth. For respondents the bias caused by this practice is minimal. However, this scheme was also used for children in the birth history and in the household schedule where date of birth was asked. In the case of childen, the imputation necessitated could distort fertility and mortality rates.

2.4 IMPORTANCE OF CORRECT DATA ON AGE

The correct determination of age is crucial for the analysis of practically all demographic phenomena. In the World Fertility Survey, the age of the respondent is used implicitly or explicitly in most calculations of levels, trends, effects and correlations. Incorrect determination of the respondents' ages can and usually will bias estimates of fertility, nuptiality and mortality levels and trends as well as the analysis of any other characteristic that changes with age or which has been determined by reference to age. Particularly disastrous biases can occur if age has been estimated by the use of the variable which is to be the subject of the analysis, for example studying parity by age when some women have had their ages estimated on the basis of numbers of children ever born.

Types of bias in results

The biases that result from an incorrect report of age can come from at least two sources.

1 *Women reported at the wrong stage in their life cycle*: In this case, calculations of means and proportions by age will be biased. Most analyses use the classification by age to show life-cycle patterns. As examples we have the proportions ever married, childless, in the menopause, using contraception, etc and the mean number of children ever born, living children, duration of breastfeeding, etc and measures derived from them such as the singulate mean age at marriage, indirect estimates of fertility and infant mortality, etc.

These biases may occur even without parity or age misreporting related to marital status, but obviously the bias would be worse if misreporting were linked to parity or marital status. And because of the age distribution, even random age misreporting by a constant fraction of the population would cause bias.

2 *Altered dates or ages at events*: The respondent was asked in the first instance to provide the date of birth of her children and marriage. If she did so, but gave her own birthdate or current age incorrectly, then her age at those births and marriage would also be incorrect. Comparisons across cohorts and over time would thus be biased if the age of the respondent at the event were the subject of study.

If the respondent was not able to give the dates of her births and marriage, she was asked about her age at the event. In this case, a wrong report of the respondent's age would not affect the distribution by age at event but would incorrectly locate the event in time and thus bias time comparisons.

Figure 1 shows the effect of a downward shift in age on the location of a respondent's events. For example, if the correct date of first marriage was reported but the respondent's age had been reported too low, then age at first marriage would be too low. Similarly, if age at birth was correctly reported but the respondent's current age was too low, then the indicated dates of birth would be too close to the date of the survey.

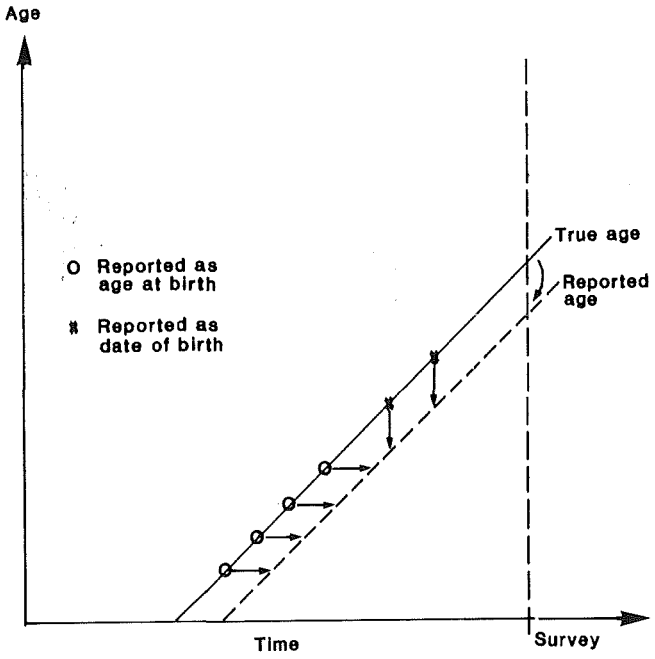

Figure 1 Misallocation of births caused by a downward shift in respondent's age at survey, according to whether births are reported by (correct) age at birth or by (correct) date of birth

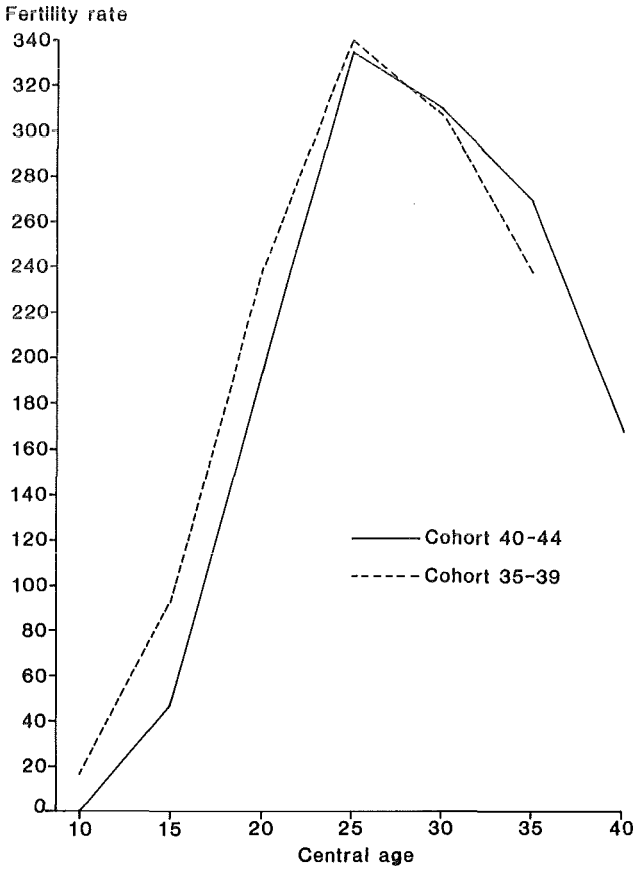

Figure 2 Effect on cohort–period fertility rates of a downward transfer from the cohort aged 40–44 to the cohort aged 35–39 (dates of event reported accurately)

It is likely that births and marriages have been reported in both manners in a survey so that both shifts will have occurred. If more women are shifted in one cohort than in another, the result can masquerade as the much discussed 'Potter effect' or 'reference-period error' (figure 2).

Sources of error in age reporting

It is not surprising that in many societies, the knowledge of one's exact age is rather hazy, and therefore is probably less well reported than other events. Knowledge of one's birth depends on the information gathered from others, usually one's parents. In societies where the registration of births is not common, or where age is not considered important after childhood, people probably have neither reliable documentary evidence nor a clear idea of their age. Current age or date of birth is rarely if ever required in daily life. Only when dealing with official matters may a report of age be required. For a woman, the situation is likely to be compounded by her lower education and the fact that either her husband or her father represents her in official matters.

It is in the household schedule that the first report of

age is obtained for all household members. Since any adult could have provided the information, proxy reports of age occurred for many eligible respondents, although it was more common for the eligible woman herself to respond for the rest of the family. Even in circumstances where the respondent knows her own age, she may not know the age of a parent, uncle, aunt, cousin, or other relative, nor may she know the age of domestic servants and hired help.

The WFS required age to be obtained for all persons listed in the household schedule and for eligible respondents. For a great many, this meant that the interviewer had to estimate current age on the basis of physical appearance or the milestones reached in the person's life. Unfortunately, such appearances and milestones are usually related to the phenomena under study and thus bias the results.

In many cases, an estimate of an eligible respondent's current age will be based on the number of children she has borne, or the age of the oldest or the youngest of her children. Evidence from the tape recorded interviews in Bangladesh (Thompson *et al* 1982) shows that many women's ages were estimated by taking the age of their oldest child, adding one year and then adding the common age at marriage of 15 years.

Even where a direct linking of study phenomena was not used to obtain age, physical appearance may have provided indirect links. Most interviewers are young adults and come from an urban setting. A poor or rural woman may appear older to them because of her poor diet, her lack of teeth and sun-wrinkled skin, or her lack of cleanliness. Similarly a woman who has had many children may appear older than she is because of physical deterioration. On the other hand, the poor physical condition of rural children may lead to stunted growth and thus an underestimate of their ages.

Where the age of an eligible woman is not known, it is plausible that interviewers are likely to place respondents at about the middle of the age range, usually between ages 30 and 40. From evidence presented below and from other studies, it appears that such a centralizing tendency did occur in many surveys.

Even though documentary evidence may be used to determine current age, unless the document was obtained in early childhood, it too may lead to an erroneous report. This is due to the fact that many documents obtained later in life are themselves based on an estimate of age. The unusual heaping on the digit three for people with documents revealed by the Turkish Fertility Survey evaluation (Üner 1983) clearly shows the effect of the identity documents having been issued to many people three years before the survey, when they reported ages terminating in zero, a normally preferred digit.

For a more detailed discussion of the causes and effects of age misreporting, see the US National Academy of Sciences report by Ewbank (1981).

2.5 AGE REPORTING

Other relevant studies of WFS surveys

Most WFS surveys have had some form of evaluation done, although in a few the evaluation covered only fertility rates calculated from the birth history data. The reports available are given in the References. In addition, there have been several other reports that are relevant to the evaluation of current age reporting.

Chidambaram and Sathar (1984) compiled data on the way in which the birthdate of the respondent in the individual survey was given. Month and year of birth were given by over half the respondents in only 3 out of 13 African surveys, and in only 7 out of 13 Asian surveys, but in all 13 American surveys, month and year were given by over 80 per cent. The authors show that complete reporting of respondents' birthdates increases with decreasing age and increasing urbanization, as well as with a higher educational level. Out of 13 surveys studied, only the south Asian countries of Bangladesh, Nepal and Pakistan had less than half the women with seven or more years of education with a complete birthdate reported.

The response reliability studies (MacDonald *et al* 1978 and O'Muircheartaigh and Marckwardt 1981) have shown considerable levels of inconsistency in reporting current age, even in countries where reporting is considered to be good. In their paper, O'Muircheartaigh and Marckwardt report that between the principal interview and a re-interview, 12 per cent of women in Peru reported themselves in a different five-year age group, 14 per cent did so in Fiji, 26 per cent in Indonesia and 41 per cent in Bangladesh. The discrepancies for single years of age are considerably higher from 34 per cent with discrepant ages in Peru to 80 per cent in Bangladesh. Fortunately, however, most of the discrepancy appears to be random, so that means, medians and standard deviations from both interviews were essentially the same.

Previous comparative studies of the quality of reporting of current age have looked at subsets of the WFS surveys (Chidambaram *et al* 1980a, 1980b and United Nations 1983). The United Nations study classified as 'weak' the quality of reporting in Bangladesh, Dominican Republic, Indonesia, Jordan, Nepal, Pakistan and Sri Lanka, while 13 others were either 'acceptable' or 'good'. Observing comparisons of matched household and individual survey reports of age, Chidambaram *et al* suggest the tentative conclusion for Latin America that direct questions on current age may result in a frequent understatement of age.

Test of data quality

In order to detect errors in data, we must in general make comparisons. The standard against which we compare our data in the internal consistency checks will be other individual items of the same dataset and *a priori* notions of distributions and their smoothness. In the external checks, we compare the data with distributions of independent datasets, such as other surveys, censuses or registration statistics. There is a third category of quasi-independent checks. For WFS data, this includes comparisons between the individual survey data and the household schedule data and comparisons with models, such as stable populations, model life tables and model nuptiality schedules.

The household survey: comparison with external data

In the evaluation reports, most household age distributions have been compared with either censuses or other surveys. A few have been compared with projected populations. Most of these comparisons are graphical and are therefore cumbersome to present and not easily summarized. In general, when compared with the external data, the household distributions show either the same or a somewhat reduced tendency toward digit preference (see table 3).

Apart from heaping, misreporting of age groups is about the same in the household survey as in previous censuses or surveys, except around the upper age limit of eligibility in the individual survey, where it is more severe for females in many of the household surveys.

Table 3 Comparison of household survey with external data

Country	Myers Index				UN Index		External Source
	Survey		External		Survey	External	
	Male	Female	Male	Female			
AFRICA							
Benin	na	35.0	na	na	67	na	na
Cameroon	13.6	15.4	15.0	18.9	75	38	1976 Census
Ghana	21.7	23.5	28.8	40.2	64	40	1970 Census
Ivory Coast	13.5	14.1	23.7	26.9	62	47	1975 Census
Kenya	na	15.2	--	26.8 ---	56	33	1969 Census
Lesotho-Maxi	na	12.4	---	12.8 ---	35	57	1966 Census
Nigeria	na	63.6	---	56.0 --	114	109	1963 Census
Senegal	na	7.4	na	na	36	19	1976 Census
Egypt	27.3	35.0	37.6	57.0	30	54	1976 Census
Mauritania	na	50.9	na	na	53	na	-----
Morocco	na	35.7	--	44.4 ---	49	96	1971 Census
Sudan	na	59.1	na	na	70	67	1973 Census
Tunisia	na	13.7	na	na	50	30	1975 Census
ASIA & PACIFIC							
Jordan	42.3	48.7	na	na	45	34	1961 Census
Syria	15.9u	22.1r	---	27.8 ---	36	34	1970 Census
Turkey	17.0	23.8	25.0	44.6	44	38	1975 Census
Yemen	na	83.5	na	na	77	na	-----
Bangladesh	na	15.8	---	69.4 --	55	57	1974 Census
Nepal	na	33.6	na	na	47.	53	1971 Census
Pakistan	na	34.2	na	na	104	na	------
Sri Lanka	16.8	16.9	14.5	19.2	34	26	1971 Census
Fiji	na	10.2	na	na	63	na	------
Indonesia	31.1	23.2	44.0	51.7	57	53	1971 Census
Korea, Rep.	na	3.8	---	4.0 --	45	23	1975 Census
Malaysia	na	17.0	--	7.4 ---	32	28	1970 Census
Philippines	na	4.8	na	na	32	24	1970 Census
Thailand	na	5.4	---	2.8 --	28	18	1970 Census
AMERICAS							
Colombia	na	11.4	--	16.8 ---	40	32	1973 Census
Ecuador	na	12.0	na	na	30	26	1974 Census
Paraguay	na	na	--	8.0 ---	35	27	1972 Census
Peru	14.8	15.5	9.8	16.7	27	22	1972 Census
Venezuela	na	9.4	na	na	39	20	1971 Census
Costa Rica	na	5.6	---	10.2 ---	37	21	1973 Census
Domin. Rep.	na	17.1	25.2	25.9	38	41	1970 Census
Mexico	na	12.6	---	17.0 --	26	19	1970 Census
Panama	na	7.4	--	6.6 ---	69	14	1970 Census
Guyana	na	na	na	na	na	na	-----
Haiti	22.6	19.9	27.3	26.8	60	38	1971 Census
Jamaica	16.2	9.4	14.4	13.4	53 ?	23	1970 Census
Trin & Tob	7.8	5.1	8.2	8.4	61	28	1970 Census
EUROPE							
Portugal	na	3.8	na	na	43	na	-----

Sources: WFS individual country evaluation reports (see bibliography)
NAS Report No. 6 (1981)

Using the UN index to compare the household survey age group distributions with an external data source (table 3), we see that only Egypt, Lesotho (maxi), Morocco, and Nepal are definitely less distorted than the external source, while 20 countries are definitely more distorted. Most of this extra distortion is from two sources: the boundary effect and a deficit of men. This lack of men, particularly at ages 20–49, also occurs in many of the external sources, but is not as prevalent as in the household surveys. Because of the nature of the household surveys, communal living arrangements, which primarily house men in this age range, were not covered. Additionally, the emphasis on identifiying respondents for the individual survey may have led interviewers to regard men as less important; moreover, they may not have wanted to return to a household of single men to do the household interview.

The individual survey

In order to measure age heaping in the individual survey, respondents between 20 and 49 years of age were classified by the terminal digit of their reported age. These limits were set so that each digit would be

Table 4 Number of women at each terminal digit of age, Myers' and Whipple's indexes, for women aged 20–49, individual surveys

Country	Total	0	1	2	3	4	5	6	7	8	9	Myers	Whipple
AFRICA													
Benin	3410	527	305	368	323	308	463	302	271	317	226	19.65	145.16
Cameroon	6359	1334	464	603	581	522	789	546	367	777	376	31.21	166.90
Ghana	4754	829	434	521	364	453	625	427	298	418	385	23.09	152.92
Ivory Coast	4373	629	481	540	410	435	502	429	358	329	260	18.42	129.32
Kenya	6111	959	531	589	474	511	915	456	558	642	477	22.34	153.30
Lesotho	3231	410	311	337	305	417	347	255	313	281	255	13.52	117.13
Senegal	3076	405	350	318	306	273	311	305	298	277	233	9.99	116.38
Egypt	8110	1397	663	809	696	617	1440	621	675	683	509	29.96	174.91
Mauritania	2903	659	220	183	163	343	493	179	151	152	360	47.86	198.56
Morocco	4235	714	374	397	381	450	527	388	326	330	348	19.86	146.52
Sudan	2849	707	126	215	131	140	864	124	168	234	140	70.34	275.86
Tunisia	3993	417	377	430	384	414	409	398	413	436	315	6.17	103.43
ASIA and PACIFIC													
Jordan	3282	593	239	341	244	242	570	220	259	335	239	32.07	177.16
Syria	4045	568	359	399	399	351	490	379	362	442	296	14.17	130.78
Turkey	4086	629	305	390	400	380	594	395	320	371	302	19.87	149.65
Yemen A. R.	2110	653	68	145	83	153	640	75	72	93	127	82.61	306.51
Bangladesh	5047	599	503	567	510	571	564	465	430	481	358	11.36	115.13
Nepal	5192	1031	395	633	369	378	841	415	297	507	327	36.49	180.31
Pakistan	4322	619	396	455	403	411	570	362	319	438	349	16.36	137.59
Sri Lanka	6634	737	497	582	731	553	926	576	618	808	606	16.55	125.36
Fiji	4700	513	502	515	473	473	495	410	458	490	371	7.28	107.23
Indonesia	8161	1307	697	809	725	750	1223	777	659	627	508	22.00	154.99
Korea, Rep.	5375	456	424	571	513	540	591	604	595	533	548	8.33	97.40
Malaysia	5902	552	572	565	582	587	722	678	586	531	527	7.44	107.93
Philippines	8952	877	851	851	866	879	1071	872	864	957	864	5.31	108.79
Thailand	3603	325	360	350	385	375	374	370	367	345	331	4.96	96.98
AMERICAS													
Colombia	3955	547	374	435	412	358	418	391	351	356	313	11.63	122.00
Ecuador	5117	670	515	606	565	490	559	448	447	446	371	13.23	120.09
Paraguay	3477	399	366	413	367	349	332	365	268	362	256	10.76	105.12
Peru	5329	569	432	594	510	520	631	483	512	581	497	9.13	112.55
Venezuela	3049	404	390	338	378	363	253	238	246	233	206	22.86	107.74
Costa Rica	3935	426	430	433	411	387	395	374	363	392	324	6.48	104.32
Domin. Rep.	2282	330	208	275	211	206	276	193	202	209	172	17.21	132.78
Mexico	6825	859	692	779	691	654	695	693	575	657	525	9.35	113.85
Panama	3699	417	409	414	377	390	356	323	337	341	335	8.52	104.49
Guyana	3617	451	344	425	367	373	414	316	324	319	284	12.25	119.57
Haiti	2554	408	234	315	209	217	340	232	239	208	152	23.28	146.57
Jamaica	2588	308	279	249	294	241	264	250	245	220	238	8.49	110.51
Trin. & Tob.	3651	450	428	403	393	385	337	326	324	334	271	12.80	107.83
EUROPE													
Portugal	5059	447	443	508	488	536	530	533	548	523	503	5.64	96.56

approximately equally likely to occur in a true distribution. For all-women samples, it would be possible to include the 15–19 year age group, with an adjustment for the fact that the digits 5 to 9 are more likely to occur; such an adjustment would *not* be recommended for ever-married samples.

A correction has not been made for the fact that in a true distribution the lower digits are slightly more likely to occur, since to do so in the manner of the Myers blended population would require a greater range of ages than are tested here. We do not think that such a correction would substantially alter the results. Myers' index is affected by sampling error, however, since it would pick up random noise. We do not think that the values presented below have been substantially raised by small samples, but application of the technique to subgroups for the smaller samples probably would be affected. Whipple's index is less likely to be affected since it concentrates on the specific digits 0 and 5.

Table 4 presents the results for 41 surveys of tabulating respondents between 20 and 49 (except Venezuela, 20–44) according to the last digit of their reported age. Also given are values of Whipple's and Myers' indexes based on these women (not blended). The surveys, classified on the basis of the two indexes and ranked in each category from low (good) to high (bad) are for Myers' index:

Good (M < 10)	Acceptable	Unacceptable (M > 20)
Thailand	Senegal	Indonesia
Philippines	Paraguay	Kenya
Venezuela	Bangladesh	Ghana
Portugal	Colombia	Haiti
Tunisia	Guyana	Egypt
Costa Rica	Trinidad and Tobago	Cameroon
Fiji	Lesotho	Jordan
Malaysia	Ecuador	Nepal
Korea, Rep. of	Syria	Mauritania
Jamaica	Pakistan	
Panama	Sri Lanka	Sudan (N)
Peru	Dom. Rep.	Yemen AR
Mexico	Ivory Coast	
	Benin	
	Morocco	
	Turkey	

On the basis of Whipple's index, the rankings are:

Good (W < 10)	Acceptable	Unacceptable (W > 30)
Portugal	Jamaica	Syria
Thailand	Peru	Dom. Rep.
Korea, Rep. of	Mexico	Pakistan
Tunisia	Bangladesh	Benin
Costa Rica	Senegal	Morocco
Panama	Lesotho	Haiti
Paraguay	Guyana	Turkey
Fiji	Ecuador	Ghana
Venezuela	Colombia	Kenya
Trinidad and Tob.	Sri Lanka	Indonesia
Malaysia	Ivory Coast	Cameroon
Philippines		Egypt
		Jordan
		Nepal
		Mauritania
		Sudan (N)
		Yemen AR

[continues]

Five-year age group distortions

Age heaping may be the result of a tendency to choose the nearest round number to report age. In the individual survey, where respondents were asked to provide their dates of birth, it seems that such rounding would happen only if the respondent did not know or did not want to report her date of birth. However, if such rounding occurred more or less at random, to the equal detriment of ages on either side of the heaped age, the biasing effect would disappear when properly grouped ages are used. The remaining distortion of the age distribution has been termed 'gross age misstatement'.

In order to detect gross age misstatement internally, we have distributed the respondents by five-year age group and again made use of age ratios. There are several difficulties in using these results, however. The boundary effect, especially at the upper boundary, will make the group 45–49 too low for most surveys and thus it will be hard to tell if women have been transferred into the age group 40–44.

More difficult, however, is the detection of age transfer for ever-married samples. Ever-married samples of women will not follow known patterns at the younger ages (less than 24) and so irregularities at these ages are hard to detect. There is a way around this problem: by estimating the number of women of all marital statuses from the number of respondents, dividing the latter by the proportions ever married at each age. These proportions have to be obtained from the household survey so that both individual and household data are evaluated. Since many analyses done on the individual survey data will also require such all-women estimates, evaluating the estimated all-women distributions is justified.

Table 5 presents the all-status distributions (estimated using proportions ever married for ever-married samples) according to five-year groups of current age. We would expect the age distribution of a developing country to have proportions decreasing somewhat as the age group increases. In this respect, many of the surveys present anomalous distributions, where an older age group has a higher or approximately equal proportion. Most of the anomalies occur among the age groups 30–34 to 40–44. Some of the anomalies are due to real variations in the proportions, due to wars, migrations and famines. However, we suspect that most are due to

Table 5 Percentage distribution of women by five-year age groups, individual survey
(For the ever-married samples, all women are estimated using the proportions married)

Country	Total	15-19	20-24	25-29	30-34	35-39	40-44	45-49
AFRICA								
Benin	4018	15.1	21.2	20.7	14.8	11.6	9.5	7.0
Cameroon	8219	18.9	17.1	16.6	14.5	12.3	11.2	7.7
Ghana	6125	22.4	19.9	16.5	13.1	11.5	9.5	7.2
Ivory Coast	5764	23.2	22.1	16.9	13.2	10.3	8.7	5.8
Kenya	8093	23.7	17.8	18.6	12.7	11.5	7.8	8.0
Lesotho	4698.	25.5	19.4	15.7	11.8	10.4	10.8	6.5
Senegal	3985	22.4	19.2	16.9	12.6	12.5	9.9	6.5
Egypt	12398.	24.4	19.9	15.9	12.7	11.0	8.8	7.4
Mauritania	4655.	28.7	20.1	15.5	12.2	9.6	7.0	7.0
Morocco	5800	24.9	20.2	14.6	11.0	11.3	9.9	8.1
Sudan	4354.	24.2	18.5	18.4	12.0	13.8	7.1	6.0
Tunisia	7728.	31.4	19.7	12.4	9.4	9.1	9.1	9.0
ASIA and PACIFIC								
Jordan	5509.	31.1	17.1	14.8	12.0	10.1	8.1	6.9
Syria	6976.	28.5	20.2	14.5	11.0	10.0	8.3	7.6
Turkey	5998.	25.3	18.3	15.1	11.7	10.8	10.3	8.4
Yemen A. R.	2941.	23.7	18.8	18.5	13.5	10.5	7.0	7.9
Bangladesh	6744.	25.1	20.6	16.8	11.7	9.1	9.4	7.3
Nepal	6605.	19.2	19.7	17.6	13.4	11.2	11.1	7.9
Pakistan	6272.	25.0	17.4	15.9	13.5	10.2	10.0	8.1
Sri Lanka	11541.	22.2	20.1	16.5	12.3	11.1	8.8	9.2
Fiji	7276.	25.7	19.4	16.1	13.6	10.5	8.7	6.1
Indonesia	11252.	22.5	18.1	14.1	12.8	12.7	11.2	8.6
Korea, Rep.	8461.	25.0	16.2	15.5	12.9	12.1	10.3	8.0
Malaysia	9357.	24.1	18.3	15.4	12.5	12.4	9.3	7.9
Philippines	16102.	25.2	18.6	15.5	12.3	11.4	9.2	7.8
Thailand	5668.	23.2	18.3	16.3	11.9	11.3	10.7	8.4
AMERICAS								
Colombia	5378	26.5	19.5	15.7	11.1	10.8	8.9	7.6
Ecuador	6797	24.7	20.3	15.8	13.0	10.5	8.6	7.1
Paraguay	4622	24.8	20.9	14.9	11.5	11.1	8.5	8.3
Peru	9005.	24.7	19.5	15.3	11.5	11.2	9.4	8.5
Venezuela	4361	30.1	22.4	16.6	12.3	10.4	8.2	--
Costa Rica	3735	--	25.1	21.3	16.6	14.8	11.4	10.8
Domin. Rep.	3115	26.7	21.2	14.9	10.6	11.4	7.7	7.5
Mexico	9273	26.4	18.4	15.3	12.4	11.4	8.8	7.4
Panama	3701	--	23.6	21.5	19.7	14.5	10.9	9.8
Guyana	4642	22.1	21.1	16.4	11.9	10.9	9.2	8.5
Haiti	3351	23.7	21.5	16.4	11.7	10.6	8.1	7.9
Jamaica	3613	28.5	17.9	14.0	10.6	10.5	9.4	9.1
Trin. & Tob.	4980	26.7	20.4	14.5	12.8	10.2	8.1	7.3
EUROPE								
Portugal	7663.	18.4	15.4	13.4	13.6	12.8	13.5	12.8

the fact that interviewers are likely to estimate these ages when the respondent does not know her age.

In order to measure the distortion of the five-year distributions we have calculated in table 6 age ratios for the groups, as mentioned above. We have also calculated sums of the absolute value of the deviation of the ratios from 100, first from the age group 20–25 to 40–44 and then from the group 25–29 to 40–44. The value of the sum indicates the amount of distortion present in the age group distribution. We have classified surveys according to the second index, so that a value 20 or below indicates low distortion, 20 to 35 shows that distortion is present but that the distribution is still acceptable and a value above 35 means that distortion makes the age distribution unacceptable. Below are given the results with the surveys in each group ranked from less to more distorted:

Good (I < 21)	Acceptable	Unacceptable (I > 35)
Ghana	Portugal	Senegal
Ecuador	Mauritania	Nepal
Jordan	Indonesia	Bangladesh
Egypt	Jamaica	Paraguay
Venezuela	Panama	Haiti
Fiji	Peru	Lesotho
Cameroon	Syria	
Philippines	Trin. and Tob.	Yemen AR
Korea, Rep. of	Costa Rica	Dom. Rep.
Turkey	Pakistan	Kenya
Guyana	Colombia	Sudan (N)
Ivory Coast	Benin	
Mexico	Tunisia	
	Thailand	
	Malaysia	
	Sri Lanka	
	Morocco	

Table 6 Age ratios for five-year age groups, individual surveys

Country	20-24	25-29	30-34	35-39	40-44	I (20-44)	I (25-44)
AFRICA							
Benin	118.6	114.6	92.0	95.3	102.0	47.9	29.3
Cameroon	107.6	98.7	100.3	95.6	112.5	26.1	18.5
Ghana	102.4	100.0	93.6	101.8	101.4	12.0	9.6
Ivory Coast	109.9	96.1	96.4	94.7	107.6	30.3	20.4
Kenya	84.1	122.1	84.3	112.4	79.8	86.3	70.4
Lesotho *	94.4	100.5	90.4	92.1	127.6	51.2	44.6
Senegal	97.5	106.4	85.6	111.2	104.2	38.7	36.2
Egypt *	98.8	97.1	95.1	101.9	95.4	15.5	14.3
Mauritania *	90.9	96.3	96.7	100.7	83.8	33.0	23.9
Morocco	102.1	93.8	84.8	108.3	101.4	33.2	31.1
Sudan *	87.1	120.5	74.7	144.6	71.2	132.1	119.2
Tunisia *	89.8	85.5	87.7	97.8	100.4	39.6	29.4
ASIA and PACIFIC							
Jordan *	74.4	101.7	96.4	100.9	94.8	37.0	11.4
Syria *	94.0	92.6	90.3	103.3	94.0	32.4	26.4
Turkey *	90.6	100.9	90.0	98.4	107.6	29.5	20.1
Yemen A. R. *	89.1	114.7	92.6	102.8	76.5	59.3	49.4
Bangladesh *	98.4	104.2	90.0	86.4	114.1	43.5	41.9
Nepal *	107.3	106.2	92.9	91.5	116.0	45.1	37.8
Pakistan *	84.9	103.0	103.4	87.0	109.2	43.7	28.6
Sri Lanka *	103.8	102.0	89.1	105.0	87.1	34.6	30.8
Fiji *	92.9	97.3	102.8	93.8	104.6	23.4	16.3
Indonesia *	98.9	91.0	95.8	105.7	105.0	25.0	23.9
Korea, Rep. *	79.8	106.5	93.7	104.2	102.8	40.0	19.8
Malaysia *	92.5	100.0	90.2	113.0	92.1	38.2	30.7
Philippines *	91.3	100.5	91.3	105.9	95.9	27.9	19.2
Thailand *	92.7	107.8	86.3	100.4	108.1	37.3	30.0
AMERICAS							
Colombia	92.8	102.1	84.3	107.7	96.5	36.2	29.0
Ecuador	100.0	95.0	98.6	97.6	97.9	10.9	10.9
Paraguay	105.6	91.8	88.8	110.6	87.9	47.7	42.1
Peru *	97.4	98.5	87.2	107.1	95.3	28.7	26.1
Venezuela	96.2	95.6	91.2	101.1	--	(18.1)	(15.3)
Costa Rica	--	102.4	91.8	105.9	88.8	(27.7)	27.7
Domin. Rep.	101.5	93.9	80.8	124.0	81.8	61.4	59.9
Mexico	88.4	99.1	93.0	107.0	94.5	32.0	20.4
Panama	--	99.3	109.8	94.3	90.3	(25.9)	25.9
Guyana	109.6	99.2	87.7	102.6	95.4	29.9	20.3
Haiti	107.2	98.9	86.5	107.3	87.2	51.5	44.3
Jamaica	94.2	98.0	87.5	105.4	95.1	40.6	24.8
Trin. & Tob.	99.2	87.1	103.9	97.0	93.1	27.5	26.7
EUROPE							
Portugal *	96.9	92.1	104.0	94.6	105.6	26.0	22.9

Notes: I the indexes are the sums of the absolute deviations of the age ratios from 100

* indicates that all women have been estimated using the proportions ever-married from the household survey

() Indicate that the age range of the survey was restricted

There are some surprises in the list, such as Jordan, Cameroon and Turkey being classified as good, since they had indications of considerable heaping. Likewise some of the countries classified as only acceptable, such as Portugal and the Caribbean countries, may have truly distorted distributions due to large-scale international migration. However, we do not think that any of the countries in the unacceptable category have been misclassified.

Returning to table 5, we will try to identify which age groups seem to have too many or too few respondents.

Country	Deficient groups	Excessive groups
Africa		
Benin	15–19	25–29
Cameroon	15–19 (45–49)	40–44
Ghana	(45–49)	None
Ivory Coast	45–49	20–24
Kenya	(15–19) 20–24, 40–44	25–29
Lesotho	(45–49)	40–44
Senegal	30–34, 45–49	(15–19)
Egypt	None	None
Mauritania	40–44 (45–49)	None
Morocco	25–29, 30–34	None
Sudan (N)	20–24, 30–34	25–29, 35–39
Tunisia	None	None
Asia and Pacific		
Jordan	45–49	15–19
Syria	40–44	None
Turkey	(45–49)	15–19, 40–44
Yemen AR	40–44 (45–49)	(15–19), 25–29
Bangladesh	30–34, 35–39	None (45–49)
Nepal	15–19 (45–49)	None
Pakistan	20–24, 35–39	40–44 (45–49)
Sri Lanka	40–44	25–29, 45–49
Fiji	45–49	None
Indonesia	25–29, 30–34 (45–49)	None
Korea, Rep. of	20–24	40–44
Malaysia	30–34	35–39
Philippines	(45–49)	None
Thailand	None	25–29
Americas		
Colombia	30–34	None
Ecuador	(45–49)	None
Paraguay	30–34, 40–44	20–24
Peru	30–34	None
Venezuela	(40–44)	None
Costa Rica	(20–24)	None
Dom. Rep.	30–34, 40–44	20–24
Mexico	None	None
Panama	(20–24) (45–49)	30–34
Guyana	None	25–29
Haiti	(15–19), 40–44 (45–49)	25–29
Jamaica	(45–49)	None
Trin. and Tob.	(45–49)	20–24
Europe		
Portugal	(45–49)	None

Groups in parentheses indicate household schedule data. The distribution for Tunisia appears to have been greatly affected by the large epidemics during and following the Second World War and so no indication of misreporting is given here, although it may exist.

Comparisons between the individual and household surveys

For a number of surveys where it was possible to match the responses to the individual questionnaire with the responses to the household survey, a direct comparison was made. However, this comparison is not as revealing as we hoped, for several reasons. For many respondents, the information was not independently gathered, and the interviewer or the respondent herself reconciled one source with the other. Indeed, if the respondent did not know her age or date of birth, the estimate worked out on the household schedule was also used for the individual questionnaire. Moreover, although inconsistency between the two sources would tell us that one or both were incorrect (assuming the sources are well matched), consistency does not mean that both are correct. If we assume that age should have been better reported in the individual questionnaire, we still are unable to evaluate reporting in that questionnaire, since all discrepancies would be attributed to errors in the household schedule report.

Table 7 presents the surveys where the consistency of the reports was checked. The table shows that consistency varies considerably among countries, but that high consistency should not be taken as an indication of good reporting. For example, in Yemen AR, 83 per cent of respondents were reported as having the same age in both the household and individual surveys, but this consistency comes from the great extent of heaping in both surveys. In the three countries where there is evidence on the effect of proxy reporting, such reporting seems only slightly less consistent than self-reporting. In fact, some 10 per cent of respondents reporting their own ages in Colombia did so inconsistently.

Table 7 Direct comparison between household schedule and individual questionnaire report of respondents' ages (Figures are percentages of matched respondents)

Country	Single years			Five-year age groups		
	Lower in HH	Same	Higher in HH	Lower in HH	Same	Higher in HH
AFRICA						
Ivory Coast	25	56	19	13	76	11
Ghana	1	87	12	na	na	na
ASIA & PACIFIC						
Indonesia	10	81	9	4	93	3
Malaysia	na	na	na	2	97	1
Philippines	na	na	na	1	98	1
-proxy	na	na	na	na	97	na
-self	na	na	na	na	98	na
Turkey	5	79	16	2	93	5
Yemen A. R.	3	83	14	2	87	11
-proxy	3	81	16	4	85	11
-self	3	84	13	1	88	11
AMERICAS						
Colombia	21	61	18	6	89	5
-proxy	na	na	na	7	88	5
-self	na	na	na	5	90	5
Domin. Rep.	21	64	15	8	88	4
Peru	na	98	na	na	99	na
Trin. & Tob.	na	na	na	na	98	na

There is, however, a reason for considering inconsistencies between two sources to be important. Most analyses using estimates of all women based on ever-married samples apply the proportions ever married determined according to age in the household schedule to the numbers of respondents in the individual survey according to their ages in the individual survey. If there are inconsistencies in the ages where these proportions change rapidly with age (under age 25), than biased estimates may result. It is especially important then to check whether there were substantial inconsistencies in reported ages less than 25 for the ever-married samples.

From the data in table 8, we would say that for many countries there could certainly be bias, due to inconsistent reporting of ages. Unfortunately, where there is no data file of matched household and individual reports, which would enable us to detect the inconsistencies, we are obviously not able to correct for them.

2.6 CONCLUSIONS AND RECOMMENDATIONS

In spite of considerable effort on the part of the World Fertility Survey, age misreporting has affected many surveys. This is to be expected, as many respondents do not know their ages or birth dates and have no reliable documentary evidence of either. In general, the countries of the Americas, and east Asia and the Pacific are less affected.

In a large number of surveys, there is evidence that the oldest age group of eligible women has been distorted, probably due to the interviewer's biased estimation of age. In the following countries, the age group 45–49 should not be used for analysis:

in Africa Ghana, Ivory Coast, Lesotho, Senegal, Mauritania and Tunisia, and 50–54 in Cameroon;

in Asia and the Pacific Jordan, Turkey, Yemen AR, Bangladesh, Nepal, Pakistan, Sri Lanka, Fiji and Indonesia;

in the Americas Ecuador, Panama, Haiti, Jamaica and Trinidad and Tobago;

in Europe Portugal.

The lowest eligible age group appears to be substantially distorted in Kenya and Senegal in Africa, Costa Rica, Dominican Republic and Haiti in the Americas, and in Yemen AR in Asia.

A number of countries showed unacceptable levels of age heaping and therefore an analyst should be very careful in the use of single-year classification and the grouping of age used.

Gross age misstatement has also occurred in a number of countries and an analyst must exercise caution in using the age distributions in these countries. From our study, the most distorted surveys, in alphabetical order are: Dominican Republic, Kenya, Nepal, Sudan and Yemen AR. Countries not as badly distorted but still requiring caution are Benin, Cameroon, Haiti and Paraguay.

The use of age–event charts does not appear to improve the quality of age reporting in many countries since, except for the Dominican Republic, the most distorted countries used such a chart. We do not know, however, if countries which used this type of chart would have been worse without it. The special probing caried out in Ghana, Mauritania and Senegal does appear to have improved the quality of the data.

The report of age by proxies in the household schedule does not appear to be much worse than that by the respondents themselves. One explanation would be that if the woman knows her age, the proxy also knows it, and if she does not, neither does the proxy.

Table 8 Direct comparison of reports of respondents' ages in the household and individual surveys, according to five-year age groups in the individual survey
(Figures are percentages of matched respondents)

Country	Age group		Total
	< 20	20-24	
Colombia			
3+ older in HH	1.6	1.4	2.1
1-2 older	15.2	18.0	15.5
Same age	72.5	61.8	61.3
1-2 younger	10.5	17.1	16.5
3+ younger in HH	0.2	1.7	4.6
Indonesia			
3+ older in HH	0.5	1.1	2.3
2 yrs older	0.5	1.7	1.0
1 yr older	5.3	8.5	6.3
Same age	75.7	75.4	80.8
1 yr younger	14.3	10.7	7.3
2 yrs younger	1.6	1.5	1.0
3+ younger in HH	2.1	1.0	1.4
Malaysia			
Older in HH	0.0	0.0	0.7
Same age	96.7	95.9	97.3
Younger in HH	3.3	4.1	2.0
Trinidad & Tobago			
Same age group	99.7	98.1	97.9
Within 1 group	100.0	100.0	99.7
Turkey			
3+ older in HH	1.2	1.6	1.6
2 yrs older	1.8	2.0	1.6
1 yr older	23.1	13.3	13.2
Same age	70.4	79.1	78.5
1 yr younger	2.7	2.2	2.7
2 yrs younger	0.9	1.0	1.2
3+ yrs younger	0.0	0.7	1.4

Recommendations

For future design of WFS-type surveys, the following is recommended:

To reduce boundary effects

- Take an all-women sample rather than an ever-married sample
- Set the upper age limit of eligibility at 54 years
- Make the selection of eligible women independent of interviewing

To reduce age misreporting

- Carry out extensive determination in the household schedule, by asking birth dates rather than ages, requiring documents, and perhaps using age–event charts
- Train interviewers in the estimation of ages
- Insert age checking questions in the individual survey, such as asking the number of years since menarche
- Code the month of birth where available

3 Assessment of Nuptiality Data

By Susheela Singh

3.1 INTRODUCTION

WFS surveys collected data on two main aspects of nuptiality, current marital status and retrospective marriage histories. Each of these may suffer from specific types of error, differentially affecting data analysis. A classic problem in the reporting of current marital (or union) status[1] is that formerly married women are classified as single or never married. This is important where surveys cover ever-married women only, since omission of these women can bias overall fertility estimates as well as estimates of the amount of time spent exposed to the risk of pregnancy. We evaluate this type of error by comparison with external sources, but this method has problems, since the external source may also be biased.[2] The main problem with obtaining retrospective data on marriage is misreporting of the dates of marriages or unions, most importantly the date of first union. This issue is the main topic covered in this chapter. Its chief impact is on any analysis of age at first marriage or union, and on marital fertility rates which are based on time spent exposed by ever-married women. Apart from misreporting by respondents, a further important source of defective estimates, which we do not explicitly discuss here, is incomplete sample coverage (see Marckwardt, 1984 and Scott and Harpham, forthcoming, for a discussion). This factor may account for some of the data problems we identify (eg discrepancies between censuses and the surveys), but would be difficult to evaluate. Marital status data of the Philippines survey is one known instance where bias was introduced by the sample selection procedure (Marckwardt 1984). In addition, errors in age reporting, discussed separately in this report, may produce errors in nuptiality data. This possibility must be recognized, although we do not go into it in any detail here (see Coale 1983).

We evaluate the quality of nuptiality data against an objective but ideal criterion, that the aim is to record all sexual exposure. In fact this was not the intention of most WFS surveys: their aim was to obtain dates of all socially recognized unions. This introduces a subjective element, varying across populations and across individuals within populations, but which usually connotes some sense of stability or duration, in what is recognized as a union. Thus our evaluation is relative to the maximum coverage of exposure, which must be relaxed in the real world. In practical terms, this issue affects mainly societies where informal sexual unions exist, and in such societies some proportions of births occurring outside recognized unions must be accepted as reality rather than a problem of data quality. Although we do not know what this proportion is, we use information on premarital births as a check on quality, because its variation across countries in the same region, or across age groups in the same country, may identify countries or groups with especially poor reporting. This is crucial in evaluating the quality of nuptiality data, but because it arises only in some regions and cultures, our measures of this reporting problem may seem culture-bound. It is inevitable that in countries where informal unions occur there will be greater difficulties in obtaining high quality data on nuptiality, and it is desirable that indicators of data quality should reflect this basic difference in the quality of data on this topic.

This chapter looks for general types of problems experienced by WFS surveys in the collection of data on nuptiality. One previous report has been done with a similar aim (United Nations 1983). However, this report covered the 20 earlier WFS surveys, while the present one covers the 41 completed surveys. In addition, the chief aim of the UN document was to evaluate fertility levels and trends, with nuptiality being given relatively less coverage. The present report aims at a more intensive examination of the quality of nuptiality data, and uses some different indicators of data quality.

The detailed evaluation reports were consulted, and some of the results presented are from these reports. Other results were extracted from cross-national studies, published or forthcoming and unpublished manuscripts, on age at first marriage, age at first birth and date reporting. We assess the quality of data on nuptiality by means of these selected aspects which are common to all countries, but we do not attempt a comprehensive evaluation which would include regional and country-specific aspects. In addition, we briefly examine the implications of our results for data analysis and for future data collection. This cross-national approach provides some insight into problems of obtaining data on nuptiality in general, and into the problems of the WFS approach to collecting nuptiality data in particular.

The quality of nuptiality data depends on the accuracy of dating of marriages and on the clarity of the definition of marriage. These two aspects may interact, since a poorly understood definition may lead to an incorrect date being supplied. The accuracy of dating this particular type of event, as with vital events, is to a great extent a function of the importance of dates in each society, which in turn depends on social and cultural characteristics, especially the level of literacy and development of countries; but in the case of nuptiality, the type of union

[1] The term marriage will be used to denote any more or less stable sexual union. In most surveys, this implies co-residence, but in the Caribbean the definition was broadened to include non-cohabiting unions.

[2] See the discussion of use of probes on current marital status in WFS surveys, by Jemai and Singh (forthcoming).

pattern that exists may itself introduce or exaggerate problems of dating. In evaluating the results of surveys, therefore, we must always bear in mind that questions may produce poor results not because they are poor questions but because the answer is not known or not relevant to the respondent. Nevertheless, the choice of questions may affect the quality of answers, and WFS used a variety of approaches for dating marriages and other vital events. Unfortunately, we cannot evaluate these different approaches, because WFS surveys were not experimental, in the sense of applying different approaches to subsamples in the same country.

For a large number of WFS surveys, the detailed evaluation reports have looked at the following aspects of the quality of nuptiality data:

(1) the form in which dates of events were reported;

(2) marital status as reported in two different places, the household and individual interviews;

(3) marital status in the past, as obtained in the marriage history, compared with external sources such as censuses or other surveys which obtained the same data;

(4) age at first marriage – the extent of heaping on particular ages, durations or calendar years;

(5) the trend in the age at marriage, and whether the pattern is a realistic one.

Apart from these items, some reports also examine country-specific topics, such as the pattern in the number of unions by age cohort, the type of first union, the occurrence of pre-marital births, or of births outside any unions, and the number of births during the first five years of being in union.

The reader is referred to these evaluation reports for detailed analyses of specific countries. The objective of this summary report is to use only a few of these tests to identify the more general types of problem in the nuptiality data. The aspects addressed here are reporting the calendar year of an event, versus more indirect forms; indices of heaping on rounded durations or calendar years; trends in proportion married and in the median age at marriage; the relationship between age at first birth and age at first marriage; and the comparison of proportions ever married according to the survey with the proportions from an external source. From the aspects included here, we construct an overall index of quality in an attempt to guide users of these survey data.

3.2 FORM OF DATE REPORTING AND HEAPING

The core questionnaire asked for the calendar date, month and year, at which events occurred, but did not explicitly provide for any probes if this date was not known. Later on, in the 1977 publication, 'Modifications to the WFS Core Questionnaires and Related Documents', some probes were recommended, eg age at start of marriage, if the date was not known, and duration of marriage if the date of dissolution was unknown. However, partly because of the lack of probes in the original core questionnaire, a number countries which carried out their surveys before 1977 did not use any probes, ie Fiji, Malaysia, Sri Lanka and Thailand in Asia, and Costa Rica, Dominican Republic, Mexico, Panama and Venezuela in Latin America. In effect, this probably meant that interviewers used their skill to pin down vague answers to at least a calendar year, since no alternative form of answer was allowed. A few pre-1977 surveys and most later surveys, however, did use probes, event charts, and other aids to dating marriages. The fact that some early surveys used probes (eg Bangladesh, Indonesia, Korea, Jordan, Pakistan, Guyana and Jamaica) suggests that other early participants in the WFS programme were aware of this possibility, but they may have voluntarily rejected it. Interviewers did not limit themselves to questions and probes in the questionnaire; the Bangladesh tape-recording study shows that interviewers frequently used the ages of living children to estimate age at first marriage, particularly for women over age 30 (Thompson *et al* 1982).

Different modes of date reporting may clearly lead to different kinds of error. If dating in the form of a calendar year is forced, heaping on rounded calendar years, ending in 0 or 5, or on years in which notable events took place, will result. In contrast, where reporting in the form of age at the event is allowed, misreporting is more likely to take the form of heaping on rounded or preferred ages; this error is difficult to detect, however, because of the concentration of ages at first marriage in a very narrow band, 15 to the early 20s. Finally, reporting in the form of years ago can lead to heaping on rounded durations of marriage, typically ending in 0 and 5 years.

Where alternative forms of reporting dates were allowed, they were certainly used (see Chidambaram and Sathar 1984). Unfortunately, much of this information was not transferred to tape, but used at the field and office editing stages to yield a calendar date. For example, in Korea where an elaborate set of questions was used to obtain the dates of all events, we have no information on whether these questions were actually necessary or whether respondents were able to supply calendar dates without probes. Thus, although the proportions reporting the date of first marriage in the form of a calendar year, shown in table 9, identify some problem countries, the results already include field and office editing changes, to a varying extent among countries. African and Middle Eastern countries stand out as usually having 70–90 per cent reporting a calendar year, while three Asian or Pacific countries, Bangladesh, Nepal and Indonesia, have very low percentages (14, 27 and 59) reporting a calendar year. While two Caribbean countries show low proportions, as may be expected, given the usual instability of first union, Haiti's figure of 100 per cent suggests that prior editing had eliminated responses in the form of age at the first union, which was the alternative form provided. Trinidad's figure of 100 per cent is probably closer to the true situation, given the high level of education and development; although with a similar union pattern to Guyana, it seems unlikely that everyone was able to give the calendar year of the first union.

The indices of heaping are more comparable across countries, and they will reflect the tendency to give answers rounded to the nearest 0 or 5, which can occur even where calendar years are supplied (see table 9 for definition of indices, and their values). One possible problem with the indices is that where the survey itself took place in a calendar year ending in 0 or 5, and where heaping on either duration or calendar years occurred, both indices will show heaping. For example, in Ivory Coast, Pakistan, Sri Lanka, Dominican Republic, Panama and Jamaica, where the surveys were in 1975 or 1980, and where substantial heaping occurred on both duration and calendar rounded years, it is likely that only one of the two types of reporting problem occurred. Other than these cases, substantial heaping for *duration* since first marriage, on digits 0 or 5, occurred in Ghana, Egypt, Mauritania, Sudan, Yemen AR, Nepal, Indonesia, Colombia, Peru and Costa Rica. Substantial heaping on calendar years occurred for the six cases mentioned earlier, as well as for Lesotho, Syria, Indonesia, Philippines, Portugal and all Latin American and Caribbean countries, except Guyana. It would be expected that rounding in more educated countries would be on calendar years, and on duration years in less educated countries, if rounding did occur.

This generalization is partly supported by these results. The absence of any heaping in a few countries with very low education – Benin, Cameroon, Kenya, Senegal and Bangladesh – is unexpected. It is possible that heaping in these countries was on the age at first marriage only, and this could be missed by our indices. Low or no heaping in some countries (Morocco, Tunisia, Jordan, Fiji, Korea, Malaysia, Thailand and Guyana) is more consistent with our expectations. In a few of these countries, use of identity cards or birth certificates helped with dating in general. Heaping in the Americas is largely due to the common occurrence of various types of informal union, especially for the first union. The exact starting date may be forgotten, because of the relatively temporary nature of the type of union, and because of the absence of any social or religious ceremony to mark its beginning. In some African countries, not only do these informal unions exist, but in addition, low education and the low relevance of calendar dates would further complicate the dating of the first union.

3.3 MARITAL STATUS: HOUSEHOLD AND INDIVIDUAL SURVEYS

Results from those evaluation studies which made a comparison between household and individual surveys show that reporting of marital status is highly consistent between the two sources. For surveys with ever-married individual samples, we were only able to check consistency for the married, widowed, divorced and separated statuses, and in all cases the level of consistency was high, with 98 per cent or more reported as having the same status. Small shifts from 'widowed' in the household survey to 'divorced' and 'separated' in the individual survey were found in Indonesia, where the post-enumeration survey also showed strong agreement with the individual survey: only 2.4 per cent reported a different status.

The comparison of the two sources for surveys with ever-married samples does not help us to check the possibility of misclassification of single women in the household survey. A few surveys with all-women individual samples also made this comparison, and found that the individual survey had slightly higher proportions ever married (Venezuela, Cameroon and Senegal) or slightly higher proportions in consensual unions (changes in status, from married and single to consensual (Dominican Republic) or a reclassification of a small number of divorced women (Mexico)) but lower proportions ever married in Haiti, where the 'rinmin' and 'fiancée' union types were the ones that changed. Two surveys which subselected the individual sample from a larger household sample found no systematic differences in marital status between women who were selected and those who were not (Dominican Republic and Mexico).

In general, therefore, these comparisons suggest that there are no major differences in the reporting of marital status in the two sources. Judging from the experience of countries with all-women samples, however, it seems that ever-married samples suffer from exclusion of a small proportion of women who are classified as single in the household survey but who are actually ever married.

3.4 COMPARISONS BETWEEN AGE AT FIRST BIRTH AND AGE AT FIRST MARRIAGE

Because of the difficulty of measuring age at first marriage accurately, it has been suggested that age at first birth is a more reliable point from which we can measure the beginning of risk of childbearing. It is generally argued that dates of births are more memorable events than dates of unions, especially informal unions of short duration. We compare the median age at first birth and first marriage here, both to see whether trends are more acceptable in one than in the other and to see whether the difference between the two is of a reasonable duration. In this case an average difference of less than one year between the two medians is considered indicative of possible misreporting of one of the two dates, probably age at first marriage. As a summary index we also present the proportion of all women in the sample who had a negative first birth interval, an index that would separate out the extreme cases of misstatement of age at first marriage. However, it must be borne in mind that when imputation of either or both dates is necessary, the dates are forced to be plausible, ie the date of first birth follows the date of marriage by a minimum gap of nine months. Thus, this test would be biased in favour of countries with high levels of imputation.

The two simpler tests (shown in columns 5 and 6 of table 9) identify black African and Caribbean and Latin American countries as having some reporting error. Several countries in these regions have quite a high proportion of first births with negative intervals; these proportions would be higher still if pre-marital conceptions (births within the first six months of marriage) were included. In addition, six countries in the Latin

Table 9 Summary indices of the quality of nuptiality data

Country and Year of Survey		% with no education (20-34 ever-married)	Percent who reported calendar year for first union	Indices of Heaping[1]		% Negative First Birth Interval	Age-groups where AGFB-AGFM < 1 yr[2]	Reversal of trend[3]		Comparison with External Source:[4]		Ages 30-34, 35-39, 40-44, 45-49[5] Prop. ever-married		Summary Index 0 = best 6 = worst[9]
				Duration Index	Calendar Year Index			Age at first marriage	Age at first birth	All ages	15-19+ 20-24	Over-stated	Under stated	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Africa														
Benin	1981/82	86	91	1.01	0.98	16.6	None	A	A	NA	NA	None	40-49	(3)
Cameroon	1978	60	80	0.99	1.02	21.8	None	A	B	+3.8	+3.7	None	35-49	3
Ghana	1979/80	49	76	1.07	1.04	8.6	None	A	A	+1.2	+3.4	None	40-44	4
Ivory Coast	1980/81	79	92	1.11	1.11	17.3	None	A	B	+4.6	+2.8	None	40-49	4
Kenya	1977/78	45	84	1.05	0.99	21.6	20-29	A	A	+0.8	+0.0	None	40-49	3
Lesotho	1977	6	94	1.00	1.11	5.4	None	Irreg	Irreg	+1.5	+2.1	None	None	2
Nigeria	1982		64											
Senegal	1978	86	100[10]	0.97	1.03	4.5	None	A	A	+3.5	+11.4	None	40-49	3
Egypt	1980	57	43	1.08	1.02	0.1	None	None	None	+4.9	+7.6	None	None	2
Mauritania	1980/81	44	81	1.12	1.00	2.7	None	A	A	-1.9	-1.8	None	40-49	4
Morocco	1980	82	59	1.04	1.04	4.4	None	None	None	+3.8	+6.5	None	None	1
Sudan (N)	1978/79	76	75	1.11	1.02	1.8	None	Irreg	A	+0.9	+3.2	30-34	None	3
Tunisia	1978	65	96	0.96	1.04	0.1	None	A	A	+3.7	+7.7	None	40-49	3
Asia & Pacific														
Jordan	1976	41	71	1.02	0.99	0.0	None	None	None	-0.4	+0.4	None	None	0
Syria	1978	61	94	1.04	1.10	0.0	None	Irreg	A	+0.8	+1.3	30-34	None	3
Turkey	1978	(45)[8]	NA	NA	NA	NA	NA	A	NA	+5.2	+9.1	NA	NA	(2)
Yemen AR	1979	99	77	1.22	0.94	0.5	None	Irreg	B	NA	NA	None	45-49	(3)
Bangladesh	1975/76	77	14	1.00	1.00	0.7	None	None	B	+0.5	+1.1	None	None	0
Nepal	1976	95	27	1.21	1.00	1.2	None	A	B	+0.4	+1.1	30-34	None	3
Pakistan	1975	85	100	1.11	1.17	0.0	None	A	A	+2.7	+6.4	None	None	3
Sri Lanka	1975	16	100	1.13	1.17	1.7	None	None	None	+0.9	-0.9	None	None	1
Fiji	1974	13	100	1.05	1.01	6.6	None	None	A	+4.3	+9.5	None	None	1+
Indonesia	1976	52	59	1.09	1.07	2.3	None	None	A	+1.0	+2.8	None	None[7]	1
Korea, R of	1974	8	100	0.99	0.99	1.5	None	None	None	+1.4	+3.0	None	None	0
Malaysia	1974	20	100	1.01	1.02	0.2	None	None	None	+0.4	-0.1	None	None	0
Philippines	1978	4	99	0.97	1.09	2.8	None	None	A	+3.7	+5.6	None	None[7]	1
Thailand	1975	13	100	1.01	1.05	4.1	None	None	None	+0.7	+1.3	None	45-49	1
Americas														
Colombia	1976	12	100[11]	1.07	1.08	10.6	20-34, 40-49	A	A	+7.7	+8.6	None	40-49	4
Ecuador	1979	10	79	0.97	1.10	13.7	20-24, 45-49	A	A	+4.4	+4.5	None	45-49	4
Paraguay	1979	5	100	0.97	1.07	9.8	40-49	A	A	+13.1	+13.6	None	45-49	4
Peru	1977/78	22	100	1.10	1.09	12.9	None	A	A	+4.7	+3.9	None	None[7]	3
Venezuela	1977	12	100[11]	0.96	1.10	4.8	None	None	None	+8.5	+8.9	None[6]	None[6]	2
Costa Rica	1976	4	100[11]	1.08	1.15	14.8	20-49	A	A	+5.6	+8.9	None	40-49	4
Dominican Rep	1975	11	100	1.07	1.09	1.6	None	A	A	+13.8	+16.4	None	45-49	4
							20-39,							

Mexico	1976/77	17	100[11]	1.01	1.08	5.1	45-49	A	A	+4.2	+7.1	None	45-49	5
Panama	1975/76	4	100	1.09	1.10	9.0	None	None	A	+2.2	+0.4	None	None	2
Guyana	1975	1	85	1.06	1.06	2.5	None	None	Irreg	+3.5	+6.2	None	None[7]	2
Haiti	1977	66	100	0.96	1.19	0.1	None	A	A	-0.6	+2.3	None	45-49	3
Jamaica	1975/76	0	53	1.14	1.14	14.5	35-39, 45-49	B	A	-0.7	-3.0	None	35-49	3
Trinidad & Tobago	1977	1	100	0.99	1.11	2.0	None	None	None	+0.3	-1.1	None	None	1
Europe														
Portugal	1979/80	2	100	1.05	1.16	4.6	None	B	B	+4.3	+5.0	None	None	2

[1] Indices measure heaping on duration or calendar year ending in 0 and 5. If there is no heaping, the index should be 1.0.

For duration: Index = $\Sigma_{i=5,10,15,20,25} \frac{x_i}{(x_i-2)+(x_i-1)+(x_i)+(x_i+1)+(x_i+2)}$

where x_i and $x_i \pm$ or - 1,2= number of women with that duration of marriage of i or i $\pm$ 1 or 2.

The index for calendar years is similar, heaping on years 50, 55, 60, 65 and 70 being considered for surveys which took place before 1977, and years 55, 60, 65, 70 and 75 for surveys in 1978 or later.

[2] Age groups with a gap of less than one year between the median age at first birth, and the median age at first marriage.

[3] Trend in median age at first marriage, for different age-groups: None=systematic increase from older to younger groups; A = U-shaped trend; B=continuous decline; Irregular=more than one rise and decline. Small differences are ignored.

[4] The mean per cent between the two sources, for all age-groups, and for the two youngest age-groups only.

[5] Understated= rise in proportion ever-married from older to younger groups, at most of the 4 ages shown in table II.

Overstated = approximately same level for other three age-groups, and noticeably higher proportion for this age-group, at most of the four exact ages shown in table II.

[6] Data only available up to age 40-44.

[7] These countries showed a small understatement of age-group 45-49, but this was a consistent and stable difference at all ages, and may therefore be a real change over time.

[8] Per cent illiterate among 25-34 year olds; per cent for 15-24 group is 34; source= First Country Report, Vol 1, p 46.

[9] See text for method of construction. Indices in brackets are incomplete because of some data being missing. They may be higher than the value indicated, but not lower.

[10] Senegal used intensive probing in household interview, with an age-event-chart, and confirmed these dates with respondents during individual interview: all dates were recorded as calendar years, though they may have been supplied in different forms.

[11] This is after inputation within the country. The original form of recording dates is not available.

American and Caribbean region, and Kenya alone in Africa, also have two or more five-year age groups with an average difference of less than 12 months between the median ages at first birth and first marriage. While a high incidence of negative or short first birth intervals implies some omission of early unions, it would also be true to say that in these societies, some proportions of births do occur from very brief relationships which may not be considered to be unions, either by the woman or by some minimum objective criteria of what is a union.

Table 10 shows median ages at first birth and first marriage for five-year age groups, and these trends are summarized in table 9 (columns 7 and 8). Less than half the number of countries (15) show the expected trend of either a continuous rise in the median age at first union or no change at all; these are mainly Asian and Pacific countries, and a few countries in the Middle Eastern and American regions. However, the majority of African and American countries show unexpected trends, typically a U-shaped trend, with a decline from the oldest age groups, followed by a rise to the youngest age groups. A small number of countries show an irregular trend with more than one dip and rise (Sudan, Syria, Yemen AR and Lesotho). Two cases only, Jamaica and Portugal, show continuous declines from the oldest to the youngest cohorts.

In general, a decline in the average age at entering first union is suspicious because the usual effect of increasing modernization in societies where female marriage is almost universal and early is to raise the status of women by increasing education, possibly by the provision of more non-traditional employment opportunities and by urbanization. These are all factors that would tend to increase age at the first union. A plausible explanation for U-shaped trend is that older women reported too high an age or too late a date for their first marriages because of the time elapsed since the event. Or they may have omitted early unions of brief duration; or again, where the age of the oldest child is used to date first marriage (as in Bangladesh, Thompson *et al* 1982) omission of first births who died could also produce this pattern. The fact that most of the countries with U-shaped trends are in Africa and Latin America, where consensual and visiting unions occur, lends some support to the second argument. In at least two cases, however, Jamaica and Portugal, it can be argued that recent social changes did lower the age at first union/marriage, although in the case of Jamaica, this is probably only a partial explanation.

If age at first birth was better reported, then it is likely that its trend would differ from that of first marriage in surveys where the latter is poorly reported. The high incidence of pre-marital births suggests that the two sets of events were indeed independently recorded, ie interviewers did not typically estimate age at first union from age at first birth. Comparison of the summary codes in table 9 shows that 13 cases changed, about half from the acceptable status of 'none' (continuous rise or no change in age at first marriage), to a U-shaped, irregular or continually declining trend in age at first birth, and the rest from U-shaped or irregular trends in age at first marriage to continuous decline or U-shaped trends in age at first birth. Fifteen cases with U-shaped trends in the age at first marriage also had U-shaped trends in age at first birth, and the same situation of stability was observed for 10 cases with irregular, continuous rise or level trends. Thus two-thirds of the cases had the same trend in both measures. Even more surprising is the lack of change in the majority of countries with U-shaped trends. If age at first marriage was incorrectly reported and age at first birth was better reported, we would expect the trend for first birth to approximate the continuous rise or no change patterns, but instead it typically remains U-shaped.

The persistence of the U-shaped pattern for both age at first birth and at first marriage, across so many countries, strongly suggests systematic error in both measures. The age at first birth is to be slightly preferred, however, because its U-shaped pattern is less pronounced. Moreover, the reporting of a substantial number of pre-marital births and conceptions argues that age at first birth was, to some extent, reported independently of age at first marriage. In addition, for some countries where fertility rises have been documented (for various reasons, eg eradication of epidemic diseases such as malaria, decline in venereal diseases, improvements in public health systems), there has occasionally also been an increase in the proportion who become mothers (eg in some Caribbean countries and Cameroon). This makes a decline in the median age at first birth more plausible for these countries. This last factor would have a limited role, however, applying only to a subset of countries which had marked fecundity changes. In general, the arguments for preferring age at first birth are especially strong in countries where informal unions are frequent; they become somewhat weaker where the first marriage defines the start of exposure, and is an event of great significance, which is likely to be recalled accurately. In the latter case, age at first birth may itself suffer from greater problems of recall, compared to age at first marriage (eg in cases where a change from a code of 'none' to a code of 'A' occurred, from first marriage to first birth, as shown in table 9, columns 7 and 8). However, even in cultures where marriage is a highly significant event in the woman's life, the frequent confusion of the date of formal marriage and the date of cohabitation (where these differ and both are not obtained) may make age at first birth the preferred measure for estimating first exposure.

About two-fifths of all countries (16) show little or no problems from these four aspects of the quality of data on age at first birth and age at first union. There are low proportions with negative or short first birth intervals, with no reversal in age at marriage, combined with no reversal, or a reasonably plausible U-shaped trend, in age at first birth. More than half of these were Asian and Pacific countries.

3.5 TRENDS IN THE PROPORTIONS EVER MARRIED BY EXACT SPECIFIED AGES

A more exact test of the correctness of the trend in proportions ever married, as recorded by the surveys, is to analyse the cumulative proportions married by single years of age, for five-year cohorts of women. We

Table 10 Comparison of median age at first union and median age at first birth, for five-year age groups

		15-19	20-24	25-29	30-34	35-39	40-44	45-49
Africa								
Benin	AGFM	18.3	18.4	18.1	18.0	18.0	18.6	19.4
	AGFB	-	19.9	19.6	19.4	19.3	20.0	20.6
Cameroon	AGFM	17.1	17.1	16.9	16.6	17.4	17.0	18.3
	AGFB	18.8	18.8	19.3	19.2	20.2	20.5	21.3
Ghana	AGFM	18.6	18.2	18.3	18.0	17.9	18.2	18.3
	AGFB	-	19.5	19.9	19.9	19.6	20.2	20.4
Ivory Coast	AGFM	17.2	17.2	17.4	17.0	17.4	17.7	17.6
	AFFB	18.4	18.4	18.8	18.7	19.2	19.5	19.7
Kenya	AGFM	-	18.5	18.1	17.5	17.5	17.7	18.5
	AGFB	-	18.9	18.8	18.6	18.8	19.5	20.4
Lesotho	AGFM	18.6	18.7	18.9	18.5	18.8	18.7	18.3
	AGFB	-	20.6	20.9	20.4	20.9	21.3	20.9
Nigeria	AGFM							
	AGFB							
Senegal	AGFM	16.7	16.7	16.3	15.6	15.6	15.6	16.1
	AGFB	18.5	18.7	18.6	17.6	17.7	18.0	18.6
Egypt	AGFM	-	19.5	18.8	17.5	16.9	16.9	16.6
	AGFB	-	21.9	21.3	19.6	19.2	19.3	19.2
Mauritania	AGFM	19.0	16.3	15.2	14.8	14.7	14.6	15.4
	AGFB	-	19.5	18.8	18.3	18.9	20.0	20.3
Morocco	AGFM	-	19.6	18.4	16.9	15.9	16.2	15.7
	AGFB	-	21.8	20.8	19.7	18.9	19.2	19.2
Sudan (N)	AGFM	-	18.6	17.0	15.7	16.2	15.9	16.2
	AGFB	-	21.2	19.4	18.8	19.7	20.1	21.1
Tunisia	AGFM	-	23.3	20.8	19.2	18.8	19.1	19.4
	AGFB	-	-	22.8	21.2	21.2	21.5	22.1
Asia & Pacific								
Jordan	AGFM	-	19.4	18.3	17.5	17.5	17.2	16.7
	AGFB	-	20.9	19.8	19.3	19.6	19.6	19.3
Syria	AGFM	-	20.0	19.3	18.4	19.0	19.2	18.7
	AGFB	-	21.8	21.2	20.4	21.2	21.3	21.6

Table 10 (*cont*)

		15-19	20-24	25-29	30-34	35-39	40-44	45-49
Turkey	AGFM	-	19.3	18.8	18.2	17.6	18.1	18.1
	AGFB							
Yemen AR	AGFM	16.0	16.2	16.1	15.2	15.8	15.4	16.0
	AGFB	-	19.5	19.9	19.8	20.5	22.1	22.9
Bangladesh	AGFM	15.0	13.4	13.1	12.5	12.5	12.4	12.4
	AGFB		16.8	16.5	16.5	16.8	17.0	17.4
Nepal	AGFM	16.8	15.8	15.2	15.0	15.6	15.6	15.8
	AGFB	-	20.2	19.8	20.0	20.6	20.9	21.0
Pakistan	AGFM	18.2	16.8	16.5	15.9	15.5	14.8	15.3
	AGFB	-	20.2	19.9	19.3	19.3	18.3	18.8
Sri Lanka	AGFM	-	-	23.0	20.4	19.8	19.2	18.2
	AGFB	-	-	24.8	22.2	21.4	20.9	20.7
Fiji	AGFM	-	20.3	19.5	18.5	18.3	17.9	17.8
	AGFB	-	22.0	20.9	20.1	19.8	20.0	20.2
Indonesia	AGFM	18.2	17.2	16.1	15.9	15.6	15.5	15.6
	AGFB	-	19.8	19.4	18.8	19.1	19.5	20.2
Korea, R of	AGFM	-	23.0	22.8	21.8	20.3	18.5	17.1
	AGFB	-	-	23.9	23.3	22.1	21.2	19.9
Malaysia	AGFM	-	21.8	20.9	19.4	18.1	17.9	16.9
	AGFB	-	23.2	22.3	21.0	20.1	19.7	19.7
Philippines	AGFM	-	-	21.8	21.2	20.6	20.2	20.5
	AGFB	-	-	23.3	22.5	21.7	21.5	22.2
Thailand	AGFM	-	20.9	20.4	20.1	19.8	19.5	19.8
	AGFB	-	22.8	22.1	21.6	21.6	21.8	21.7
Americas								
Colombia	AGFM	-	21.0	20.7	20.2	19.8	20.7	20.9
	AGFB	-	21.7	21.3	20.9	20.8	21.4	21.8
Ecuador	AGFM	-	20.7	20.5	19.8	19.8	19.4	20.0
	AGFB	-	21.4	21.5	20.9	20.8	20.5	21.9
Paraguay	AGFM	-	21.0	20.6	20.7	20.3	19.6	20.3
	AGFB	-	22.1	21.6	21.7	21.4	20.5	21.1
Peru	AGFM	-	21.8	20.6	20.1	19.8	20.0	20.3
	AGFB	-	-	23.0	21.4	21.3	21.0	21.9

Table 10 (*cont*)

		15–19	20–24	25–29	30–34	35–39	40–44	45–49
Venezuela	AGFM	-	20.7	19.9	19.6	19.0	18.9	NA
	AGFB	-	21.9	21.2	21.0	20.5	20.4	NA
Costa Rica	AGFM	NA	21.5	21.7	21.2	21.1	21.1	21.8
	AGFB	NA	22.0	22.2	21.3	21.3	21.2	22.2
Dominican Rep	AGFM	-	18.8	17.9	18.2	17.9	18.0	18.8
	AGFB	-	20.8	19.8	19.7	19.7	19.8	20.4
Mexico	AGFM	-	20.4	20.1	19.7	19.6	19.3	20.0
	AGFB	-	21.1	20.8	20.4	20.3	20.3	20.9
Panama	AGFM	NA	20.5	19.9	19.5	19.3	18.9	18.9
	AGFB	NA	21.6	21.1	20.5	20.4	20.0	20.3
Guyana	AGFM	-	18.7	18.4	17.8	17.8	17.6	17.9
	AGFB	-	20.9	20.4	19.4	19.8	19.3	19.8
Haiti	AGFM	-	20.4	19.8	19.8	19.9	19.4	20.9
	AGFB	-	23.3	22.5	22.4	22.5	21.5	23.5
Jamaica	AGFM	-	17.4	17.8	17.7	18.6	19.4	20.2
	AGFB	-	19.1	19.2	18.8	19.3	20.7	20.8
Trinidad & Tob	AGFM	-	19.3	19.2	18.8	18.4	17.7	17.8
	AGFB	-	23.1	22.1	21.4	20.9	20.0	20.2
Europe								
Portugal	AGFM	-	22.5	22.6	22.9	23.0	23.5	23.7
	AGFB	-	23.9	24.3	24.5	24.7	25.1	25.3

extracted from such tables the proportions ever married by ages 17, 19, 21 and 23, for the four older age groups (see table 11). These age groups were chosen because they are the most likely to suffer from omission of early unions or misstatement of age at first marriage, and the particular single years of 17, 19, 21, 23 were chosen as representative of the age range during which most women marry. To summarize these results, we take a similar approach to that used for analysing the trend in the median age at first union: a consistent rise in the proportion ever married or a stable proportion are considered acceptable, but a consistent decline or a decline followed by a rise probably indicates reporting error. Cases where a trend suggesting misreporting are found at young ages (eg by age 17 or 19) but where this trend disappears or is attenuated by older ages (21 or 23) further support the argument that older women have dated the first union at too high an age.

This pattern, where a trend of increasing proportions ever married is either greatly reduced or disappears, comparing single years of age from age 17 to age 23, is found in Benin, Ivory Coast, Senegal, Mauritania, Colombia, Costa Rica, Dominican Republic and Jamaica and, to a small extent, in Tunisia, Thailand, Ecuador, Paraguay and Mexico. It suggests that overstatement of the age at first union by older age groups occurred. In some other countries, although a rise in the proportion ever married occurs, it remains fairly consistent across all the ages shown here (17 to 23), suggesting that either a real increase in the proportion ever married had occurred over time, or that older women severely misreported their age at first union, so that even by age 23 the proportion had not evened out. We agree with the first interpretation, given that these patterns usually involve only moderate changes (Indonesia, Peru, Philippines and Guyana). However, in Haiti the increase is quite large, about 12 per cent from the 45–49 to the 40–44 age group, and although this difference is consistent at all ages (17, 19, 21 and 23), the low proportion ever married among 45–49 year olds, even by age 23 (64

Table 11 Trends in per cent ever married by specific ages, 17, 19, 21 and 23

	Percent Married at Age 17				Percent Married at Age 19				Percent Married at Age 21				Percent Married at Age 23			
	30-34	35-39	40-44	45-49	30-34	35-39	40-44	45-49	30-34	35-39	40-44	45-49	30-34	35-39	40-44	45-49
Africa																
Benin	37	34	25	20	63	62	55	46	78	77	73	70	86	87	85	78
Cameroon	55	46	50	39	73	65	67	55	85	79	78	70	91	86	82	76
Ghana	36	40	35	35	62	64	58	61	78	79	76	79	88	87	84	88
Ivory Coast	50	44	41	40	71	68	64	67	83	83	78	79	90	90	86	86
Kenya	44	44	42	32	66	66	63	56	83	83	80	76	91	90	89	87
Lesotho	26	23	29	30	56	53	54	58	78	76	75	80	85	84	84	92
Nigeria																
Senegal	73	72	68	64	86	85	82	80	94	93	92	91	96	96	96	95
Egypt	45	51	52	54	63	70	69	70	75	81	82	84	84	87	88	89
Mauritania	68	73	69	60	78	81	76	70	85	87	85	82	88	91	90	85
Morocco	51	63	61	65	71	80	78	82	83	89	89	91	90	95	94	95
Sudan (N)	61	57	63	57	76	71	72	72	85	81	82	81	91	86	87	87
Tunisia	27	31	32	28	48	52	49	46	66	70	66	64	76	80	80	77
Asia & Pacific																
Jordan	45	45	49	53	63	65	66	73	76	81	82	82	83	88	88	89
Syria	36	29	31	35	55	49	48	52	70	65	67	65	78	76	78	77
Turkey																
Yemen AR	66	60	64	58	76	73	73	70	85	83	83	80	89	89	89	85
Bangladesh	97	93	96	95	99	97	98	97	99	98	99	98	100	99	99	99
Nepal	68	63	64	63	81	77	76	76	89	87	86	86	95	92	93	91
Pakistan	61	66	75	72	75	83	87	84	86	89	90	94	90	92	93	96
Sri Lanka	25	31	31	34	40	44	48	50	54	58	64	67	62	69	77	77
Fiji	33	38	41	42	57	58	57	60	73	73	75	74	84	84	87	86
Indonesia	64	65	67	65	79	81	83	81	88	89	91	89	93	93	95	93
Korea, Rep of	3	8	27	48	16	31	58	80	40	62	78	91	65	83	91	96
Malaysia	30	40	39	51	47	58	64	68	61	70	76	81	72	80	83	88
Philippines	15	16	18	16	33	35	39	36	49	53	57	55	63	66	70	67
Thailand	17	17	18	18	39	41	45	41	61	60	68	63	71	76	79	82
Americas																
Colombia	23	25	20	19	41	43	37	34	56	59	52	51	69	67	66	63
Ecuador	26	29	29	24	44	44	48	43	58	60	62	60	71	73	74	71
Paraguay	18	19	23	18	37	38	44	39	52	56	62	55	64	69	73	69
Peru	22	24	23	22	40	43	40	39	56	60	60	57	68	69	72	68
Venezuela	31	30	28	NA	46	50	51	NA	59	64	66	NA	74	77	76	NA
Costa Rica	16	19	16	13	33	35	33	26	49	49	50	43	62	60	63	57
Dominican Rep	34	38	42	30	61	60	61	52	75	77	76	69	83	86	83	81
Mexico	26	28	27	28	43	45	47	44	59	60	63	58	71	71	72	70
Panama	26	27	31	33	44	48	51	51	62	63	66	63	74	76	76	77
Guyana	41	41	42	38	63	62	64	61	79	79	77	78	90	87	86	85
Haiti	24	29	30	15	44	44	45	34	58	57	62	51	72	71	76	64
Jamaica	37	31	24	23	65	54	46	39	82	71	68	58	88	83	77	75
Trinidad & Tob	31	35	41	42	52	56	62	60	68	73	76	75	78	81	83	83
Europe																
Portugal	4	3	2	3	13	12	11	12	31	29	28	26	51	50	46	44

per cent), suggests that misreporting in this country may have persisted to a higher age than usual. This table adds to the previous discussion based on medians, because medians cannot show the patterns of change across single years of age.

Another way of looking at these results is to identify age groups which probably suffered from understatement or overstatement of age at first marriage, taking into consideration the above discussion on stability or change in the pattern across the four selected ages (17, 19, 21 and 23). Identification of understatement of the proportion ever married is straightforward, but decisions on overstatement are more subjective. Where all age groups but one show approximately the same proportion ever married, and one age group is noticeably higher, consistently across at least three of the selected ages (17, 19, 21 and 23), we classify this age group as having overstated proportions ever married, and their age at the first marriage will be understated. We enter these age groups into columns 11 and 12 of table 9, as a summary index of table 11.

Overstatement is apparently very limited in occurrence. Only three countries exhibit this type of reporting error, Sudan, Syria and Nepal, and in all three cases, it is the age group 30–34 which showed higher proportions ever married in combination with approximately stable proportions for age groups 35–49. In contrast, understatement of the proportion ever married is much

Table 12 Comparison of per cent ever married in the survey with per cent ever married in the most recent census, matching census year with retrospective survey data

Country	Source	Year	At age					
			15-19	20-24	25-29	30-34	35-39	40-44
Africa								
Benin	Census							
	Survey	1981/2						
Cameroon	Census	1976	45.6	80.2	90.8	93.9	94.9	95.4
	Survey	1978	48.3	85.0	96.0	97.4	98.7	98.3
Ghana[1]	Census	1971	31.8	84.0	96.5	98.6	99.1	99.3
	Survey	1979/80	37.5	85.2	96.2	98.4	99.8	99.4
Ivory Coast	Census	1975	49.5	81.3	90.0	93.0	94.0	94.4
	Survey	1980/1	49.3	87.1	95.7	98.4	99.4	99.7
Kenya[6]	NDS	1977	29.0	78.0	94.0	97.0	98.0	99.0
	Survey	1977/80	28.0	79.0	96.0	99.0	99.0	99.0
Lesotho	Census	1976	29.5	80.6	91.4	94.7	95.9	96.3
	Survey	1977	32.1	82.2	93.1	94.7	97.4	97.7
Senegal[1]	Census	1970	43.4	85.4	97.6	99.3	99.7	99.4
	Survey	1978	57.8	93.9	98.6	99.2	99.5	97.0
Egypt[1]	Census	1976	21.8	61.1	86.0	92.9	95.3	95.1
	Survey	1980	29.9	68.2	90.2	97.5	97.4	98.3
Mauritania	Census	1977	48.3	80.3	91.5	94.6	96.6	96.3
	Survey	1980/1	46.3	78.7	87.8	93.6	96.5	93.3
Morocco	Census	1971	29.8	79.6	94.0	96.9	97.7	97.6
	Survey	1980	38.2	84.3	97.2	99.2	99.6	99.0
Sudan (N)	Census	1973	43.1	84.9	95.4	97.3	98.2	98.2
	Survey	1978/9	50.7	83.7	94.7	97.3	98.7	97.5
Tunisia	Census	1975	6.2	48.5	82.7	94.2	97.4	98.3
	Survey	1978	12.6	57.5	86.3	96.6	97.9	98.4
Asia & Pacific								
Jordan[1]	NFS	1972	30.5	73.0	92.9	96.4	97.4	98.2
	Survey	1976	31.3	73.1	90.8	96.0	97.1	97.9
Syria	Census	1976	25.5	63.2	84.5	92.2	95.8	97.0
	Survey	1978	26.4	64.9	85.3	93.7	95.7	97.3
Turkey[1]	NFS	1970	24.2	78.7	93.4	93.4	96.7	96.8
	Survey	1978	38.5	82.7	96.8	98.0	98.5	99.9
Yemen AR[1]	Census	1975						
	Survey	1979	57.5	86.7	96.4	97.7	97.2	98.7
Bangladesh[7]	Census	1974	75.5	96.8	99.1	99.4	99.6	99.6
	Survey	1975/6	78.7	95.8	99.5	99.6	99.6	99.7
Nepal[1],[2]	Census	1971	60.7	92.1	97.4	98.6	98.9	99.1
	Survey	1976	63.5	91.6	97.5	98.7	99.3	98.7

Table 12 (*cont*)

Country	Source	Year	At age					
			15-19	20-24	25-29	30-34	35-39	40-44
Pakistan[1]	Census	1972	34.4	78.7	92.8	96.4	97.9	98.5
	Survey	1975	44.3	81.7	94.3	97.2	98.6	99.0
Sri Lanka[1]	Census	1971	10.5	46.6	75.2	89.0	94.1	95.3
	Survey	1975	11.7	43.6	76.3	91.7	96.0	96.0
Fiji	Census	1966	16.8	68.4	89.2	94.4	95.8	96.5
	Survey	1974	25.7	78.5	91.0	95.7	98.1	97.8
Indonesia[1]	Census	1971	43.0	85.2	96.3	98.3	98.8	98.9
	Survey	1976	47.9	85.9	96.2	97.9	99.1	99.3
Korea, R of	Census	1970	2.9	42.8	90.3	98.6	99.3	99.8
	Survey	1974	3.3	45.9	91.9	99.0	99.6	99.3
Malaysia[1]	Census	1970	16.1	57.0	86.2	94.4	96.7	98.1
	Survey	1974	16.9	60.4	86.9	94.7	97.5	99.4
Philippines[1]	Census	1970	10.8	49.6	78.5	88.2	91.9	-
	Survey	1978	15.9	55.8	82.0	90.3	93.6	-
Thailand[1]	Census	1970	19.0	62.1	84.4	91.9	94.8	96.1
	Surrey	1975	20.7	63.1	84.7	92.3	95.2	96.7
Americas								
Colombia[1]	Census	1973	13.5	48.8	70.9	80.0	83.2	84.1
	Survey	1976	20.6	58.9	80.1	86.0	88.5	92.5
Ecuador[1]	Census	1974	19.5	59.3	78.7	85.7	88.0	88.5
	Survey	1979	25.9	61.9	83.1	91.2	91.8	92.5
Paraguay[1]	Census	1972	11.7	45.1	68.8	78.9	81.4	81.3
	Survey	1979	22.1	62.0	80.6	91.9	94.2	95.0
Peru[1]	Census	1972	17.0	55.5	77.7	86.0	88.9	89.4
	Survey	1977/8	19.6	60.7	82.4	91.0	94.0	94.8
Venezuela[1,5]	Census	1971	16.1	49.3	72.0	80.3	82.3	-
	Survey	1977	21.9	61.3	83.8	86.1	89.3	-
Costa Rica	Census	1973	15.1	51.3	73.5	82.3	85.2	85.8
	Survey	1076	29.7	54.5	78.2	85.5	84.8	92.4
Dominican Rep[1]	Census	1970	22.3	60.8	83.1	84.6	83.5	83.9
	Survey	1975	34.8	81.2	92.6	96.4	99.6	96.4
Mexico[1]	Census	1970	21.2	61.5	82.6	89.6	92.2	92.7
	Survey	1976/7	28.1	68.9	86.4	92.6	94.4	94.5
Panama	Census	1970	26.6	66.5	84.9	91.2	93.2	93.4
	Survey	1975/6	24.1	69.9	88.1	93.2	96.3	97.4
Guyana[1,3]	Census	1970	19.4	65.1	88.3	92.7	94.4	93.7
	Survey	1975	24.9	72.1	92.7	94.1	95.2	95.4
Haiti[1,4]	Census	1971	5.5	37.8	66.3	76.9	79.7	76.8
	Survey	1977	8.6	39.4	66.4	76.5	75.8	72.8

Table 12 *(cont)*

Country	Source	Year	At age					
			15-19	20-24	25-29	30-34	35-39	40-44
Jamaica[1,3]	Census	1970	25.0	57.0	76.0	83.0	87.0	88.0
	Survey	1975/6	24.0	52.0	77.0	84.0	89.0	86.0
Trinidad & Tob[1,3]	Census	1970	17.5	52.1	79.6	89.3	92.0	92.4
	Survey	1977	13.9	53.4	80.8	88.3	94.1	94.1
Europe								
Portugal	Census	1970	5.3	39.3	75.0	85.0	87.5	87.4
	Survey	1979/80	8.0	46.6	79.8	88.6	90.8	91.4

Footnotes

1 Results from evaluation reports published (or drafts to be published) in the WFS Scientific Report Series, or in country monographs (Pakistan), or in other scientific reports (Sri Lanka, Thailand, Colombia).

2 Proportions derived from age at cohabitation, not age at marriage.

3 Proportions ever-married or ever in common-law unions, to match census definitions, ie, visiting unions are omitted.

4 Proportions ever-married or ever in 'placée' unions, to match census definitions.

5 Proportions single/separated, to match census definition.

6 Results taken from the First Country Report.

7 Census data from National Academy of Sciences, Committee on Population and Demography, "Estimation of recent trends in fertility and mortality in Bangladesh" Report No 5.

more frequent. In most countries it occurs for the oldest age group (45–49) only, with 8 cases, or for the two oldest age groups (40–44 and 45–49), with 7 cases, or for the group aged 40–44 only, with 1 case. This is true of 16 cases out of the 18 cases with understatement. In 2 other cases, Cameroon and Jamaica, understatement occurred at ages 35–49, and in data not shown here, persists at even younger ages. We omit the 4 cases which had a rise in the proportion ever married, from age 45–49 to 40–44, because this increase remained approximately the same at all four selected ages. This persistence suggests that the trend could well be real. The greater frequency of understatement among black African, Latin American and Caribbean countries, where informal unions occur, seems plausible. Cases of understatement which do not fit the hypothesis of omission of early informal unions are Mauritania, Tunisia, Yemen AR and Thailand, where the existence of poorer quality retrospective data may be due to the extremely low level of education of older women, together with the wording of questions or interviewing problems.

Nearly half of the countries (18) had neither overstatement nor understatement errors, judging from this test. These include most Asian and Pacific countries, and a smaller proportion of countries within other regions. The possibility of very sharp declines in the proportion ever married, which occurred for some of these countries, disguising some understatement by the oldest age group, cannot however be completely dismissed.

3.6 COMPARISON OF SURVEYS AND EXTERNAL SOURCES

Comparison of survey results with an external data source, whether census or survey, is one of the more important tests of data quality, and is an essential part of the detailed evaluation reports. These reports compare both the proportion ever married and the distribution by marital status with the findings of the external source. Here we show only the more simple of the two comparisons, for the proportion ever married. Where evaluation reports or drafts were available, their results are quoted, and in other cases, a variety of sources were used for obtaining the data from the closest census or from some other recent survey. In all cases, the method of compari-

son is the same. Survey proportions ever married at the date of the external source are reconstructed from the marriage history, to give an exact comparison (see table 12). For samples of ever-married women, single-year proportions ever married are taken from the household data, and applied to the sample of women in the individual survey.

One common test of quality is that the proportion ever married should rise continuously or stabilize, but should not dip at the last age group (here, 40–44 year olds). A dip in the WFS survey data of over one per cent is found in six cases (Senegal, Mauritania, Sudan, Dominican Republic, Haiti and Jamaica), and among the external data sources, in only one case (Haiti). This difference could well be due to the reconstruction: age group 45–49 is known to suffer from this dip frequently, because of omission, misreporting or selectivity, and and it is this group which becomes age 40–44, five years before the survey, while the actual age group 40–44 is present for the external source. A further reason may well be selectivity for young marrying women in the transference of 45–49 year olds to age 50 or higher.

The overall level of proportions ever married is plausibly high. WFS surveys in almost all countries showed that over 90 per cent of women had married by age 30–34, the exceptions being Colombia, Venezuela and Portugal (omitting the Caribbean for which a restricted definition was used, to be comparable with the census). As an indication of the direction of differences between the two sources, we find nine cases where the external source shows 85–89 per cent ever married at age 30–34. The general pattern is for WFS surveys to find higher proportions ever married than do the external sources. One plausible argument supporting the quality of the WFS surveys is that by interviewing the women themselves and by using more probes, as well as a complete marriage history, and by widening the definition of marriage to include informal unions, these surveys obtained more accurate information that is usually gained from the short census questionnaire, usually answered by male heads of household. One argument against the quality of WFS retrospective data on proportions ever married is that errors in reporting the age of the respondent can interact with correct reporting of the time of first marriage, in the form of years ago or duration, to inflate the proportions ever married at young ages, 15–19 and 20–24, at periods 10 years or more before the survey. Thus a woman actually aged 40, but reporting herself as 35, and reporting correctly that she has been married for 20 years, will appear to have begun the first union at age 15–19, 20 years before the survey. On the other hand, most women marry at the age range of 15–24, and differential errors of reporting between the two sources will show up mainly at these ages, making it difficult to identify which source is incorrect.

We present in table 9 two summary indices based on table 12, the average per cent difference between the two sources for age groups 15–19 and 20–24, and for all represented age groups (columns 9 and 10 of table 9). Given that most external sources are five or more years earlier than the WFS survey, at least one age group will be lost in the reconstruction, and typically six age groups are represented, 15–44.

Almost without exception, the average differences are positive: the proportions ever married from surveys are higher than those from the external sources. Differences in the four Caribbean countries should be ignored because of the definitional issue (see below) and otherwise only four cases of small negative differences, in one or both indices, occur, Mauritania and Jordan being the only countries with a negative difference across all represented ages, −1.9 and −0.4 per cent respectively. In four Latin American countries, this overall average difference is quite high (8–13 per cent), but the more typical difference is 3–5 per cent which is found in 13 countries, mainly Latin American and African. In the remainder, 16 out of the total of 33 countries under consideration (omitting the four Caribbean countries, and the four countries for which no external data are available), the difference is within 2 per cent of 0. The large differences in Latin America and the Caribbean are plausible because of the high probability that censuses will omit some informal unions.

The comparison of the average per cent difference for the age groups 15–19 and 20–24 with the overall difference is a useful test of whether the two sources differ mainly at young ages. In 9 countries, the two youngest age groups actually have a smaller difference than all ages together, while in 11 more cases, there is only a small positive difference of less than 2 per cent. In 12 more countries, the difference is 2–3 per cent, which is moderately significant. Only in a few cases is the difference about 4 per cent (Tunisia, Turkey and Pakistan) or greater (8 per cent in Senegal).[3] It is interesting to note that some of the countries with quite large differences between the two sources at young ages have equally large differences at all ages, especially in Latin America. Here it seems that a wider definition of marriage in the surveys could well be the explanation for the large, even differences.

In the surveys in Guyana, Jamaica and Trinidad and Tobago, a wider definition of unions was used, compared to the census: the 1960 census did not ask about 'visiting' unions at all, and the 1970 census obtained only a small proportion of women of this status. As a result, the data from these surveys are substantially superior to the censuses, because of the more complete coverage of visiting unions. This cannot be seen in the data presented here, because of the matching of definitions, but data evaluations of each survey show this (Balkaran 1982; Hunte 1983; and Singh 1982). Reproduction within this non-cohabiting type of union is frequently close to and occasionally higher than that within the two types of cohabiting union, consensual and married unions.

The data presented in table 12 are for the external source which is closest in time to the year of the survey. It has been argued, however (Coale 1983; Makinson 1984) that comparison with earlier sources, eg ten or more years before the survey, shows much larger differences in the proportion ever married, at ages 15–19 and 20–24 especially. Plausible explanations for this widening differential have been suggested. Overstatement of the age of young women in censuses, if they are married or have children, and understatement of the age of

[3] The total is 37 countries, omitting only the 4 for which data are missing.

Table 13 Comparison of proportions ever married between survey and external source, for two or more points in time

Country/ year of survey	Source	Year of recon-struction	At age 15-19	20-24	25-29	30-34	35-39	40-44
Egypt 1980	Survey	1960	50.7	85.6	94.4			
	Census	1960	34.0	77.1	93.3			
	Survey	1976	29.9	68.2	90.2	97.5	97.4	98.3
	Census	1976	21.8	61.1	86.0	92.9	95.3	95.1
Lesotho 1977	Survey	1966	32.6	82.1	94.0	96.4	97.8	
	Census	1966	22.0	79.2	92.4	95.6	96.5	
	Survey	1976	32.1	82.2	93.1	94.7	97.4	97.7
	Census	1976	29.5	80.6	91.4	94.7	95.9	96.3
Morocco 1980	Survey	1960	65.4	91.8	98.3	99.2		
	Census	1960	56.5	92.5	97.1	97.9		
	Survey	1971	38.2	84.3	97.2	99.2	99.6	99.0
	Census	1971	29.8	79.6	94.0	96.9	97.7	97.6
Senegal 1978	Survey	1960	75.4	95.4	99.0			
	Census	1960	62.8	90.1	97.9			
	Survey	1970	57.8	93.9	98.6	99.2	99.5	97.0
	Census	1970	43.4	85.4	97.6	99.3	99.7	99.4
Tunisia 1978	Survey	1966	25.4	76.5	93.3	97.0	98.0	
	Census	1966	19.0	73.0	91.3	96.1	97.6	
	Survey	1975	12.6	57.5	86.3	96.6	97.9	98.4
	Census	1975	6.2	48.5	82.7	94.2	97.4	98.3
Fiji 1974	Survey	1956	40.1	79.9	95.2	95.7		
	Census	1956	29.1	74.5	89.5	94.3		
	Survey	1966	25.7	78.5	91.0	95.7	98.1	97.8
	Census	1966	16.8	68.4	89.2	94.4	95.8	96.5
Indonesia 1976	Survey	1964	65.1	92.1	97.0	99.0	99.0	
	Census	1964	40.2	85.8	96.4	98.2	98.6	
	Survey	1971	47.9	85.9	96.2	97.9	99.1	99.3
	Census	1971	43.0	85.2	96.3	98.3	98.8	98.9
Jordan 1976	Survey	1961	45.6	84.5	94.7	97.7		
	Census	1961	28.0	73.3	88.8	94.4		
	Survey	1972	31.3	73.1	90.8	96.0	97.1	97.9
	Census	1976	30.5	73.0	92.9	96.4	97.4	98.2
Korea, R of 1974	Survey	1955	15.8	80.3	98.5			
	Census	1955	14.8	79.2	97.0			
	Survey	1960	7.1	69.9	97.3	99.2		
	Census	1960	8.4	68.4	97.3	99.6		
	Survey	1966	5.0	48.7	93.8	99.6	99.3	
	Census	1966	3.9	48.4	92.3	99.0	99.7	
	Survey	1970	3.3	45.9	91.9	99.0	99.6	99.3
	Census	1970	2.9	42.8	90.3	98.6	99.3	99.8

Table 13 (*cont*)

Country/ year of survey	Source	Year of recon-struction	At age 15-19	20-24	25-29	30-34	35-39	40-44
Malaysia 1974	Survey	1957	39.6	78.4	95.1	98.0		
	Census	1957	37.0	78.6	94.4	97.9		
	Survey	1970	16.9	60.4	86.9	94.7	97.5	99.4
	Census	1970	16.1	57.0	86.2	94.4	96.7	98.1
Pakistan 1975	Survey	1961	57.9	90.1	97.8	98.7		
	Census	1961	74.5	94.2	97.5	98.5		
	Survey	1968	51.6	84.9	95.4	98.3	99.3	99.2
	Census	1968	31.4	82.0	94.4	98.1	99.1	98.2
	Survey	1972	44.3	81.7	94.3	97.2	98.6	99.0
	Census	1972	34.4	78.7	92.8	96.4	97.9	98.5
Philippines	Survey	1960	22.7	67.1	84.2	89.1		
	Census	1960	12.7	55.7	80.5	88.4		
	Survey	1970	15.9	55.8	82.0	90.3	93.6	
	Census	1970	10.8	49.6	78.5	88.2	91.9	
Sri Lanka 1975	Survey	1953	36.9	70.9	88.9			
	Census	1953	24.3	67.5	89.4			
	Survey	1963	24.7	63.8	84.5	94.9	96.8	
	Census	1963	15.0	58.7	82.9	91.7	95.2	
	Survey	1971	11.7	43.6	76.3	91.7	96.0	96.0
	Census	1971	10.5	46.6	75.2	89.0	94.1	95.3
Syria 1978	Survey	1960	39.3	74.0	89.1	95.5		
	Census	1960	42.2	74.6	90.0	94.2		
	Survey	1970	32.9	73.5	88.4	94.8	96.5	99.0
	Census	1970	27.7	70.2	89.0	94.3	96.3	96.8
Thailand 1975	Surrey	1960	24.9	69.2	90.6	94.8		
	Census	1960	13.9	61.4	85.9	93.3		
	Surrey	1970	20.7	63.1	84.7	92.3	95.2	96.7
	Census	1970	19.0	62.1	84.4	91.9	94.8	96.1
Turkey 1978	Survey	1955	48.9	89.8				
	Census	1955	40.8	86.3				
	Survey	1960	50.3	90.0	97.1			
	Census	1960	32.9	85.8	95.3			
	Survey	1965	39.5	88.6	97.6	97.8		
	Census	1965	27.7	83.8	95.6	97.8		
	Survey	1970	38.5	82.7	96.8	98.0	98.5	
	Census	1970	20.2	87.0	87.0	97.8	97.8	
	NFS	1970	24.2	78.7	93.4	93.4	96.7	96.8
	Survey	1975	29.6	79.6	94.1	98.5	98.3	99.0
	Census	1970	21.9	76.0	93.3	96.6	97.9	97.9

Sources: United Nations, Demographic Yearbook 1979, Historical Supplement, and other publications cited in Footnote 1 of Table 12.

unmarried young women are believed to be common types of reporting error. This would cause the census proportion ever married at 15–19 to be too low, and probably to a lesser extent, the proportion ever married in the houschold survey. The net result will be a greater similarity between census and survey proportions ever married in the recent period than in earlier periods. This could be exaggerated by a different kind of reporting error, which can occur in retrospective data obtained by surveys: older women may have reported too young an age or too recent a date of birth, while giving the correct duration since their first marriage (or date or age at first marriage). Thus, their age at marriage is underestimated, and the proportions married at young ages appears too high. Both of these reporting errors have the effect of exaggerating any existing trend of a rising age at marriage, especially in the period just before the survey.

Table 13 shows comparisons for two or more points in time for those countries with a time series, and where informal unions are infrequent. Looking at age 15–19 only, we find several cases where the earlier external sources show increasingly lower proportions ever married, compared with the survey estimates (Egypt, Lesotho, Sri Lanka, Thailand, Indonesia, Jordan, Philippines and, to some degree, Pakistan and Turkey). These are slightly more than half of the countries shown in table 13, those with about the same reporting in the past as in recent period being Morocco, Senegal, Tunisia, Syria, Fiji, Korea and Malaysia. This is definitely an important type of reporting error, affecting a substantial proportion of Asian, Middle Eastern and probably African countries.

3.7 CONCLUSIONS

From the discussion of these few aspects of the quality of nuptiality data, some differences between regions have emerged. The comparative absence of severe errors in the Asian and Pacific region is countered by quite frequent problems in the black African and the Latin American and Caribbean regions, while the Arabic-speaking countries lie between these two extremes. The Latin American and Arabic-speaking groups of countries are more mixed in quality of the nuptiality data; a substantial minority have quite high quality data, while the rest are of much lower quality.

Although the overall level of education is not strongly related to the quality of nuptiality data, it is noteworthy that the only sub-Saharan African country with high quality data is Lesotho which also has quite a high level of education. Among the Arabic group also, there is some association between data quality and education, if we exclude Mauritania, where Koranic education was taken into consideration. The only two countries in the Asian region with poor quality data have the lowest levels of education (Nepal and Pakistan); and while Bangladesh may have been expected to have low data quality, its extremely low median age at marriage reduced the likelihood of our measures identifying some errors, eg in the trend in proportions married by specific ages 15–23. In Latin America, where the level of education is generally high, there is less of a correlation between data quality and education.

These summary data demonstrate that culture, in the sense of marriage and union patterns, are at least as important in determining the quality of nuptiality data as level of modernization, indicated here by educational attainment. This basic fact had been recognized by WFS from the start. The differences among countries in questionnaire design and use of probes, and in the use of wider definitions of union, or the specific questioning about the date of cohabitation, where this was later or earlier than the date of marriage, show the high level of awareness about culturally specific problems of obtaining accurate data on nuptiality. However, although efforts were made to deal with the problems, these results show that many difficulties remain. The comparison with external sources shows that in general WFS surveys succeeded in obtaining more comprehensive coverage of unions. However, the not insubstantial level of unacceptably short or negative first birth intervals, mainly in those countries where informal unions are common, points to the lack of success in obtaining a complete record of unions. One technique which may have helped in this regard is the recording of the names of fathers of each child, in the birth history, and the interviewer's use of these names to probe further in determining the union history. However, Haiti was the only country to do this, and its results support our suggestion: practically no negative first birth intervals were recorded and the mean number of unions increased systematically from younger to older women, unlike, say, the case of Jamaica.

In addition, the general problem of retrospective surveys obtaining poorer data in the distant past, seen in the lower quality of data for the 40–49 age group, remains a common occurrence. Even where educational attainment is now quite high, these older women would be substantially less educated than the 20–34 group, for whom we show the per cent with no schooling.

In general, the data for Asian and Pacific countries are usually of reasonable to high quality, while the Arabic-speaking group of countries suffer mainly from heaping of first marriage on rounded duration years, and from poor data for the oldest age group. Sub-Saharan Africa and the Latin American and Caribbean regions suffer from both of these problems, as well as from omission of early unions. Where the level of education is very low, it is difficult to see how some heaping, usually by duration, and poorer quality data for the distant past can be avoided. However, omission of early unions, and therefore to some extent heaping of the date of first union might have been reduced in Latin America and the Caribbean, if events in the birth and marriage histories had been specifically related to each other, and used for consistency checking of the dates in each history.

4 Assessment of the Fertility Data Collected in WFS Individual Surveys

By Noreen Goldman

4.1 INTRODUCTION

The most important component of the individual interviews in the WFS is the detailed birth history which provides the basic information on fertility levels and trends as well as on infant and child mortality. Although the actual format of the birth history section varied across countries, all surveys obtained the following information for each live birth: date of birth; sex of child; whether the child was still alive; and, if not, how long the child lived (or the child's age or date of death). In addition, all countries obtained some information on pregnancies that terminated in foetal mortality.

The recommended structure of the WFS questionnaire was first to obtain the total number of live births by a series of questions on the numbers of sons and daughters residing with and not residing with the respondent and the number of children who died. This information was to be reconciled with subsequent information from the birth history. Next, detailed information for each live birth (described in the first paragraph), beginning with the first child, was to be ascertained. Information on the date and outcome of non-surviving pregnancies was to be collected in a separate table. Only a quarter of countries adhered to this recommended format. About a third of countries used a single table, with questions on live births preceding those on other pregnancies for each live birth interval. The remaining countries used either a fully integrated pregnancy history, with information obtained on each pregnancy in chronological order, or a segmentation of pregnancies into more than two categories (eg living children, dead children, still births) with information obtained on all events of one type before information was collected from the next category. All countries except Haiti and Senegal collected information by the 'forward approach': interviewers began collecting information on the first birth and proceeded sequentially to the most recent birth (Singh 1984a).

Almost half of the WFS surveys (primarily those in Latin America and in Africa) administered the individual questionnaire to women of all marital statuses, most frequently to women aged 15–49. In the remaining countries, where non-marital fertility was thought to be negligible, the individual questionnaire was asked only of ever-married women.

The information from the birth history, together with the age of the woman, her marital status and her age at first marriage, constitutes the ingredients for calculating various measures of fertility used in the study of levels, trends and differentials. Past experience indicates that these data obtained through a retrospective survey of the WFS type are subject to errors of various forms. The high standards set by WFS should result in better quality data than typically obtained in the past, but this expectation in no way obviates the need for a detailed assessment of the quality of the data. Results of such detailed evaluations will not only alert analysts by identifying any defects in the data, but also may improve the design of future fertility surveys. Recognizing these needs, the WFS initiated a programme for evaluating the data from each country survey as soon as possible after the publication of the First Country Report. To assist the countries in this work, WFS sought to develop new methodologies and refine old ones by commissioning work from outside experts and from its own staff.

As was described in chapter 1, WFS also launched a programme of workshops to train the national staff in the relevant techniques of evaluation. Several groups of participants from four or five countries were invited to London for a period of several months to evaluate data from their respective countries. The participants worked in close collaboration with, and received formal training from, WFS staff and consultants. Since the first workshop in 1979, a total of six workshops were conducted, in which the participant from each country produced a document published in the *Scientific Reports* series, assessing the quality of data in a particular WFS survey.

The chapter which follows is essentially a summary of previously published analyses of WFS surveys. To a large extent the information presented here is based upon the country-specific assessments of data quality discussed above. Hence, the nature and frequency of the errors reported in this analysis for a particular survey are partly a function of the thoroughness of the analysis produced by the demographer responsible for assessing that survey. Data from these evaluations are augmented by other data drawn from WFS cross-national summaries (eg Goldman and Hobcraft 1982; Chidambaram *et al* 1980b; Singh 1984b), from *WFS Scientific Reports* not produced as part of the data quality programme (eg Hobcraft 1980; Alam and Cleland 1981), and occasionally from outside manuscripts (eg Coale 1983).

4.2 TYPES OF ERROR

The discussion below focuses on two types of error which can distort estimates of levels and trends in fertility: omissions of live births and displacement of dates of birth. Past experience has shown that although surveys frequently incorporate probe questions to assure a full count of vital events, respondents frequently fail to report all births (as well as all marriages or infant deaths), especially those which occur in the remote past. Such omissions may occur because of a lapse of memory, or more likely because of a misunderstanding of the intent of a questionnaire, eg in failing to report a child who left home. Since omissions are typically more

frequent in early periods, they may distort estimates of the trends in fertility as well as of the level of fertility.

Even in situations where a complete count of births is obtained, respondents may supply inaccurate birth dates for their children. Past experience has also shown that the extent of such displacement frequently increases with the age of the respondent (or the length of the time period of the events from the interview date). The outcome of these errors has often been an overestimate of a recent decline in fertility or an apparent decline when in fact fertility remained constant (Potter 1977a).

Although there is some attempt below to separate errors of omission of births from date misreporting, these two types of error often produce similar distortions in the birth history and hence cannot always be distinguished from one another. Moreover, these errors often cannot be distinguished from those of age misreporting of the respondent. For example, average understatement of age for a cohort will produce too low estimates of fertility in some periods and too high in others, as would certain types of displacement of dates in the fertility history. The extent of age misreporting in WFS surveys is reviewed in this report (chapter 2), but the reader should keep in mind that such errors may be largely responsible for some of the anomalies described later.

As is probably clear to any researcher who has attempted to evaluate the quality of survey data, the demographer is forced to assume the role of a detective. He or she searches for evidence of anomalies with a battery of tests in hand, but the best strategy for a particular dataset can never be clearly specified in advance. The demographic history of a country, the other data sources available, the nature of the questions included in the survey, etc all affect, or should affect, the analyst's approach to the dataset. The final conclusions are, unfortunately, often subjective ones, or at least open to question. Nevertheless, one of the goals of the data assessment programme at WFS was to define a set of tabulations which could be carried out for all or most surveys and which provided some information on the extent of errors in the surveys.

This chapter concentrates on two of the basic types of test which have been used to assess the extent of errors in the birth histories: (1) internal checks of consistency in the reporting of births, and (2) validation of the WFS data with data from other surveys, vital registration or censuses, wherever possible. As shown later, such validation is not always useful because census and vital registration data are frequently more inaccurate than the WFS data.

An additional mechanism for evaluating the quality of WFS data is the use of a post-enumeration survey (PES), ie a re-interview soon after the WFS survey, using the same or similar questionnaire and field procedures as in the original survey. Although the PES is not a basic component of the WFS surveys, a subsample of respondents was re-interviewed for several WFS surveys. Consistency of some of the fertility variables, eg children ever born, year of first birth, length of first and last closed birth interval, has been assessed by a matching of responses from the original survey with those from the re-interview. Results of these reliability studies for Fiji, Indonesia, Peru, Lesotho, and Bangladesh are described in O'Muircheartaigh and Marckwardt (1981). For one survey – the Bangladesh Fertility Survey – the accuracy of some of the individual questionnaire information has been evaluated via a laborious analysis of transcripts of 218 tape-recorded interviews (out of a total of 6513 interviews; Thompson *et al* 1982). These two types of data evaluation procedure – re-interviews and analysis of content of interviews – are not discussed further in this chapter.

As a preliminary step in this review, we consider the proportion of births for which actual months and years of birth were reported (table 14). The presumption is that fertility data should be more accurate when this information is supplied by the respondent than when the reported data are only year of birth or number of years ago that the birth occurred. We then consider several simple types of tabulation which can reveal omissions of live births: reported parity by cohort (table 15); sex ratios at birth by time period (table 16); and proportions dead of children ever born by cohort (table 17). Next, we examine the evidence for displacement of dates of birth (as well as of omissions) via two types of comparison across cohorts: median age at first birth by cohort (table 18); and cumulative fertility at successive ages for the three oldest cohorts (table 19). The effect of displacement error on recent trends in fertility is examined by a comparison of cumulative fertility (up to age 30–34) for 20 years before the survey (table 20). A more thorough examination of these trends and possible distortions in the rates requires an examination of the full array of cohort–period fertility rates and the accompanying cumulative rates by cohort and by period which can be found in Goldman and Hobcraft (1982).

The reliability of estimates of the level of fertility in a recent period is of considerable importance to analysts of WFS data. We examine the estimates of the total fertility rate (TFR) for a five-year period before the survey date and compare these estimates with those from external sources wherever possible (table 21). In addition, we inspect P/F ratios by age and by duration of motherhood (ie duration since first birth) for the five-year period before the survey date in order to assess the reliability of recent estimates of total fertility (table 22). The nature of the P/F procedure, ie a comparison of cumulative fertility for a cohort with cumulative fertility within a time period, and its utility for assessing the quality of birth history data are described in detail elsewhere (Hobcraft *et al* 1982). Since it is beyond the scope of this report to present new analyses of the data or to report a particular country's analysis in detail, we conclude the review by presenting a short summary of the major anomalies detected in the individual country assessments of the birth histories (table 23).

4.3 DATE REPORTING

A useful preliminary step for an evaluation of the birth history data is an examination of the percentage of births for which actual month and year of occurrence were reported. Respondents who could not supply month and year of birth, or even the year of birth, were

asked to estimate the length of time since the birth or the age of child at interview. Table 14 presents the information for the first birth, for the most recent birth and for all births.

In general, knowledge of dates of birth is much higher in Latin America than in either Asia or Africa. Month and year reporting is almost complete in Latin American countries (although some of the '100 per cents' are due to imputation on the raw data tape), as well as in the Philippines, Korea and Nepal. In the light of data problems reported for the Nepal Fertility Survey, including the fact that only 13 per cent of respondents knew their own dates of birth (Goldman *et al* 1979), the complete reporting of month and year of birth in Nepal is indeed surprising. This discrepancy appears to be the result of the different form of the birth history questionnaire used

Table 14 Reporting of the date of occurrence for the first live birth, last live birth and all live births

	PERCENT REPORTING DATE OF								
	First Live Birth as:			Last Live Birth as:			All Live Births as:		
	Month & Year	Year Only	Years Ago or Age	Month & Year	Year Only	Years Ago or Age	Month & Year	Year Only	Years Ago or Age
AFRICA									
Benin	15	83	2[1]	27	72	1[1]	12	85	2[1]
Cameroon	42	47	11	57	36	8	41	48	11
Ghana	64	20	16	78	13	9	63	21	16
Ivory Coast	29	71	--	57	43	--	28	72	--
Kenya	78	9	13	87	5	8	75	10	15
Lesotho	92	3	5	94	3	3	90	4	6
Nigeria	23	34	38[1]	37	30	33[1]	27	36	37[1]
Senegal	99	1	--	99	1	--	99	1	--
Egypt	45	7	48	57	6	37	41	8	51
Mauritania	13	87	--	20	80	--	12	88	--
Morocco	59	16	26	69	10	21	60	15	25
Sudan (North)	60	35	5	84	15	1	63	33	4
Tunisia	71	17	12	75	15	10	70	18	12
ASIA AND PACIFIC									
Jordan	69	10	21	84	6	10	67	11	22
Syria	83	13	4	95	4	1	83	14	3
Yemen A.R.	10	86	4	40	58	2	11	84	5
Bangladesh	15	2	83	33	4	63	12	3	85
Nepal	100[2]	--	--	100[2]	--	--	100[2]	--	--
Pakistan	79	21	--	90	10	--	80	20	--
Sri Lanka	78	14	8	83	12	5	73	18	9
Fiji	88	12	--	96	4	--	86	14	--
Indonesia	51	9	40	56	8	36	47	10	43
Korea, Rep. of	100	--	--	100	--	--	100	--	--
Malaysia	82	18	--	95	5	--	86	14	--
Philippines	98	1	--	99	1	--	96	3	--
Thailand	87	10	3	91	8	2	84	13	3
AMERICAS									
Colombia	100[3]	--	--	100[3]	--	--	91[4]	9	--
Ecuador	85	15	--	89	11	--	78	22	--
Paraguay	100	--	--	100	--	--	100	--	--
Peru	95	5	--	98	2	--	93	7	--
Venezuela	100[3]	--	--	100[3]	--	--	100[3]	--	--
Costa Rica	100[3]	--	--	100[3]	--	--	100[3]	--	--
Dominican Rep.	100	--	--	100	--	--	100	--	--
Mexico	100[3]	--	--	100[3]	--	--	100[3]	--	--
Panama	98	2	--	99	1	--	98	2	--
Guyana	95	1	4	93	3	4	91	4	5
Haiti	94	6	--	96	4	--	94	6	--
Jamaica	93	--	7	93	--	7	91	--	9
Trinidad & Tobago	96	4	--	96	--	4	94	6	--

Source: Chidambaram and Sathar, 1984.

-- Less than 0.5 percent
1 Includes 1 to 2 percent with no information
2 The format of the birth history requires that calendar month and year be coded.
3 After imputation, but the extent of imputation is not known.
4 As reported in the First Country Report.

in Nepal, which required the inteviewer to record a month and year for all births, even those reported in terms of 'years ago' (Chidambaram *et al* 1980a).

The worst cases reported in table 14 are Benin, Mauritania, Yemen AR and Bangladesh, where month and year of birth were reported for no more than 12 per cent of all births. In all these cases, the date of last birth is reported with higher frequency than the date of earlier births. In the African countries, information on year of birth only was supplied by the respondent, whereas in Bangladesh the date of birth was most frequently given in terms of 'years ago'. At the time of recoding and tabulation, all dates of births which were not in terms of month and year were imputed as such, based on a program written at WFS (DEIR; see Otto 1980 for details).

In an attempt to examine the effects of imputation, Chidambaram and Pullum (1981) examine the birth history data for Bangladesh under several imputation schemes. They conclude that the estimated recent fertility decline in Bangladesh is smaller under an imputation procedure which defines 'years ago' as completed years than under a procedure which defines 'years ago' as rounded years. Thus, it is clear that the nature of the imputation procedure can bias estimates of levels and trends in fertility, especially when the percentage of imputed dates is high and varying over time (Chidambaram *et al* 1980a).

A more elaborate assessment of the imputation procedures (DEIR) demonstrates that imputation injects sampling variability into the resulting estimates because of the random allocation of possible months of birth. In addition, DEIR probably induces a more systematic bias into the estimates because it is based on a uniform imputation scheme within logical boundaries of possible months, rather than being based on models of actual reproductive behaviour (Trussell forthcoming). Trussell concludes that careful analysts are unlikely to reach substantially different conclusions from repeated runs of the DEIR imputation program (ie employing different random numbers), although this might not be the case if they were to incorporate different interpretations of women's responses, as illustrated in Chidambaram and Pullum (1981).

4.4 COVERAGE OF LIVE BIRTHS

Without the existence reliable external data sources, there are no easy methods for estimating the level of omision of births in WFS surveys. The basic tabulations described below can, in certain circumstances, reveal *substantial* omissions, but cannot indicate the severity of the omission nor the presence of less severe misreporting.

In the absence of fertility increases in the past, substantial omissions of births may be detected by a simple inspection of mean parity by age: ie mean numbers of children ever born should be continually increasing with the age of cohort. An examination of mean parities in table 15 reveals that estimated parity from WFS surveys increases with age for all countries except Mauritania, Morocco, Bangladesh, Pakistan and Indonesia. For these five countries, the fact that the cohort aged 45–49 has the same or lower parity than women aged 40–44 is a clear indication that the oldest cohort have not accounted for all their births.

Table 15 also presents a comparison with estimated parity from external sources – censuses or non-WFS surveys – wherever such data were available from earlier reports. In addition, for many countries, parity estimates from WFS surveys have been reconstructed for the appropriate date in the past so as to be comparable to the external estimates. For a number of countries, eg Egypt, Nepal and Bangladesh, the external estimates are so low as to provide no information about the plausibility of the WFS estimates. In fact, the only countries for which the external estimates are substantially greater than the WFS estimates are Costa Rica, Thailand and Haiti, for ages 30–39. These differences are probably not due to errors, but rather are the result of the fact that the census was taken at least several years before the WFS survey, and that fertility rates declined substantially in the interim. In some cases, eg Sri Lanka, Panama and Ecuador, the close agreement between the WFS and the external estimates might give us confidence in the completeness of parity reports in the birth histories.

The basic conclusion to be drawn from table 15 is that, in most countries, WFS surveys have achieved a significant improvement in the coverage of live births, resulting in higher estimated parities for the older cohorts as compared with censuses and other surveys. An exception to this finding comes from a recent comparison of reported parity from WFS surveys and Contraceptive Prevalence Surveys (CPS) for seven countries. Anderson and Cleland (1984) note that the two sets of estimates are quite close at older ages in spite of the fact that the CPS surveys involve only a simple question on parity whereas the WFS estimates are based on the more complete sequence of questions described earlier.

An examination of sex ratios at birth (males per 100 females) by time period sometimes provides evidence for selective omission of births by sex. For example, a tendency for older women to fail to report all of their female children (or female deaths) should be reflected in higher sex ratios for more distant periods. The data in table 16 indicate that this type of error may have occurred in some surveys, eg Mauritania, Sudan, Bangladesh and Pakistan. Unfortunately, the very high sampling errors associated with sex ratios renders the detection of sex-selective omissions a difficult task.

Gross omissions of births may also be revealed from a tabulation of percentages of children ever born who subsequently died, according to mother's age (table 17). In the absence of rising infant and child mortality, these percentages should increase with the age of mother since, on average, the children of older women have had more years of exposure to the risk of death. (An exception to this relationship is the sometimes higher value for 15–19 year olds, because of the excessive risks of deaths for infants of teenage mothers.) With only a few exceptions, eg the low value for 45–49 year olds in the Dominican Republic and the high values for 20–24 year olds as compared with 25–39 year olds in Pakistan and Sudan, the percentages are higher for older women. Although this finding is comforting, one should keep in mind that the absence of irregularities does not necessarily indicate

Table 15 Comparison of WFS estimates with external estimates (where available) of mean numbers of children ever born by age of women

	Source/Year	AGE						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
AFRICA								
Benin	WFS (1981-82)	0.3	1.5	3.1	4.7	5.7	6.1	6.3
Cameroon	WFS (1978)	0.4	1.6	3.0	4.2	4.9	5.2	5.2
Ghana	WFS (1979-80)	0.2	1.4	2.7	4.0	5.4	6.1	6.7
Ivory Coast	WFS (1980-81)	0.5	1.9	3.3	4.7	5.9	6.7	6.9
Kenya	WFS (1978)	0.3	1.8	3.8	5.6	6.8	7.6	7.9
	Survey (1977)†	0.3	1.8	3.7	5.6	6.7	7.3	7.5
Lesotho	WFS (1978)	0.2	1.2	2.4	3.8	4.6	5.0	5.2
	Census (1976)	0.2	1.1	2.1	3.4	4.2	4.7	4.7
Nigeria	WFS (1982)	0.4	1.8	3.2	4.3	5.1	5.1	5.8
Senegal	WFS (1978)	0.4	1.7	3.4	5.3	5.9	6.8	7.2
Egypt	WFS (1980)	0.7	1.8	3.1	4.6	5.8	6.5	6.9
	WFS reconstructed for 1976	0.8	1.9	3.4	4.8	6.1	6.6	7.1
	Census (1976)	0.4	1.3	2.4	3.6	4.5	4.9	5.1
Mauritania	WFS (1980-81)	0.4	1.6	3.4	4.8	5.7	5.9	5.9
Morocco	WFS (1980)	0.2	1.2	2.9	4.8	6.1	7.1	7.1
Sudan	WFS (1978-79)	0.2	1.4	3.0	4.8	5.8	5.9	6.2
Tunisia	WFS (1978)	0.0	0.6	2.3	4.3	5.7	6.5	7.0
ASIA AND PACIFIC								
Jordan	WFS (1976)	0.2	1.6	3.7	5.6	7.1	8.4	8.6
	WFS reconstructed for 1972	0.3	1.7	3.9	5.6	7.4	8.4	---
	Survey (1972)†	0.2	1.7	4.0	5.9	7.2	7.6	7.2
Syria	WFS (1978)	0.2	1.3	3.1	4.8	6.3	7.3	7.7
	WFS reconstructed for 1976-Urban	0.2	1.3	3.1	4.9	6.1	7.3	---
	Census (1976)-Urban	0.2	1.2	2.8	4.4	5.9	6.6	---
	WFS reconstructed for 1976-Rural	0.3	1.5	3.2	5.0	6.8	7.4	---
	Census (1976)-Rural	0.2	1.3	3.2	5.0	6.6	7.5	---
Turkey	WFS (1978)	0.2	1.4	2.8	4.2	5.4	5.9	6.3
	WFS reconstructed for 1970	0.3	1.6	3.4	4.8	5.7	5.5	---
	Census (1970)	0.6	1.5	2.7	4.1	4.9	5.3	---
Yemen A.R.	WFS (1979)	0.4	1.7	3.2	5.0	6.0	6.4	7.2

Table 15 (*cont*)

	Source/Year	AGE						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
Bangladesh	WFS (1975)	0.6	2.3	4.2	5.6	6.7	7.1	6.8
	Survey (1974)†	0.4	1.9	3.5	4.9	5.9	6.2	6.1
Nepal	WFS (1976)	0.2	1.3	2.8	4.1	5.1	5.5	5.8
	WFS (1976)*	0.3	1.4	2.9	4.1	5.1	5.5	5.8
	Census (1971)*	0.3	1.1	2.2	3.1	3.7	4.0	4.0
Pakistan	WFS (1975)	0.2	1.5	3.1	4.8	5.9	6.9	6.8
	Survey (1971)	0.2	1.3	2.8	4.4	5.5	6.0	6.5
Sri Lanka	WFS (1975)	0.0	0.6	1.7	3.3	4.6	5.3	5.9
	WFS reconstructed for 1971*	0.6	1.5	2.9	4.3	5.2	5.3	---
	Census (1971)*	0.6	1.5	2.7	4.0	5.1	5.2	---
Fiji	WFS (1974)	0.1	1.0	2.5	4.1	5.0	6.0	6.5
	WFS reconstructed for 1966	0.1	1.5	3.1	4.6	5.8	---	---
	Census (1966)	0.1	1.3	3.1	4.5	5.7	---	---
Indonesia	WFS (1976)	0.2	1.3	2.7	3.9	4.8	5.3	5.2
	WFS reconstructed for 1973*	0.7	1.7	3.1	4.2	4.9	5.2	5.3
	Survey (1973)*†	0.6	1.5	2.8	3.9	4.6	4.9	4.6
Korea, Republic of	WFS (1974)	0.0	0.4	1.8	3.3	4.4	5.1	5.7
	Census (1970)	0.0	0.4	1.9	3.2	4.1	4.8	5.2
Malaysia	WFS (1974)	0.1	0.9	2.3	4.0	5.3	6.0	6.1
	WFS reconstructed for 1970*	0.7	1.7	3.2	4.5	5.7	6.1	6.3
	Census (1970)*	0.7	1.8	3.1	4.5	5.5	5.9	5.7
Philippines	WFS (1978)	0.1	0.8	2.1	3.7	5.2	6.4	6.6
	WFS reconstructed for 1975	0.1	0.9	2.3	4.0	5.5	6.4	---
	Census (1975)	0.1	0.8	2.2	3.8	5.1	5.9	---
Thailand	WFS (1975)	0.1	0.9	2.1	3.5	4.6	5.8	6.5
	Census (1970)	0.1	1.0	2.4	3.8	5.1	5.9	6.1
AMERICAS								
Colombia	WFS (1976)	0.2	1.1	2.4	4.0	5.0	6.1	6.7
	WFS reconstructed for 1973	0.2	1.2	2.7	4.3	5.3	6.5	---
	Census (1973)	0.1	1.0	2.4	3.9	5.0	5.8	---
Ecuador	WFS (1979)	0.2	1.2	2.5	4.0	5.5	6.4	6.8
	WFS reconstructed for 1974	0.2	1.3	2.9	4.6	5.8	6.5	---
	Census (1974)	0.2	1.3	2.9	4.3	5.6	6.4	6.7

Table 15 (*cont*)

	Source/Year	AGE						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
Paraguay	WFS (1979)	0.1	1.0	2.2	3.5	4.6	5.8	6.3
Peru	WFS (1977-78)	0.1	1.0	2.5	4.0	5.4	6.3	6.6
	Survey (1975-76)†	0.1	1.0	2.6	4.0	5.2	6.0	6.2
Venezuela	WFS (1977)	0.2	1.1	2.4	3.9	5.0	6.1	---
Costa Rica	WFS (1976)	---	1.0	2.0	3.5	4.8	6.1	6.7
	Census (1973)	---	1.1	2.5	4.1	5.5	6.2	6.3
Dominican Republic	WFS (1975) *	0.2	1.3	3.0	4.6	6.3	6.4	6.5
	WFS reconstructed for 1970	0.3	1.7	3.4	5.3	6.1	6.3	---
	Census (1970)	0.2	1.6	3.3	4.6	5.6	5.8	6.0
Mexico	WFS (1976)	0.2	1.3	2.9	4.6	6.0	6.6	6.8
	WFS reconstructed for 1970	0.3	1.5	3.2	4.9	5.9	6.5	---
	Census (1970)	0.2	1.4	3.1	4.6	5.7	6.3	---
Panama	WFS (1976)	--	1.2	2.6	3.8	4.9	5.6	5.8
	Survey (1976)†	0.2	1.2	2.6	3.8	4.9	5.6	5.7
Guyana	WFS (1975)	0.2	1.3	2.8	4.8	5.7	6.3	6.4
	WFS reconstructed for 1970	0.2	1.4	3.7	4.9	5.9	6.3	---
	Census (1970)	0.2	1.4	3.4	4.9	6.0	6.2	---
Haiti	WFS (1977)	0.1	0.8	2.0	3.4	4.5	5.6	5.9
	Census (1971)	0.1	1.0	2.2	3.5	5.0	5.5	---
Jamaica	WFS (1975-76)	0.3	1.6	2.8	4.1	5.1	5.4	5.5
	WFS reconstructed for 1970	0.4	1.7	3.0	4.4	5.0	5.2	---
	Census (1970)	0.3	1.5	3.0	4.0	4.6	4.7	---
Trinidad and Tobago	WFS (1977)	0.1	0.9	2.0	3.2	4.3	5.2	5.8
	WFS reconstructed for 1970	0.1	1.1	2.7	4.1	5.2	5.6	---
	Census (1970)	0.1	1.1	2.7	4.1	4.9	5.2	---
EUROPE								
Portugal	WFS (1979-80)	0.0	0.5	1.2	1.8	2.3	2.6	2.9

* Per ever-married women

† Surveys:

Kenya — National Demographic Survey, 1977
Bangladesh -- Bangladesh Retrospective Survey of Fertility and Mortality, 1974
Indonesia — Fertility-Mortality Survey, 1973
Jordan — National Fertility Survey, 1972
Panama — Retrospective Demographic Survey, 1976
Peru -- National Demographic Survey, 1975-76

Table 16 Sex ratios at birth (males per 100 females) for five-year periods before the survey

	YEARS PRIOR TO SURVEY							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	TOTAL
AFRICA								
Benin	106	106	102	97	95	114	(125)	104
Cameroon	106	108	105	95	101	103	108	104
Ghana	106	100	100	109	100	111	(104)	104
Ivory Coast	103	102	106	108	104	98	96	104
Kenya	102	104	98	102	106	115	102	102
Lesotho	105	98	91	111	109	104	(96)	101
Senegal	104	107	103	94	98	106	(103)	103
Egypt	108	106	108	109	100	108	112	107
Mauritania	109	113	108	111	120	128	(118)	112
Morocco	112	105	105	100	100	119	110	106
Sudan (North)	109	99	109	103	109	139	(189)	106
ASIA AND PACIFIC								
Jordan	102	102	107	106	114	116	(103)	105
Syria	106	105	103	107	106	121	(118)	106
Turkey	103	103	102	100	115	105	--	103
Bangladesh	101	105	104	102	112	120	127	105
Nepal	107	101	103	103	115	110	(106)	105
Pakistan	106	105	111	110	115	124	(138)	109
Sri Lanka	105	103	99	110	109	97	109	104
Fiji	110	102	109	106	110	107	(102)	107
Indonesia	104	105	107	97	105	109	91	104
Korea, Rep. of	107	105	105	113	106	110	(87)	107
Malaysia	106	103	104	107	107	108	126	105
Philippines	106	106	111	106	108	109	(139)	107
Thailand	108	105	104	105	105	104	(96)	106
AMERICAS								
Colombia	108	107	106	98	114	117	(92)	106
Ecuador	99	99	106	107	104	108	(104)	102
Paraguay	105	104	107	100	111	119	(97)	105
Peru	108	101	101	104	107	113	91	104
Venezuela	120	108	97	100	97	102	--	--
Costa Rica	105	106	109	101	113	112	(165)	107
Dominican Rep.	94	95	95	103	84	87	(115)	95
Mexico	102	107	104	98	102	106	(131)	103
Panama	106	109	97	107	106	93	(68)	104
Guyana	106	109	101	96	111	126	(122)	106
Haiti	110	100	101	102	113	75	(150)	104
Jamaica	103	107	108	106	117	104	(141)	107
Trinidad & Tobago	103	102	99	105	104	92	(89)	102
EUROPE								
Portugal	113	108	119	105	111	98	(150)	111

Note: Values in parentheses are based on fewer than 100 female births.

Table 17 Per cent dead children ever born by cohort

	COHORT						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
AFRICA							
Benin	12.6	18.2	18.6	23.1	25.7	30.8	31.5
Cameroon	16.9	14.9	17.9	20.5	23.2	25.7	28.8
Ghana	10.8	12.3	10.8	12.0	12.6	15.5	17.1
Kenya	10.2	13.0	14.3	15.5	17.5	19.1	23.7
Lesotho	9.2	14.9	15.7	18.7	18.6	20.1	23.2
Senegal	17.8	20.9	24.9	25.2	29.0	32.3	32.3
Egypt	18.9	18.1	19.4	21.7	24.3	27.0	30.5
Mauritania	14.9	15.4	18.2	17.6	19.1	24.7	26.0
Morocco	12.4	13.8	15.0	15.0	17.9	20.1	23.8
Sudan (North)	15.3	16.0	12.4	14.2	15.3	16.6	18.6
ASIA AND PACIFIC							
Jordan	8.2	8.1	8.6	9.4	11.2	16.6	17.0
Syria	7.9	8.1	8.3	9.4	10.5	13.0	14.4
Turkey	17.0	16.4	16.6	20.5	22.9	25.9	26.6
Yemen A.R.	20.8	20.7	23.7	28.2	29.0	32.8	35.0
Bangladesh	23.5	20.5	22.7	23.9	25.4	27.6	30.6
Nepal	18.1	21.3	22.5	25.2	27.2	30.7	31.6
Pakistan	17.2	22.1	20.3	20.3	20.6	28.4	28.9
Sri Lanka	4.6	7.9	8.6	8.4	9.5	11.5	13.2
Fiji	6.9	5.6	5.1	5.7	7.9	9.2	10.9
Indonesia	14.0	15.2	15.0	19.5	19.7	22.1	27.2
Korea, Rep. of	7.7	4.2	4.6	7.0	9.2	13.0	19.0
Malaysia	6.6	4.8	5.6	6.1	8.3	10.5	13.4
Philippines	7.0	7.0	7.9	8.7	9.8	11.7	13.1
Thailand	8.8	7.7	9.0	11.3	12.2	16.5	17.4
AMERICAS							
Colombia	10.5	8.7	9.4	10.1	13.1	14.7	17.3
Ecuador	9.0	10.3	11.5	13.5	14.4	17.5	19.4
Paraguay	7.3	7.1	6.7	7.5	7.2	9.2	9.2
Peru	10.9	12.4	14.4	15.6	19.3	21.4	25.1
Venezuela	5.9	5.1	5.9	6.3	6.9	7.7	--
Costa Rica	--	5.1	7.5	7.8	9.8	10.2	13.2
Dominican Rep.	9.0	11.5	12.2	13.3	14.8	16.5	15.0
Mexico	11.0	8.4	9.5	11.4	12.2	14.6	17.4
Panama	--	2.9	5.2	6.0	8.0	8.3	10.9
Guyana	10.2	6.1	6.7	6.7	9.3	11.2	13.7
Haiti	23.2	17.9	19.8	18.5	24.8	23.4	24.8
Jamaica	4.3	4.9	5.2	5.7	7.9	9.5	10.2
Trinidad & Tobago	6.5	4.5	4.3	5.8	6.8	6.9	8.2
EUROPE							
Portugal	2.0	3.3	4.0	5.0	5.5	7.4	8.9

that the data are accurate, but rather that the data are not severely distorted. A review of the quality of WFS mortality data (chapter 5) indicates that omissions of infant deaths have been detected even when reported proportions dead by age appear consistent.

The reported parities by five-year age group shown in table 15 reveal only a few gross anomalies in WFS data. In two surveys, an examination of parity by single year of age provides clear indication of misreporting. In the case of Nepal (figure 3), reported parity for the heaped ages of 35, 40 and 45 is substantially lower than parity at neighbouring ages and lower than the level of cumulative fertility implied by recent fertility rates (see Goldman *et al* 1979). It seems likely that this deficiency in reported parity is the result of especially large omissions of births by women whose age is reported at a heaped number, or, more generally, by women who do not know their ages. This deficiency of parity at older heaped ages occurs to a lesser extent in several other WFS surveys. By contrast, reported parity in Turkey is considerably higher at ages 30, 35, 40 and 45 than at neighbouring ages; in fact, reported parities at ages 35, 40 and 45 are higher than at any other age up to 49. Although also the result of age misreporting, the distortion in reported parities in Turkey is produced by a different mechanism than in Nepal. A combination of differential age misreporting and differential fertility by region in Turkey has resulted in more age misreporting (ie heaping) occurring in the highest fertility areas. In essence, estimated parity for ages 35, 40 and 45 is based on the reports of women from the most fertile areas (mostly the east) who are more likely not to know their ages, whereas estimated parity for non-heaped ages is based on reports from less fertile areas, consisting of women who by and large do know their ages (Coale and Richards 1983). It is interesting to note that the severe distortions in reported parity by single years of age are not apparent when the data are presented in five-year age groups (table 15). This is not

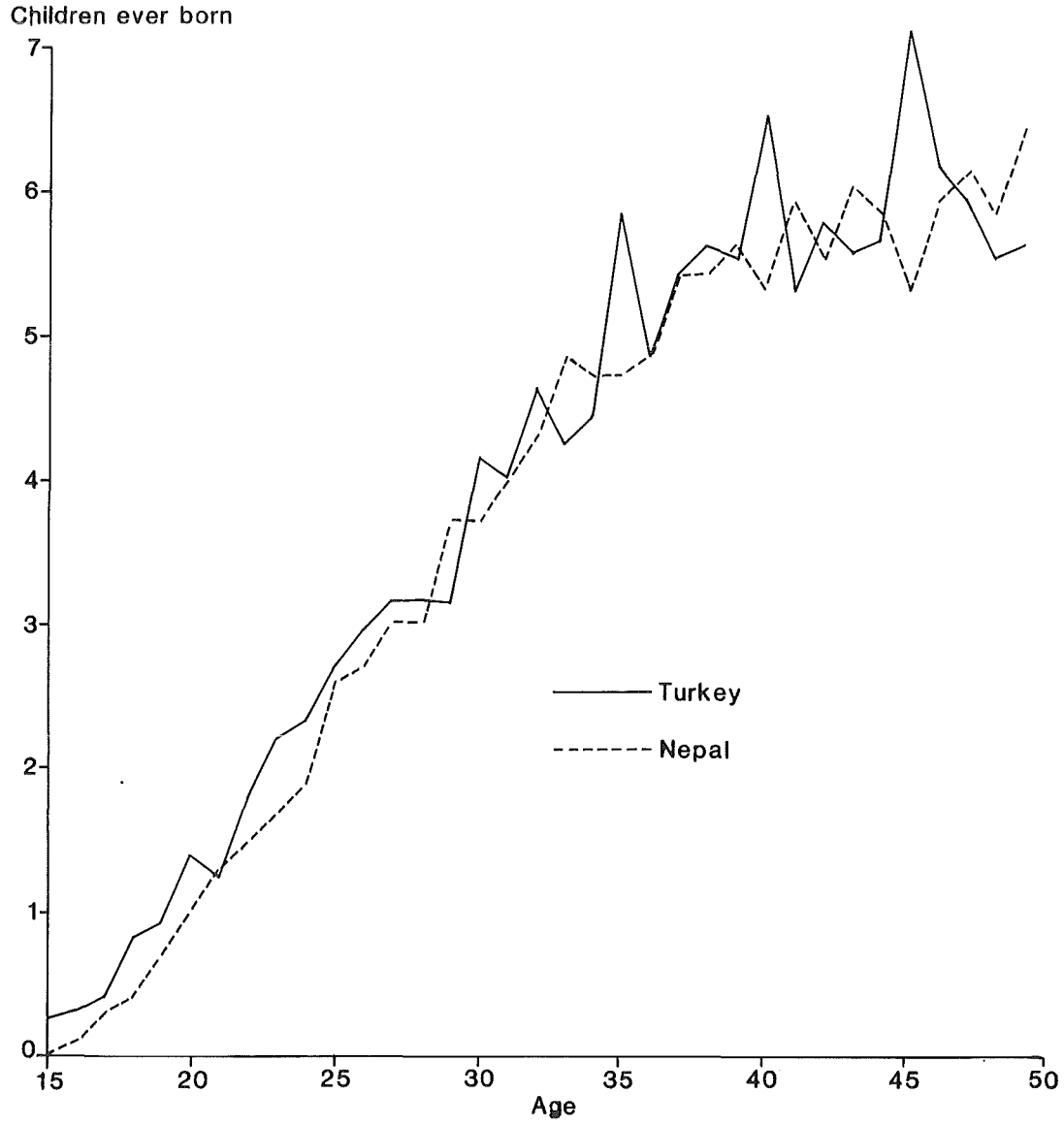

Figure 3 Reported number of children ever born per ever-married woman by single years of age, Nepal Fertility Survey and Turkish Fertility Survey

to say, however, that the age misreporting has not distorted aggregated parity values, but rather that the latter distortions are not apparent.

4.5 DISPLACEMENT OF DATES OF BIRTHS

There is considerable evidence from survey data that, when reporting a history of vital events, some respondents are apt to misreport the dates of these events, even in situations where they are able to include all the appropriate births or deaths. In general, the older the respondent and the further in the past the period in which the events occur, the more frequent and more severe the misreporting. Although the nature and extent of the errors vary with the survey, a common type of event misplacement in data for developing countries is older respondents reporting their early events as occurring closer to the survey date (ie at an older age) than they actually did. Forward displacement of births is unlikely to be frequent in recent periods because it would result in births being dated in the future, or at least in a relatively large age misstatement for young children. In the absence of omissions of births, the combination of forward displacement of early births with accurate reporting in the recent past results in a concentration of births in an intermediate period, eg 5–15 years ago, at the expense of births in earlier periods. The presence of such errors may create a completely spurious estimate of rising fertility in earlier periods, eg 20–30 years ago, followed by a decline in more recent periods. When fertility is actually declining, this type of displacement error will result in an exaggerated estimate of the decline (Potter 1977a). Although it is difficult to prove the existence of this Potter effect, an examination of median (or mean) age at marriage (chapter 3), median age at first birth, and age- or period-specific fertility rates by cohort suggests that this type of date displacement has indeed occurred to some extent in most of the WFS surveys.

Table 18 shows median ages at first birth for cohorts aged 20–24 up to 45–49 as derived from life-table calculations (Smith 1981a; 1981b). In the absence of a change in age at first birth, we would expect no change in these values across cohorts; recent increases in age at first birth should be reflected by higher values for the youngest cohorts. In addition to a recent increase in age at first birth, which is indicated by the data for more than half of the countries in table 18, about two-thirds of the surveys indicate a higher age at first birth for the oldest cohort (45–49) than for the next oldest cohort or cohorts. For example, in Kenya the cohort aged 45–49 has a median age at first birth (20.4) almost one year higher than 40–44 year old women (19.5) and about one and a half years higher than 35–39 year old women (18.8). Similarly large differences occur in Sudan, Yemen AR, Indonesia and Dominican Republic. In some countries, eg Benin, Cameroon, Ivory Coast and Nepal, fertility rates for several older cohorts seem to have been affected by displacement, whereas in other countries, eg Ecuador and Dominican Republic, it is mainly the rates for the oldest cohort which appear distorted. Since few countries experienced a decline in age at first birth during a period from about 30 to 15 years ago, such a trend is implausible and most probably reflects either misreporting of the type discussed above or age misreporting of the respondent. Note that omissions of early births for the oldest cohorts could also produce these anomalies, since later births, which by definition occur at an older age, would be recorded as lower parity births.

In several countries, eg Sri Lanka and Korea, the trend for the oldest cohorts is opposite to that produced by a Potter effect. Event displacement in which early births tend to be moved backwards in time and interbirth intervals become exaggerated (Brass 1978) appears to be present in the data for Sri Lanka (Goldberg 1981). In Korea, the quality of reporting seems to be high and the reported differences by cohort are probably real (Coale *et al* 1981).

Table 19 traces the reporting of births for the three oldest cohorts by presenting cumulative fertility rates at successive ages. As expected from the results in table 18, in the majority of WFS surveys, women aged 45–49 have fewer births as at a specified age than do women aged 40–44 (and in some cases women aged 40–44 have fewer than women aged 35–39). For example, when they were aged 20–24 (22.5 on average), women aged 45–49 at the time of the interview in Mauritania had about 0.2 fewer children, on average, than 35–39 year olds. These differences among the oldest cohorts persist through all age groups and become greater in absolute terms for the older ages. On the assumption that fertility has remained constant for the older cohorts, the data for Mauritania suggest that the older respondents are omitting births from their histories as well as misreporting dates of the early births. A similar combination of displacement and omission errors appears to have distorted birth histories in Benin, Cameroon, Ivory Coast, Kenya, Lesotho, Morocco, Sudan, Yemen AR, Bangladesh, Nepal, Pakistan, Indonesia, Haiti, and to a lesser extent in the Philippines, Dominican Republic, Jamaica and Mexico. In many of the other WFS surveys, eg Egypt, Syria, Thailand and most of the Latin American countries, a notable displacement of early births by the oldest cohort(s) is 'made up' by later ages so that the differences among the oldest cohorts disappear by ages 30–34 or 35–39.

A serious consequence of this type of displacement error is a potential concentration of births in an intermediate period and hence a spurious estimate of fertility decline. Unfortunately, in the presence of a real decline (or trend) in fertility, it is not always possible to detect an over-reporting of births for a particular period. Table 20 presents estimates of cumulative fertility for the four most recent five-year periods. Since the oldest five-year age group in most WFS surveys is 45–49, fertility values can only be cumulated up to the age group 30–34.

Although firm conclusions would require a more detailed analysis of the entire array of cohort–period fertility rates (and the accompanying P/F ratios), the data in table 20 suggest some anomalies, mostly in Africa and in south Asia. For example, the low fertility values for periods more than 10 years ago in Cameroon, Ivory Coast and Yemen AR and more than 15 years ago in Kenya and Bangladesh are likely to be the result of omission and displacement error. The clearest examples of a Potter effect, ie where the data indicate a concentration of births either in the period 5–9 years ago or 10–14

Table 18 Median age at first birth by cohort

	COHORT					
	20-24	25-29	30-34	35-39	40-44	45-49
AFRICA						
Benin	19.9	19.6	19.4	19.3	20.0	20.6
Cameroon	18.8	19.3	19.2	20.2	20.5	21.3
Ghana	19.5	19.9	19.9	19.6	20.2	20.4
Ivory Coast	18.4	18.8	18.7	19.2	19.5	19.7
Kenya	18.9	18.8	18.6	18.8	19.5	20.4
Lesotho	20.6	20.9	20.4	20.9	21.3	20.9
Senegal	18.7	18.6	17.6	17.7	18.0	18.6
Egypt	21.9	21.3	19.6	19.2	19.3	19.2
Mauritania	19.5	18.8	18.3	18.9	20.0	20.3
Morocco	21.8	20.8	19.7	18.9	19.2	19.2
Sudan (North)	21.2	19.4	18.8	19.7	20.1	21.1
Tunisia	--	22.8	21.2	21.2	21.5	22.1
ASIA AND PACIFIC						
Jordan	20.9	19.8	19.3	19.6	19.6	19.3
Syria	21.8	21.2	20.4	21.2	21.3	21.6
Yemen A.R.	19.5	19.9	19.8	20.5	22.1	22.9
Bangladesh	16.8	16.5	16.5	16.8	17.0	17.4
Nepal	20.3	19.9	20.1	20.7	21.0	21.2
Pakistan	19.8	19.6	18.9	18.8	17.9	18.3
Sri Lanka	--	24.9	22.3	21.6	21.0	20.7
Fiji	22.1	21.1	20.2	19.8	20.1	20.3
Indonesia	19.9	19.5	18.9	19.2	19.5	20.3
Korea, Rep of.	--	24.0	23.5	22.2	21.3	20.0
Malaysia	23.2	22.3	21.1	20.1	19.8	19.8
Philippines	--	23.4	22.6	21.9	21.7	22.2
Thailand	22.5	22.0	21.6	21.8	21.7	22.1
AMERICAS						
Colombia	21.7	21.4	21.0	21.0	21.5	21.8
Ecuador	21.4	21.5	20.9	20.8	20.5	21.9
Paraguay	22.1	21.6	21.7	21.4	20.5	21.1
Peru	22.7	21.6	21.1	20.9	20.9	21.7
Venezuela	21.9	21.2	21.0	20.5	20.4	[1]
Costa Rica	22.1	22.3	21.4	21.4	21.3	22.3
Dominican Republic	20.7	19.8	19.8	19.6	19.7	20.5
Mexico	21.5	21.0	20.6	20.4	20.4	21.0
Panama	21.6	21.2	20.6	20.4	20.0	20.5
Guyana	21.0	20.5	19.6	19.8	19.5	19.8
Haiti	23.3	22.5	22.4	22.5	21.5	23.5
Jamaica	19.3	19.2	18.9	19.7	20.7	20.9
Trinidad & Tobago	23.1	22.1	21.4	20.9	20.0	20.2
EUROPE						
Portugal	23.9	24.3	24.5	24.7	25.1	25.3

Source: The above medians are based on life table values for each cohort and are taken from Smith (1981a, 1981b)

-- cohort was too young to supply an estimate of the median age at first birth

[1] women aged 45-49 were not included in the survey.

Table 19 Cumulative fertility by age for the three oldest cohorts

COHORT	AGE						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
AFRICA							
Benin							
45-49	.18	1.20	2.53	3.95	5.06	5.93	6.27
40-44	.21	1.35	2.85	4.26	5.33	6.06	--
35-39	.37	1.57	3.09	4.55	5.75	--	--
Cameroon							
45-49	.22	1.09	2.15	3.15	4.01	4.80	5.18
40-44	.30	1.24	2.45	3.63	4.58	5.20	--
35-39	.36	1.38	2.63	3.89	4.87	--	--
Ghana							
45-49	.30	1.28	2.64	4.05	5.30	6.24	6.71
40-44	.23	1.24	2.60	4.06	5.29	6.12	--
35-39	.39	1.49	2.89	4.30	5.36	--	--
Ivory Coast							
45-49	.30	1.42	2.87	4.23	5.47	6.40	6.86
40-44	.35	1.54	3.09	4.56	5.88	6.73	--
35-39	.37	1.65	3.23	4.76	5.87	--	--
Kenya							
45-49	.33	1.46	3.01	4.59	6.16	7.29	7.88
40-44	.40	1.61	3.24	5.03	6.56	7.59	--
35-39	.49	1.87	3.72	5.44	6.82	--	--
Lesotho							
45-49	.19	1.05	2.25	3.33	4.30	4.94	5.24
40-44	.23	1.06	2.31	3.44	4.42	5.05	--
35-39	.16	1.08	2.39	3.59	4.58	--	--
Nigeria							
45-49	.33	1.15	2.34	3.62	4.70	5.42	5.84
40-44	.19	1.00	2.20	3.39	4.48	5.13	--
35-39	.39	1.45	2.74	4.08	5.08	--	--
Senegal							
45-49	.30	1.60	3.05	4.53	5.80	6.78	7.16
40-44	.44	1.80	3.28	4.77	6.05	6.80	--
35-39	.55	1.90	3.39	4.82	5.94	--	--
Egypt							
45-49	.41	1.79	3.44	5.01	6.09	6.61	6.76
40-44	.44	1.79	3.50	4.95	5.85	6.32	--
35-39	.44	1.85	3.49	4.76	5.66	--	--
Mauritania							
45-49	.45	1.37	2.49	3.77	4.83	5.64	5.95
40-44	.58	1.59	2.81	4.12	5.25	5.85	--
35-39	.69	1.78	3.18	4.63	5.68	--	--
Morocco							
45-49	.51	1.88	3.53	4.97	6.11	6.85	7.11
40-44	.48	1.88	3.57	5.11	6.34	7.07	--
35-39	.58	1.99	3.62	5.10	6.09	--	--
Sudan (North)							
45-49	.22	1.08	2.21	3.55	4.82	5.72	6.16
40-44	.35	1.32	2.73	4.24	5.36	5.95	--
35-39	.44	1.55	3.07	4.67	5.80	--	--
Tunisia							
45-49	.23	1.10	2.74	4.46	5.84	6.63	6.95
40-44	.26	1.30	2.91	4.50	5.69	6.48	--
35-39	.28	1.38	3.06	4.55	5.70	--	--

Table 19 (*cont*)

COHORT	AGE 15-19	20-24	25-29	30-34	35-39	40-44	45-49
ASIA AND PACIFIC							
Jordan							
45-49	.43	1.86	3.69	5.55	7.23	8.28	8.64
40-44	.42	1.71	3.76	5.82	7.46	8.40	--
35-39	.40	1.82	3.79	5.60	7.08	--	--
Syria							
45-49	.28	1.34	2.94	4.67	6.28	7.31	7.69
40-44	.25	1.31	3.00	4.80	6.29	7.28	--
35-39	.24	1.35	3.15	4.80	6.26	--	--
Turkey							
45-49	.19	.35	3.12	4.60	5.61	6.13	6.26
40-44	.34	1.63	3.32	4.66	5.52	5.87	--
35-39	.42	1.89	3.54	4.76	5.43	--	--
Yemen A.R.							
45-49	.20	1.00	2.22	3.70	5.02	6.34	7.19
40-44	.29	1.13	2.53	4.02	5.45	6.45	--
35-39	.31	1.38	2.77	4.55	6.02	--	--
Bangladesh							
45-49	.74	2.05	3.47	4.76	5.89	6.61	6.79
40-44	.82	2.29	3.83	5.35	6.53	7.06	--
35-39	.90	2.39	4.13	5.81	6.70	--	--
Nepal							
45-49	.15	1.02	2.35	3.64	4.75	5.50	5.77
40-44	.16	1.06	2.41	3.75	4.87	5.52	--
35-39	.23	1.20	2.62	4.02	5.08	--	--
Pakistan							
45-49	.39	1.71	3.22	4.74	5.94	6.67	6.83
40-44	.57	1.85	3.38	4.94	6.20	6.89	--
35-39	.38	1.64	3.25	4.77	5.89	--	--
Sri Lanka							
45-49	.32	1.39	2.79	4.16	5.22	5.72	5.86
40-44	.30	1.32	2.68	3.97	4.88	5.26	--
35-39	.33	1.25	2.61	3.83	4.61	--	--
Fiji							
45-49	.37	1.53	3.08	4.56	5.75	6.35	6.49
40-44	.39	1.68	3.36	4.84	5.73	6.04	--
35-39	.39	1.67	3.25	4.38	5.02	--	--
Indonesia							
45-49	.36	1.31	2.45	3.60	4.48	5.02	5.18
40-44	.39	1.51	2.77	3.96	4.87	5.27	--
35-39	.46	1.59	2.89	4.04	4.76	--	--
Korea, Rep. of							
45-49	.14	1.28	2.60	4.03	5.16	5.64	5.75
40-44	.14	.91	2.46	3.95	4.79	5.13	--
35-39	.04	.77	2.32	3.66	4.36	--	--
Malaysia							
45-49	.35	1.48	3.01	4.45	5.50	6.04	6.15
40-44	.34	1.64	3.26	4.66	5.60	5.99	--
35-39	.37	1.57	3.14	4.42	5.30	--	--
Philippines							
45-49	.14	.99	2.46	4.11	5.48	6.35	6.58
40-44	.18	1.17	2.77	4.42	5.72	6.41	--
35-39	.17	1.13	2.63	4.12	5.18	--	--
Thailand							
45-49	.11	.95	2.58	4.21	5.54	6.32	6.52
40-44	.14	1.09	2.67	4.16	5.27	5.84	--
35-39	.13	1.02	2.49	3.81	4.62	--	--

Table 19 (*cont*)

COHORT	AGE 15-19	20-24	25-29	30-34	35-39	40-44	45-49
AMERICAS							
Colombia							
45-49	.24	1.28	2.79	4.42	5.78	6.55	6.75
40-44	.27	1.34	2.98	4.54	5.59	6.08	--
35-39	.29	1.48	3.03	4.27	5.04	--	--
Ecuador							
45-49	.22	1.25	2.89	4.53	5.79	6.55	6.78
40-44	.35	1.54	3.13	4.61	5.76	6.36	--
35-39	.32	1.50	3.11	4.51	5.46	--	--
Paraguay							
45-49	.19	1.19	2.66	4.05	5.28	6.08	6.26
40-44	.24	1.37	2.84	4.19	5.22	5.80	--
35-39	.24	1.18	2.46	3.69	4.59	--	--
Peru							
45-49	.25	1.20	2.78	4.31	5.57	6.34	6.58
40-44	.24	1.40	2.96	4.45	5.60	6.26	--
35-39	.30	1.37	2.87	4.32	5.37	--	--
Venezuela							
40-44	.29	1.60	3.14	4.61	5.63	6.10	--
35-39	.41	1.72	3.18	4.34	5.04	--	--
Costa Rica							
45-49	.12	1.05	2.82	4.43	5.81	6.54	6.69
40-44	.21	1.42	3.11	4.69	5.69	6.09	--
35-39	.24	1.47	3.12	4.23	4.79	--	--
Dominican Republic							
45-49	.35	1.49	2.98	4.42	5.68	6.39	6.53
40-44	.47	1.69	3.25	4.75	5.88	6.43	--
35-39	.42	1.77	3.71	5.30	6.35	--	--
Guyana							
45-49	.28	1.56	3.11	4.57	5.71	6.29	6.40
40-44	.38	1.75	3.44	4.93	5.89	6.27	--
35-39	.41	1.90	3.62	4.92	5.66	--	--
Haiti							
45-49	.09	.67	1.88	3.32	4.59	5.51	5.94
40-44	.16	1.05	2.47	3.86	4.90	5.58	--
35-39	.22	.95	2.19	3.46	4.52	--	--
Jamaica							
45-49	.26	1.11	2.38	3.72	4.81	5.38	5.53
40-44	.26	1.21	2.57	4.02	4.94	5.40	--
35-39	.36	1.56	3.06	4.30	5.06	--	--
Mexico							
45-49	.30	1.39	2.95	4.44	5.74	6.51	6.75
40-44	.33	1.55	3.19	4.77	6.00	6.63	--
35-39	.34	1.63	3.32	4.88	6.01	--	--
Panama							
45-49	.35	1.44	2.94	4.19	5.11	5.66	5.77
40-44	.34	1.55	3.04	4.37	5.27	5.64	--
35-39	.35	1.58	3.11	4.31	4.94	--	--
Trinidad & Tobago							
45-49	.35	1.56	3.07	4.45	5.34	5.72	5.81
40-44	.33	1.55	3.16	4.33	4.95	5.20	--
35-39	.31	1.56	2.97	3.87	4.30	--	--
EUROPE							
Portugal							
45-49	.02	.39	1.26	2.11	2.63	2.87	2.93
40-44	.04	.40	1.24	2.02	2.44	2.59	--
35-39	.04	.44	1.29	2.01	2.34	--	--

Table 20 Cumulative fertility up to age group 30–34 for periods 0–4, 5–9, 10–14 and 15–19 years before the survey

	YEARS PRIOR TO SURVEY			
	0-4	5-9	10-14	15-19
AFRICA				
Benin	4.7	4.5	4.5	4.5
Cameroon	4.3	4.2	3.9	3.6
Ghana	3.9	4.1	4.2	4.2
Ivory Coast	4.9	5.0	4.8	4.6
Kenya	5.2	5.5	5.7	5.1
Lesotho	3.7	3.6	3.6	3.5
Nigeria	4.3	4.1	3.4	3.6
Senegal	4.9	4.8	4.9	4.9
Egypt	3.8	3.9	4.7	5.1
Mauritania	4.2	4.9	4.6	4.2
Morocco	3.9	4.5	4.8	5.0
Sudan (North)	3.9	4.9	4.7	4.3
Tunisia	3.5	3.9	4.5	4.6
ASIA AND PACIFIC				
Jordan	5.0	5.5	5.9	5.7
Syria	4.5	4.7	5.1	4.8
Turkey	3.4	4.3	4.6	5.0
Yemen A.R.	5.1	4.9	4.4	4.5
Bangladesh	4.5	6.2	6.0	5.2
Nepal	4.1	4.2	4.0	3.8
Pakistan	4.3	4.8	4.8	4.7
Sri Lanka	2.4	3.1	3.7	3.9
Fiji	3.1	3.7	4.6	4.8
Indonesia	3.4	3.8	4.0	4.0
Korea, Rep. of	3.1	3.2	3.6	3.7
Malaysia	3.2	3.7	4.3	4.5
Philippines	3.2	3.9	4.1	4.3
Thailand	3.0	3.7	4.0	4.3
AMERICAS				
Colombia	3.2	4.0	4.6	4.7
Ecuador	3.5	4.1	4.5	4.7
Paraguay	3.2	3.5	3.7	4.0
Peru	3.5	4.1	4.2	4.4
Venezuela	3.2	3.8	4.3	--[2]
Costa Rica	2.7[1]	3.5	4.6	4.7
Dominican Rep.	3.9	4.8	5.2	4.7
Mexico	4.1	4.6	4.8	4.7
Panama	3.2[1]	4.0	4.3	4.3
Guyana	3.7	4.4	5.0	5.1
Haiti	3.2	3.3	3.5	3.8
Jamaica	3.6	4.3	4.7	4.3
Trinidad & Tobago	2.4	2.9	3.9	4.6
Europe				
Portugal	1.8	2.0	2.1	2.1

[1] Based on the assumption that the fertility rate for the cohort 15-19 (not included in the survey) during the period 0-4 years prior to survey is equal to that of the cohort 20-24 during the period 5-9 years prior to survey.

[2] Not estimated since the survey does not include 45-49 year olds.

years ago, are Bangladesh, Mauritania, Kenya, Sudan, Dominican Republic and Jamaica. As already noted, many of these datasets are also plagued by omissions of births which further distort actual trends in fertility.

It is important to keep in mind that some of these apparent anomalies may be due to real increases in fertility. On the basis of comparing birth registration data and WFS data for 15–20 countries, Dyson and Murphy (1984) conclude that there are indications of widespread fertility increases in developing countries, particularly during the 1950s. They argue that the fertility increases which precede the recent declines are probably the result of reductions in sterility and widowhood, shorter durations of lactation, and relaxation of post-partum taboos. Although the consistency of some of the anomalies noted above suggests problems with the data, we cannot eliminate the possibility of a real increase in fertility.

4.6 ESTIMATES OF RECENT FERTILITY

One of the most important pieces of information to be gathered from WFS surveys is the current level of fertility. Table 21 presents the total fertility rates for a five-year period before each survey. These estimates are derived from the array of cohort–period fertility rates which have been produced for each WFS survey, based on five-year cohorts (defined by age at survey) and five-year periods (defined by years prior to interview) by Goldman and Hobcraft (1982). Technically, the TFRs derived from the summation of cohort–period fertility rates for the most recent five-year period are slightly different from the conventional TFRs which are based on age-specific fertility rates, but the differences are slight.

The remainder of table 21 shows the estimates of the TFR from the WFS survey and from an external source, for a recent period. These estimates have been gleaned from the detailed evaluation reports and several non-WFS documents, in an attempt to obtain both sets of estimates for a comparable period. For a number of countries, both the WFS and the external estimate refer to only the single year preceding the relevant interview date.

By and large, these data suggest one of two scenarios: WFS fertility data for a period of several years before the survey appear to be reliable since they are in agreement with census, vital registration or other survey estimates (eg in Kenya, Lesotho, Malaysia, Nepal and Paraguay); or, fertility estimates derived from the external sources are sufficiently low (due to under-reporting) that no assessments of the reliability of the WFS estimates are possible (eg Bangladesh, Turkey and Jamaica). A comforting finding from table 21 is the apparent reliability of recent estimates for some surveys (eg Kenya and Nepal) in spite of considerable evidence from tables 18, 19 and 20 of distorted trends in fertility for earlier periods.

An alternative way in which to evaluate the accuracy of recent estimates of total fertility is to use the P/F procedure. For example, P/F ratios for the five-year period before the survey reflect the comparison of parity reported as at the survey date (by women of a particular age or duration group) to cumulative fertility rates (up to the same age or duration group) for the most recent five-year period. In the absence of changes in fertility and reporting errors, P/F ratios should equal unity. Deviations from unity which are invariant with age or duration may reflect reference period errors in the reporting of births for a specified period, in which case the P/F ratios provide adjustment factors for the reported fertility rates or the TFR. Declining P/F ratios by age are most commonly produced by omissions in the reports of parity by older women whereas increasing ratios are usually the result of declining fertility. In addition to conventional P/F ratios by age, which have been used for the past two decades in conjunction with census data (Brass and Coale 1968), P/F ratios by duration of marriage and duration of motherhood have proved very useful in the analysis of the quality of birth history data because they are less distorted by changes in fertility which arise from changing age at marriage or changing age at first birth (Hobcraft *et al* 1982).

The P/F ratios by age and by duration of motherhood which are presented in table 22 can be used to assess the accuracy of the reported TFRs in the first column of table 21. As expected, the ratios increase with age and with duration in the majority of countries because of both rising age at marriage and declining marital fertility. Nevertheless, the constancy of the P/F ratios for most durations of motherhood at a value near unity for a number of countries in which there is little reason to suspect a change in marital fertility (Benin, Ivory Coast, Kenya, Lesotho, Mauritania, Sudan, Syria, Yemen AR, Nepal and Pakistan) suggests rather good reporting of births for the most recent period. The higher values of the P/F ratios by age for Mauritania, Sudan, Jordan and Pakistan are probably the result of an increasing age at marriage and not of date misplacement in the recent past.

Although not detected by the P/F procedure, there is some evidence that recent fertility may be understated for some countries. In an assessment of levels and trends in fertility from 20 WFS surveys, the United Nations (1983) concludes that some births have been shifted out of the most recent five-year period because of age overstatement of children below age five. Such age overstatement, which results in an underestimate of recent fertility and an exaggeration of a recent decline, is most likely to have occurred in south Asian and African surveys (United Nations 1983).

By and large, the P/F ratios in table 22 suggest that estimates of the TFR for the most recent five-year period are reasonable. They give no indication, however, of the accuracy of estimates of the TFR for a shorter period, eg the one-year or two-year period before the survey. Little (1982) has shown that fertility rates calculated for a one-year period are associated with an unreasonably high level of sampling error. For example, increasing the reference period from one to two years reduces the standard error of the estimated age-specific fertility rates an average of 41 per cent and of the estimated TFR an average of 30 per cent. In addition, an analysis of recent fertility in 15 WFS surveys by Goldman and Westoff (1980) indicates that, for several countries, a substantially greater number of births is recorded in the past year

Table 21 Total fertility rates (TFR) for five-year period before the survey and for recent period which is comparable to external estimates (where available)

	WFS ESTIMATES			EXTERNAL ESTIMATES	
	TFR for five-year period prior to survey[1]	Year	TFR[2]	Source/Year	TFR
AFRICA					
Benin (1981-82)	7.0				
Cameroon (1978)	6.3				
Ghana (1979-80)	6.3				
Ivory Coast (1980-81)	7.3				
Kenya (1978)	8.2	*	7.9	Survey (1977)/*	8.0
Lesotho (1978)	5.6	*	6.0	Census (1976)/*	5.9
Nigeria (1982)	6.4				
Senegal (1978)	7.1				
Egypt (1980)	5.3	*	5.3	Census (1976)/*	5.6
Mauritania (1980-81)	6.2				
Morocco (1980)	5.9				
Sudan (North) (1978-79)	6.1				
Tunisia (1978)	5.7				
ASIA AND PACIFIC					
Jordan (1976)	7.8				
Syria (1978)	7.3				
Turkey (1978)	4.6	1972-74	5.4	Survey (1973)/*	4.7
Yemen A.R. (1979)	8.5				
Bangladesh (1975)	6.1	1975	5.4	Survey (1974)/*	4.8[3]
Nepal (1976)	6.1	*	6.3	Survey (1976)/*	6.4
Pakistan (1975)	6.3	*	6.6	Survey (1976)/*	7.0
Sri Lanka (1975)	3.7	1974	3.5	Vital Stat/1974	3.5
Fiji (1974)	4.2			Vital Stat/1970-74	3.6
Indonesia (1976)	4.7	1971-75	4.8	Survey (1976)/ 1971-75[4]	4.9
Korea, Rep of. (1974)	4.2	1970-74	4.2	Census (1975)/ 1970-74[3]	4.1
Malaysia (1974)	4.6	1970-73	4.6	Vital Stat/ 1970-73	4.7
Philippines (1978)	5.1	1970	6.6[5]	Survey (1973)/ 1970	5.8[5]
Thailand (1975)	4.5	1970-74	4.9	Census (1970,1975)/ 1970-75[7]	5.0

Table 21 (*cont*)

	WFS ESTIMATES			EXTERNAL ESTIMATES	
	TFR for five-year period prior to survey[1]	Year	TFR[2]	Source/Year	TFR
AMERICAS					
Colombia (1976)	4.6	1972-74	4.7	Census (1973)/*	4.4
Ecuador (1979)	5.3	1976-78	5.3	Vital Stat/ 1976-78	5.2
Paraguay (1979)	4.9	1976-78	5.0	Survey (1977)/*	5.0
Peru (1977-78)	5.5	1974-76	5.6	Survey (1975)/*	5.3
Venezuela (1977)	4.4[5]	1972-75	4.3[5]	Vital Stat/ 1972-75	5.0
Costa Rica (1976)	3.8[6]	1971-75	3.8[6]	Vital Stat/ 1971-75	4.0
Dominican Republic (1975)	5.7	*	5.0		
Mexico (1976)	6.1	*	5.6	Survey (1978)/*	5.2
Panama (1976)	4.4[6]			Vital Stat/ 1971-75	4.5
Guyana (1975)	4.9	1972-74	4.8	Vital Stat/ 1972-74	4.3
Haiti (1977)	5.4				
Jamaica (1975-76)	5.0	1969-71	5.6	Census (1970)/*	4.6
Trinidad & Tobago (1977)	3.2	1974-76	3.2	Vital Stat/ 1974-76	3.2
EUROPE					
Portugal (1979-80)	2.3				

Table 21 (*cont*)

Notes:

* Estimates are for the one-year period prior to survey or census.

[1] Estimates for five-year periods prior to survey are based on cohort-period rates, for cohorts aged 15-19, 20-24, ... 45-49 at survey date (Goldman and Hobcraft, 1982)

[2] In most cases, estimates are the summation of age-specific fertility rates for five-year age groups for the specified calendar years. Since the oldest women interviewed in most WFS surveys are 49, rates for ages 45-49 are usually truncated: i.e., estimates for several years prior to survey have exposure for only the early part of the age group (e.g., ages 45-46).

[3] A P/F procedure applied to the estimated TFR of 4.8 produced a corrected value of 7.2 (Committee on Population and Demography, 1981, p. 39).

[4] Own-children estimate.

[5] Excludes 45-49 year olds.

[6] Based on the assumption that the fertility rate for the cohort 15-19 (not included in the survey) during the period 0-4 years prior to survey is equal to that of the cohort 20-24 during the period 5-9 years prior to survey.

[7] Based on parity increments between 1970 and 1975.

Surveys:

Kenya	-- National Demographic Survey, 1977
Bangladesh	-- Bangladesh Retrospective Survey of Fertility and Mortality, 1974
Indonesia	-- SUPAS I, 1976
Nepal	-- Demographic Sample Survey, 1976
Philippines	-- National Demographic Survey, 1973
Mexico	-- Contraceptive Prevalence Survey, 1978
Paraguay	-- Encuesta Demográfica Nacional, 1977

than in the preceding year, but in no country is the reverse pattern found. Some of the excess fertility of the past year is probably due to a heaping of reported or imputed dates to a date one year before the survey. The United Nations (1983) similarly argues that there is a deficit of births one to two years before the survey for many countries. Estimates of fertility based on the most recent two years (Goldman and Westoff 1980) and on the most recent three years (Hanenberg 1980) appear to be considerably more accurate than those based on only a single year. A five-year period has the advantage of further reducing sampling error as well as of minimizing the effects of age or date misstatement.

Further inspection of the P/F ratios in table 22 indicates anomalies in the birth histories of older cohorts. For example, the declining values for the older cohorts in Cameroon, Lesotho, Kenya, Mauritania, Sudan, Yemen AR, Bangladesh and Nepal suggest omissions, as has been indicated by previous tabulations. The absence of distortions in the corresponding P/F values at higher durations of motherhood is probably the result of a selection bias. Since the oldest age of respondent in most WFS surveys is 49, women at higher durations (over 25 years) must have been married and had their first child at young ages. Hence, parity values and P/F ratios at high durations of marriage and motherhood are frequently inflated because of the overall higher fertility levels experienced by women who had their first child at a young age (Hobcraft *et al* 1982). In Bangladesh, the constant deviation from unity of P/F values by duration of motherhood suggests that the total fertility rate of 6.1 for the early 1970s may be under-reported by about 15 per cent (Brass 1978; Hobcraft *et al* 1982), although some of the apparent decline in fertility is probably the result of famine in the aftermath of the 1971 war.

A question posed by Anderson and Cleland (1984) is whether more reliable measures of current fertility are obtained from a birth history than from a single question on the date of the most recent birth. A comparison of estimated TFRs for the 12 months preceding the survey,

Table 22 P/F ratios by age at survey and duration since first birth at survey, for 0–4 years before the survey

	AGE						YEARS SINCE FIRST BIRTH				
	20–24	25–29	30–34	35–39	40–44	45–49	5–9	10–14	15–19	20–24	25–29
AFRICA											
Benin	0.99	0.98	1.00	0.97	0.91	0.99	1.01	1.00	1.01	0.97	1.00
Cameroon	0.99	0.97	0.96	0.92	0.88	0.82	1.01	1.02	1.01	1.00	1.03
Ghana	1.05	1.02	1.03	1.07	1.05	1.06	1.02	1.05	1.06	1.10	1.13
Ivory Coast	0.99	0.95	0.97	0.98	0.99	0.94	1.01	1.02	1.03	1.06	1.10
Kenya	1.05	1.06	1.08	1.04	1.00	0.97	1.01	1.02	1.03	1.05	1.00
Lesotho	1.03	0.97	1.01	0.97	0.94	0.93	0.98	0.96	0.99	0.98	1.01
Nigeria	1.16	1.06	1.00	0.96	0.86	0.92	1.02	1.03	1.02	0.99	1.04
Senegal	0.99	1.02	1.08	0.99	1.01	1.00	1.02	1.01	0.98	0.97	1.04
Egypt	1.07	1.07	1.17	1.21	1.22	1.27	1.00	1.02	1.05	1.10	1.17
Mauritania	1.14	1.18	1.13	1.08	1.00	0.97	1.03	1.04	1.02	1.02	1.01
Morocco	1.10	1.13	1.22	1.24	1.26	1.21	1.01	1.05	1.10	1.09	1.10
Sudan (North)	1.22	1.19	1.21	1.14	1.05	1.01	1.02	1.04	1.05	1.05	1.00
Tunisia	1.03	1.14	1.23	1.24	1.20	1.22	0.98	1.00	1.04	1.06	1.13
ASIA AND PACIFIC											
Jordan	1.09	1.12	1.11	1.09	1.13	1.10	1.00	1.01	1.02	1.01	1.04
Syria	1.02	1.04	1.07	1.05	1.05	1.05	0.99	0.98	1.02	1.03	1.05
Turkey	1.13	1.14	1.21	1.32	1.31	1.36	1.06	1.08	1.19	1.24	1.30
Yemen A.R.	0.99	0.96	0.96	0.91	0.85	0.85	1.04	1.01	1.01	0.97	0.95
Bangladesh	1.19	1.26	1.25	1.24	1.19	1.11	1.08	1.14	1.16	1.17	1.13
Nepal	1.03	1.02	0.98	0.98	0.94	0.94	0.99	1.00	0.99	1.02	1.07
Pakistan	1.10	1.09	1.11	1.08	1.12	1.08	1.02	1.03	1.01	1.02	1.05
Sri Lanka	1.14	1.18	1.34	1.43	1.46	1.57	1.04	1.08	1.14	1.22	1.29
Fiji	1.07	1.18	1.32	1.35	1.50	1.56	0.99	1.08	1.15	1.25	1.45
Indonesia	1.09	1.10	1.15	1.14	1.15	1.10	1.01	1.02	1.08	1.10	1.14
Korea, Rep. of	1.00	1.02	1.08	1.16	1.25	1.37	0.99	1.01	1.06	1.14	1.23
Malaysia	1.05	1.11	1.23	1.29	1.33	1.34	1.02	1.05	1.11	1.16	1.21
Philippines	1.06	1.07	1.16	1.23	1.30	1.28	1.01	1.04	1.12	1.20	1.26
Thailand	1.02	1.08	1.19	1.23	1.35	1.44	1.05	1.11	1.19	1.29	1.47
AMERICAS											
Colombia	1.04	1.12	1.27	1.28	1.37	1.46	1.04	1.14	1.26	1.36	1.48
Ecuador	1.06	1.05	1.16	1.23	1.27	1.29	1.02	1.11	1.14	1.22	1.36
Paraguay	1.02	1.04	1.09	1.12	1.24	1.29	1.01	1.05	1.12	1.15	1.33
Peru	1.04	1.11	1.15	1.18	1.20	1.21	1.01	1.03	1.05	1.10	1.22
Venezuela	1.08	1.10	1.21	1.29	1.39	--	1.05	1.11	1.22	1.26	1.47
Costa Rica[1]	--	1.05	1.31	1.48	1.67	1.76	1.02	1.22	1.44	1.64	2.00
Dominican Rep.	1.05	1.14	1.18	1.28	1.16	1.15	1.02	1.06	1.11	1.14	1.20
Mexico	1.02	1.04	1.07	1.11	1.15	1.13	1.02	1.06	1.09	1.12	1.16
Panama[1]	--	1.12	1.17	1.28	1.33	1.32	1.03	1.08	1.22	1.29	1.35
Guyana	1.02	1.07	1.30	1.28	1.31	1.30	1.03	1.09	1.16	1.27	1.30
Haiti	1.02	1.06	1.06	1.06	1.13	1.11	0.96	1.01	1.04	1.06	1.18
Jamaica	1.09	1.09	1.13	1.16	1.11	1.11	1.01	1.07	1.13	1.24	1.17
Trinidad & Tobago	1.08	1.13	1.30	1.50	1.66	1.80	1.04	1.11	1.32	1.45	1.62
EUROPE											
Portugal	1.02	0.97	1.03	1.11	1.14	1.26	1.03	1.12	1.20	1.36	1.62

[1] P/F ratios by age are based on the assumption that the fertility rate for the cohort 15–19 (not included in the survey) during the period 0–4 years prior to survey is equal to that of the cohort 20–24 during the period 5–9 years prior to survey.

-- P/F ratios for ages 20–24 are equal to unity in Costa Rica and Panama because 15–19 year olds were not interviewed. In Venezuela, the oldest cohort is aged 40–44.

as derived from the birth histories and as estimated from nine WFS household schedules which included a question on the date of the last live birth, indicates a close agreement for five of the sets of estimates (Anderson and Cleland 1984). For the remaining estimates (Thailand, Sudan, Cameroon and Syria), the much lower values derived from the household survey are probably due to reference period error in the household data as well as errors resulting from the fact that responses are often supplied by proxies who, in the case of the Colombian Fertility Survey, have been shown to understate parity and current fertility (Hobcraft 1980).

Table 23 Summary of substantial anomalies[1] detected in analyses of fertility histories

Country	Findings
AFRICA	
Kenya	A questionable rise in fertility during the 1960s followed by a questionable decline in recent years (Henin et al., 1982).
Lesotho	Lower parity (and lower proportions dead) for the Individual Survey as compared with the Household Survey; omission of births for high parity women (Timaeus and Balasubramanian, 1984).
Senegal	Overestimate of fertility for cohort 30-34, probably due to age misstatement (Gueye, 1984).
Egypt	Understatement of marital fertility in recent period for teenagers (because of age overstatement) which leads to unsupported estimates of a recent fertility decline (Coale, 1983).
ASIA AND PACIFIC	
Jordan	Possible omission of (female) births; possible exaggerated fertility 10-19 years before survey and underestimated fertility 20-24 years before survey (Abdel-Aziz, 1983).
Syria	Omission of (female) births in earliest periods; overestimate of fertility for period 10-14 years before survey (Ali, 1983).
Turkey	Age misreporting in high fertility regions which results in overestimate of fertility at heaped ages (30, 45, 40, 45) and underestimate at remaining ages; possible omission of births by younger cohorts (Uner, 1983).
Bangladesh	Omission of births by oldest cohorts in early periods (especially female births); possible understatement of fertility in most recent period (Brass, 1978).
Nepal	Omission of births by women in their 40s, especially women who don't know their ages (Goldman et al., 1979).
Pakistan	Omission of births for oldest cohort(s) in early periods; possible age misreporting of cohort 40-44 producing distorted trend in fertility (Booth, 1979).

[1] Excluding displacement of dates of birth by oldest cohorts (Table 14) and heaping of births in preferred calendar years (e.g., 1970, 1975).

Table 23 (*cont*)

Country	Findings
Sri Lanka	Possible backward displacement of dates of births (or age misstatement) resulting in large discrepancies in estimated fertility rates for ages 15-19 between the survey and vital registration data (Alam and Cleland, 1981).
Fiji	No major anomalies (Potter, 1977b).
Indonesia	Omission of births by oldest cohort(s) in early periods (Supraptilah, 1982). Unsubstantiated large decline in fertility in the several years before survey (Feeney and Suharto, 1984).
Malaysia	No major anomalies (Yatim, 1982)
Philippines	No major anomalies (Reyes, 1981)
AMERICAS	
Colombia	No major anomalies (Hobcraft, 1980).
Ecuador	No major anomalies (Herrera de Rivadeneira, 1984).
Paraguay	Omission of early (female) births (Schoemaker, 1983).
Peru	No major anomalies (Cespedes, 1982).
Venezuela	No major anomalies (Vielma, 1982)
Dominican Rep.	Exaggerated fertility of cohort 35-39, probably due to selective transfer of high parity women from neighboring cohorts; underestimated fertility for women in their 40s (due to omission of (dead) children and possibly age misreporting) (Guzman, 1980).
Mexico	No major anomalies (Ordorica and Potter, 1981).
Guyana	No major anomalies (Balkaran, 1982).
Haiti	Age misstatement among cohorts over 30 producing relatively higher fertility for cohort 40-44 and low fertility for cohort 35-39; omission of births (especially infant deaths) for oldest cohort (Tardieu, 1984).
Jamaica	Considerable displacement of dates of birth of older cohorts which results in peaked fertility 10-14 years before survey and hence exaggerated recent fertility decline; possible omission of (female) births by oldest cohorts (Singh, 1982).
Trinidad & Tobago	No major anomalies (Hunte, 1983).

4.7 OTHER TYPES OF ERROR IN THE BIRTH HISTORIES

Since the data quality assessment for each survey cannot be reviewed in detail, the main findings on fertility data from the individual survey evaluations are summarized in table 23. The anomalies listed here do not include reference period errors for the older cohorts, since these errors were a frequent finding of the evaluation studies and they have already been described in conjunction with table 19. Errors which become apparent when fertility rates are constructed for single calendar years rather than five-year periods (eg an overestimate of births for rounded years such as 1970 and 1975) are not

mentioned in table 23, although they also occurred in many surveys.

A number of reviewers detected errors of misstatement of the respondent's age, which resulted in distorted fertility trends. For example, reported parity for 35–39 year olds in the Dominican Republic National Fertility Survey was inexplicably high, probably as a result of a selective transfer of high parity women from neighbouring age groups (particularly from the age group 40–44). These errors, together with under-reporting of births for women in their forties (probably due to a combination of age reporting errors and omissions of births), resulted in spurious trends in fertility for periods prior to the survey (Guzmán 1980). Age reporting errors for the older cohorts which distorted estimates of fertility were also found in the WFS surveys in Turkey, Nepal, Haiti, Senegal and Pakistan.

Another type of age reporting error was detected in an analysis of fertility levels in Egypt (Coale 1983). As a result of a fairly complex analysis, a recent decline in marital fertility at young ages and a recent increase in age at marriage, as estimated from the WFS survey, were found to be largely the result of age overstatement of young women, especially of women reported to be 15–19. This analysis of the Egyptian Fertility Survey was based upon comparisons of WFS data with vital registration data, as well as an examination of single-year age-specific and duration-specific fertility rates and first marriage rates as derived from the survey data. The results suggest that the total fertility rate for 1980 is about 5.5 instead of the reported TFR of 5.2 and, hence, that fertility in Egypt has remained constant during the later half of the 1970s. These results for the Egyptian Fertility Survey could not have been detected from the tabulations presented here (eg tables 21 and 22), nor were they uncovered in a detailed evaluation of the Egyptian Fertility Survey which neither incorporated vital registration data nor analysed single-year marriage and fertility rates (El Deeb 1984).

Age overstatement for teenagers, especially those who have reached puberty, are married or have a child, occurs frequently in south Asian and African censuses because interviewers are forced to estimate women's ages on the basis of physical appearances (United Nations 1967). Although age is ascertained through a more thorough questionnaire in WFS surveys, a recent study suggests that this 'African–south Asian' pattern of age misstatement may have occurred in a number of WFS surveys, particularly in the household surveys. Specifically, estimates of percentages ever married and/or age-specific fertility rates for Fiji, Philippines, Sri Lanka and Thailand reveal a widening discrepancy for the age group 15–19 for periods further in the past between the estimate from an external data source (vital registration or a census) and the WFS-derived estimate (Makinson 1984). If women reported to be 15–19 were in fact younger, in both the external data source and the WFS survey, the estimates would yield greater discrepancies in earlier than in more recent periods, because WFS-based estimates for earlier periods are no longer based on the reports of young women. Further confirmation of this type of age misstatement could be obtained by an examination of age-specific marital fertility rates at the young ages, as was done for Egypt. It is important to keep in mind that even if age misreporting were only to affect reports in the household survey, estimates of fertility for the younger cohorts would be affected in many surveys since the household survey data provide estimates of the denominators of fertility rates whenever the individual surveys are restricted to ever-married women.

The absence of reported anomalies in table 23 (or in the individual evaluation reports) does not necessarily mean that the data are accurate. The evaluations of the Egyptian Fertility Survey described above illustrate how two researchers can reach different conclusions about the quality of the data and therefore about the reported levels and trends in fertility. In the case of Egypt, the disparate findings resulted partly from differential access to external data.

In other circumstances, analysts have reached different conclusions when faced with the same data. For example, in an evaluation of WFS data for Indonesia, Supraptilah (1982) demonstrates that both the 1976 WFS survey and the 1973 Fertility–Mortality Survey show declines in fertility beginning around 1970, but that the estimated decline from the 1973 survey anticipates that from the 1976 survey by about two years. Supraptilah suggest that, even though this discrepancy cannot be reconciled, the fertility decline through the early 1970s is real. On the other hand, Feeney and Suharto (1984) argue that a consistent form of bias (ie age misreporting of young children) has produced almost identical trends from the IFS and the FM Survey: a spurious decline during a period about two to five years before the survey, followed by an equally spurious sharp rise in the last year before the survey.

Demographers have also disagreed on whether apparent increases in fertility are real or artifactual. For example, Mosley *et al* (1982) conclude that reported increases in fertility in Kenya are partly due to modernization, with the erosion of traditional patterns of breastfeeding, post-partum abstinence and polygamy. On the other hand, Henin *et al* (1982) argue that reported increases in fertility in Kenya are primarily due to reporting errors and that fertility has been relatively constant for the past 20 years.

4.8 SUMMARY AND CONCLUSIONS

This chapter has reviewed the evidence for the existence of errors in the detailed birth histories. For the majority of the surveys, coverage of births appears to be generally complete. However, for some surveys (mostly in Africa and south Asia), the oldest respondents have not supplied a full count of births. With a few exceptions, the levels of omission are not sufficiently large to produce decreasing parities or decreasing proportions dead of children ever born by age of respondent. In several instances, high sex ratios at birth suggest a selective omission of female births. All of these findings have been restricted to the reporting of live births. As might have been expected, coverage of non-live births (Chidambaram *et al* 1980) and of current pregnancies (Goldman and Westoff 1980) is far from complete in WFS surveys.

Although it is difficult to distinguish errors of omission of births from those of displacement of dates of birth, it appears that the latter is the more serious problem. Event displacement, particularly in the form of a shift of distant births by older women towards the survey date, is a common defect of WFS surveys. In many surveys, particularly those in Latin America and some parts of Asia, the displacement appears to be minor and to produce notable distortions only in the earliest periods. Nevertheless, a number of WFS surveys (eg in Africa and south Asia) show spurious trends in fertility for the most recent ten or fifteen years, quite possibly as a result of a Potter effect or of age misstatement. For some countries, the reported increases in fertility for the earlier periods may be real.

Evidence from an evaluation of the Haiti Fertility Survey and from an experimental questionnaire in Bangladesh indicates no obvious advantage or disadvantage to the use of a backward version of the birth history, ie one which begins with the most recent birth (Anderson and Cleland 1984). In spite of the evidence for event displacement, estimates of fertility for the five years before the survey appear to be fairly accurate in the majority of WFS surveys.

An undeniable conclusion of this report is that, for almost all countries, WFS surveys have achieved a better coverage of live births than have previous surveys, censuses or vital registration systems. Nevertheless, an important lesson of the WFS data assessment programme is that estimation of fertility levels and trends should never be made without a critical assessment of the data.

5 Assessment of the Quality of WFS Data for Direct Estimation of Childhood Mortality

By Shea Oscar Rutstein

5.1 INTRODUCTION

The birth histories obtained from the individual interview of WFS surveys provide valuable estimates of levels, trends and differentials of infant and child mortality, if they are accurate. Their value is considerably reduced if they suffer from misreporting. This chapter reviews evaluations of the quality of the relevant data and includes some new tabulations. It concentrates on the direct estimation of mortality.

5.2 ERRORS IN INFORMATION FOR MORTALITY ESTIMATION

To produce estimates of infant and child mortality, dates of birth for all children and ages at death for dead children are required. The WFS birth histories provide this information, although estimates made from them may be biased. The biases can be grouped into:

1 *Structural biases resulting from the structure and design of the survey and questionnaire.* These include truncation of data on the past, since the survey only interviewed women up to a certain age; censoring of exposure to mortality by the date of the interview; selection bias resulting from the fact that only surviving mothers reported on the deaths of children; and the form of the question used to determine age at death (whether age at death, date of death, or how many years ago the child died).

2 *Reporting errors.* Reporting errors include omission (and erroneous inclusion) of dead or surviving children, misreporting of dates of birth, and misreporting of ages at death. In addition, there may be errors in the reporting of the classificatory variables such as age of mother, education, etc.

Effects of structural errors

Structural errors may result in biased estimates. Censoring results in reduced exposure time and therefore a reduced count of deaths, lowering mortality estimates. To avoid censoring, an analyst should ignore censored cohorts of children. In other words, the analyst should not use the cohorts of children where all members have not reached the upper limit of age at death for the rate concerned, ignoring, say, the cohort born less than one year before the survey when the infant mortality rate is estimated. Another alternative would be to use synthetic cohorts in a life-table approach. For an example of such an approach, see Rutstein (1983).

Truncation of data means that for some periods before the survey, not all children born or living in those periods are represented in the survey. Truncation occurs because only women up to a given age are eligible for interview, and therefore children born to women who had an age greater than the maximum eligible age less the number of years prior to the survey would not have been recorded by the survey. Since the mortality of children appears to vary with the age of the mother at birth, normally thought to fall in a U or J shape, the estimated rate will be either above or below the true rate, depending on the number of years before the survey. The only direct control for this truncation bias is to limit the estimation to age at birth groups not affected, by studying, for example, the trend of mortality of children born to women up to age 29 for periods up to 19 years before the survey (for surveys with 49 as an upper age limit).

The selection bias that occurs because the birth histories represent only children born to women living at the time of the survey is a bias similar to truncation. It distorts trends because the longer ago a child was born, the more likely is it that the mother is no longer living. Since it is believed that children of dead mothers are themselves more likely to die, the bias would reduce estimates of mortality. Similar distortions would occur for differentials, since less educated, more rural, and older women are less likely to have survived from the time of birth to the survey.

The form of the question used to determine age at death will affect estimates of the rates. In Dominican Republic, Paraguay and Venezuela, only age at death in completed years was asked so that neo-natal and post-neonatal rates cannot be calculated. In 10 countries, the data of death was asked either as an alternative or instead of the age at death. Korea and Portugal only asked for date of death. Date of death was an alternative to age in Nepal, Philippines, Malaysia and Senegal. In Guyana, Jamaica and Trinidad and Tobago, if date of death was not known, the respondent was asked how long before the survey the death occurred. Since the accuracy of the coding of date of death was limited to month, neo-natal rates will be underestimated and post-neonatal rates will be overestimated. This effect occurs because the mean exposure for children who died at '0' months of age would really be only two weeks. The bias is very noticeable for Malaysia where only date of death was recorded. Infant mortality rates would also be underestimated, albeit by less than one twenty-fourth.

In Cameroon, the unit of time reported was left to the respondent. In this case, children who died at age one year or above were most likely to have their age reported only in years. Non-standard rates should therefore not be calculated. The result in Cameroon on measures of misreporting of age at death are dramatic (see below) but also misleading.

Biases caused by reporting errors

Omission of dead children is the reporting error likely to bias mortality rates most, although the percentage reduction in the rates is less than the per cent of children omitted, since the denominator is also affected. Omission of living children would have an opposite effect, but it is believed to occur far less often. It is thought that omission is selective for children born long ago and for girls; it varies according to educational level and parity of the mother. Therefore overall levels would be reduced and trends and differentials especially affected.

Misreporting of ages at death would not be very likely to bias estimates of mortality under age five, since most deaths occur at ages far below sixty months exactly, but it is likely to bias estimates of the component rates, neonatal, post-neonatal, toddler and child mortality. Heaping on preferred ages is thought to be the most likely source of misreporting of age at death and many analysts assign half the deaths at 12 months to the infant period.

The misreporting of birth dates of children would distort trends of mortality. If, on the whole, children were brought forward in time regardless of whether they were alive at the time of interview, as in the Potter hypothesis, then mortality rates would be overestimated for the periods which they moved into, and an excessive drop in mortality would occur for the most recent period. The opposite would occur if births had been shifted backwards. Misreporting of birth dates according to survival status would have a much more profound effect that would depend on the directions and levels of the shifts for dead and living children. If, for example, births of living children were brought forward, say by understating their current ages, then mortality rates would be too low recently and too high in the past.

External test for data quality

There are no definitive tests of quality except where complete vital registration occurs, which is not the case for most of the less developed countries covered by the WFS. In fact, many countries lack any national direct estimates of infant and child mortality apart from the WFS. Comparisons with vital statistics can be made, however, to show gross errors, since lower estimates from the survey would undoubtedly mean that the data are deficient. Comparisons with indirect estimates, say from censuses or surveys, are another matter however, since they assume certain patterns of mortality and usually overestimate when a downward trend of mortality has occurred. In addition they depend on the correct reporting of mother's age, as well as a lack of omission. Indirect techniques do not depend on information on age at death and so have an advantage over direct estimates.

Internal tests for data quality

Since most countries do not have data that allow for definitive external tests, certain internal checks are useful. These divide into two groups: those on the basic data and those on the resulting estimates. For the basic data we are limited to checking the plausibility of the pattern of births over time and the reporting of age at death. In order to check the estimates of mortality, we are obliged to study the plausibility of age patterns, trends over time and differentials according to sex, age of mother at birth, parity, education, type of place of residence, etc. Only the most deficient data are likely to produce implausible patterns and so these checks are not very conclusive. In addition, what may seem implausible, such as a rise in mortality over time or higher urban than rural mortality, may truly be the case.

5.3 THE QUALITY OF WFS DATA FOR DIRECT ESTIMATES

Findings from the evaluation reports

For many countries, reports evaluating the quality of the demographic data include an examination of the infant and child mortality rates. The references at the end of this study include a list of these reports. We summarize the information in the table opposite.

An asterisk is put against the result for the Dominican Republic because although the evaluation report of the survey concluded there had been omission, a comparison with the second survey showed the same rise in mortality at the same calender period.

For only 3 of the 23 countries mentioned here did the authors of the evaluation reports conclude that omission had affected the mortality rates of the fifteen years preceding the survey, but for 13 of the 23 there was omission in earlier periods. For 8 of the countries, age at death was, they concluded, misreported. In addition, Mott (1982) reached that conclusion for Kenya. Meegama (1980) concludes that the estimates of infant mortality from the Sri Lankan survey show a broad similarity both in levels and trends with registration figures. Blacker *et al* (1983) concludes for the Jordan Fertility Survey that the retrospective data from both the individual questionnaire and the household schedule appear to be of good quality, although the reports of children ever born for older women were better in the individual survey. They suggest, however, that near the date of the survey, direct estimates are too low probably because of misdating of births and child deaths. Somoza (1980), after a series of tests on the Colombian National Fertility Survey, finds that data for mortality estimation are of good quality.

Internal checks applied to the WFS data

We begin by looking at the percentage of deaths with missing ages at death. Table 24 shows these percentages by whether age in completed years at death was missing, or whether age in months was missing, or both, according to the five-year time period of birth. Only 29 countries present data on age at death which was not previously coded into groups on the data file. We are therefore not able to examine the remaining surveys since the missing data were assigned to a group for coding. Age at death was not machine imputed in any of the countries.

In 22 of the 29 countries, less than 2 per cent of the

Country	Evidence of omission		Evidence of misreporting age at death
	<15 years ago	15+ years ago	
Senegal	No	No	Yes
Egypt	Possibly	Possibly	No
Jordan	Yes	Yes	No
Turkey	No	Yes	No
Yemen AR	Yes	Yes	Yes
Nepal	No	No	No
Sri Lanka	No	Yes	No
Indonesia	No	Yes	Yes
Malaysia	No	No	Yes
Philippines	No	No	No
Colombia	No	No	No (Somoza, 1980)
Ecuador	No	No	No
Paraguay	No	Yes	No
Peru	No	No	No
Venezuela	No	No	Yes
Costa Rica	No	Yes	Yes
Dom. Rep.	No	Yes*	No
Mexico	No	No	No
Guyana	No	Yes	No
Haiti	No	Yes	Yes
Jamaica	No	Yes	Yes
Trin. & Tob.	No	No	No
Portugal	No	Yes	No

*A second survey showed the same rise in mortality (see p. 64).

deaths lacked age at death in both year and month. In Benin, Lesotho and Haiti, about 6 per cent were missing; in Ghana about 5 per cent; in Mauritania about 4 per cent and in Fiji and Tunisia about 3 per cent. A few countries have substantially more missing data for age at death in months: in Egypt and Tunisia about 10 per cent of the deaths have missing data codes for months, 8 per cent in Portugal and 4 per cent in Senegal and Yemen AR. We suspect that much of this is due to a woman saying her child died at a given age in years and was either not asked, or did not know exactly, how many months longer he or she lived.

We would expect that deaths that occurred longer ago would be more subject to missing age at death and in general table 24 confirms our expectations, although the effect is not very strong. Four countries, however, show more missing data for later-born children: Mauritania, Tunisia, Yemen AR and Jamaica. This pattern may indicate omission of earlier deaths.

So far we have left out Cameroon which shows no missing data for age at death in completed years but does so for 40 per cent of the deaths for age in completed months. The explanation of this phenomenon lies in the method of response to the question on age at death. As mentioned above, age at death could have been given in a variety of units of time, from days to years. Both the unit and the amount were noted on the questionnaire. In this case, for ages at death above a year it is likely that the woman gave the years and so no information on completed months beyond the completed years is available.

For the countries with ungrouped ages at death (except Cameroon) table 25 shows the extent of heaping on certain ages at death. In this table several indexes of heaping are presented. Below (p. 68), we reclassify the countries based on the middle index (column 3), which calculates the per cent of deaths at 0 to 60 months that occurred at 6, 12, 18, 24, 30 and 36 months.

Table 24 Percentages of deaths with missing ages at death by period of birth (countries with ungrouped age at death codes)

Country	Data	Total	Period of birth						
			0-4	5-9	10-14	15-19	20-24	25-29	30-34
AFRICA									
Benin	Year	6.1	5.0	5.6	6.6	6.8	7.5	3.8	13.8
	Month	6.1	5.0	5.6	6.6	6.8	7.5	3.8	13.8
	Both	6.1	5.0	5.6	6.6	6.8	7.5	3.8	13.8
Cameroon	Year	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Month	40.2	26.2	41.9	42.4	48.1	39.5	44.5	53.3
	Both	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ghana	Year	5.2	2.2	4.3	6.8	5.3	6.5	7.5	13.3
	Month	5.6	2.2	5.0	6.6	6.0	7.1	8.2	15.6
	Both	5.1	2.2	4.3	6.3	5.3	6.5	7.5	13.3
Ivory Coast	Year	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Month	0.2	0.1	0.1	0.4	0.1	0.0	0.0	0.0
	Both	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kenya	Year	1.8	1.4	1.5	1.4	2.7	2.7	1.4	0.0
	Month	2.0	1.3	1.5	1.7	3.5	2.6	1.8	0.0
	Both	1.7	1.3	1.5	1.3	2.7	2.4	1.4	0.0
Lesotho	Year	6.1	6.1	7.5	5.5	6.3	5.2	4.9	0.0
	Month	6.1	5.9	7.7	5.7	6.0	5.2	4.9	0.0
	Both	6.0	5.9	7.5	5.5	6.0	5.2	4.9	0.0
Senegal	Year	1.3	1.4	1.3	0.7	1.4	1.7	2.0	0.0
	Month	3.8	3.3	4.2	3.5	3.6	4.1	5.1	2.9
	Both	1.3	1.4	1.3	0.7	1.4	1.7	2.0	0.0
Egypt	Year	1.5	1.9	1.3	1.9	1.1	1.2	1.8	0.0
	Month	9.6	4.7	8.2	12.0	11.4	10.9	10.3	9.2
	Both	1.1	1.2	0.9	1.5	0.8	0.9	1.3	0.0
Mauritania	Year	4.7	7.5	4.9	3.7	4.2	3.4	2.2	2.2
	Month	4.2	6.6	3.9	4.0	3.9	3.1	1.7	2.2
	Both	4.0	6.6	3.7	3.5	3.7	3.1	1.7	2.2
Morocco	Year	0.7	0.6	0.9	0.9	0.8	0.0	1.5	0.0
	Month	1.2	1.4	0.7	1.7	1.1	0.6	2.2	1.5
	Both	0.5	0.6	0.7	0.9	0.3	0.0	0.6	0.0
Sudan	Year	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	Month	1.8	1.3	1.1	1.9	2.0	3.0	3.9	6.9
	Both	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Tunisia	Year	7.4	9.1	8.5	8.0	6.5	5.8	5.4	7.8
	Month	9.8	8.4	8.6	12.5	9.0	10.0	11.9	3.9
	Both	3.2	5.3	2.6	3.7	2.8	2.7	1.6	0.0

Table 24 (*cont*)

Country	Data	Total	Period of birth						
			0-4	5-9	10-14	15-19	20-24	25-29	30-34
ASIA and PACIFIC									
Jordan	Year	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Both	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syria	Year	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Both	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yemen	Year	1.5	3.0	1.8	1.0	0.2	0.5	0.0	2.4
	Month	3.8	3.6	3.7	3.7	3.7	4.3	8.2	0.0
	Both	1.4	2.9	1.7	1.0	0.2	0.5	0.0	0.0
Bangladesh	Year	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Month	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Both	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Nepal	Year	8.3	0.4	4.8	10.2	11.2	15.3	25.2	20.8
	Month	0.3	0.4	0.1	0.2	0.5	0.0	0.6	0.0
	Both	0.3	0.4	0.1	0.2	0.5	0.0	0.6	0.0
Fiji	Year	2.7	2.2	3.7	1.7	1.8	4.7	2.9	0.0
	Month	2.7	2.2	3.7	1.7	1.8	4.7	2.9	0.0
	Both	2.7	2.2	3.7	1.7	1.8	4.7	2.9	0.0
Korea	Year	1.6	0.4	1.7	2.5	1.6	0.8	1.2	5.3
	Month	1.6	0.4	1.7	2.5	1.6	0.8	1.2	5.3
	Both	1.6	0.4	1.7	2.5	1.6	0.8	1.2	5.3
Malaysia	Year	0.9	0.4	0.9	0.9	1.6	0.9	0.4	0.0
	Month	0.9	0.4	0.9	0.9	1.6	0.9	0.4	0.0
	Both	0.9	0.4	0.9	0.9	1.6	0.9	0.4	0.0
Philippines	Year	0.9	0.3	0.3	1.0	1.5	1.7	1.2	0.0
	Month	2.0	1.2	1.3	2.0	3.0	3.0	2.5	0.0
	Both	0.9	0.3	0.3	1.0	1.5	1.7	1.2	0.0
AMERICAS									
Paraguay	Year	0.2	0.0	0.5	0.5	0.0	0.0	0.0	0.0
	Month	na	na	na	na	na	na	na	na
	Both	na	na	na	na	na	na	na	na
Venezuela	Year	0.9	0.7	1.2	2.2	0.0	0.0	0.0	na
	Month	na	na	na	na	na	na	na	na
	Both	na	na	na	na	na	na	na	na
Domin. Rep.	Year	1.8	0.8	2.2	3.2	1.0	2.4	0.0	0.0
	Month	na	na	na	na	na	na	na	na
	Both	na	na	na	na	na	na	na	na

Table 24 (*cont*)

Country	Data	Total	Period of birth						
			0–4	5–9	10–14	15–19	20–24	25–29	30–34
Guyana	Year	1.3	1.7	1.5	0.8	1.2	1.4	0.0	0.0
	Month	1.3	1.7	1.5	0.8	1.2	1.4	0.0	0.0
	Both	1.3	1.7	1.5	0.8	1.2	1.4	0.0	0.0
Haiti	Year	5.9	4.6	5.3	5.7	5.9	8.7	10.8	8.0
	Month	5.9	4.6	5.3	5.7	5.9	8.7	10.8	8.0
	Both	5.9	4.6	5.3	5.7	5.9	8.7	10.8	8.0
Jamaica	Year	0.5	2.5	0.0	0.7	0.0	0.0	0.0	0.0
	Month	0.5	2.5	0.0	0.7	0.0	0.0	0.0	0.0
	Both	0.5	2.5	0.0	0.7	0.0	0.0	0.0	0.0
Trin. & Tob.	Year	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Both	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EUROPE									
Portugal	Year	1.9	1.2	1.5	1.9	1.1	2.3	5.7	na
	Month	7.8	2.4	6.6	5.0	12.7	6.9	13.2	na
	Both	1.9	1.2	1.5	1.9	1.1	2.3	5.7	na

Less than 10 per cent: Korea, Trinidad and Tobago, Portugal

10–19 per cent: Nepal, Philippines, Guyana, Jamaica, Fiji

20–29 per cent: Ivory Coast, Kenya, Lesotho, Senegal, Jordan, Malaysia, Haiti, Bangladesh

30–39 per cent: Benin, Ghana, Egypt, Morocco, Sudan, Tunisia, Yemen AR

40 per cent and above: Mauritania

Heaping on month 12 is especially crucial for the estimation of infant mortality rates. Ten countries have more than 10 per cent of births in months 0 to 30 occurring at month 12: Benin, Ivory Coast, Egypt, Mauritania, Morocco, Sudan, Tunisia, Jordan, Syria, and Yemen AR.

Age pattern of mortality

The children most likely to be omitted, it is thought, are those who died soon after birth. Table 26 examines the proportion of infant mortality represented by neo-natal mortality (see also figure 4). As mentioned above, a number of countries asked date of death in preference to age at death. In these cases a low percentage of neo-natal deaths would not necessarily indicate omission, but would mean that neo-natal mortality was understated and post-neonatal mortality overstated.

Only three countries, Syria, Malaysia and Philippines, show substantially low levels of neo-natal mortality in the most recent five-year period and one, Trinidad and Tobago, shows a very high level. In both Malaysia and the Philippines, date of death was asked (also in Trinidad and Tobago), so that only Syria shows evidence of omission in the most recent five-year period.

A number of countries, however, show substantial decreases in the proportion of neo-natal deaths as we observe back in time. These countries and the years before the survey when the proportion of neo-natal mortality drops substantially are given below:

Country	Period
Kenya	20–24
Jordan	15–19
Syria	10–14, 20–24
Turkey	5–9, 25–29
Nepal	10–14
Korea, Rep. of	15–19
Malaysia	5–9
Philippines	15–19, 20–24
Thailand	15–19, 20–24
Colombia	20–24
Peru	15–19
Costa Rica	10–14, 15–19
Panama	15–19
Trinidad and Tobago	10–14, 15–19

Table 25 Indexes of heaping of age at death

Country	Percent of deaths 0-30 at given months		Percent of deaths 0-60 at 6,12,18, 24,30, & 36 months	Single-month age ratios	
	12	24		12	24
AFRICA					
Benin	11.8	11.5	37.0	13.9	78.6
Ghana	9.7	10.5	32.1	8.6	32.3
Ivory Coast	11.5	9.7	29.9	12.1	744.0
Kenya	9.8	8.0	29.7	11.2	48.2
Lesotho	9.4	5.6	22.2	10.5	38.2
Senegal	6.9	6.2	22.1	3.8	5.5
Egypt	10.7	7.2	34.1	12.3	71.7
Mauritania	16.2	20.3	44.7	28.8	112.9
Morocco	15.2	9.8	32.1	23.6	96.0
Sudan	14.2	11.1	36.7	17.6	138.0
Tunisia	12.1	5.9	32.8	10.7	101.6
ASIA and PACIFIC					
Jordan	10.8	4.6	26.8	11.9	40.8
Syria	10.7	6.8	27.3	15.6	47.0
Yemen	12.3	8.8	30.0	33.9	273.4
Bangladesh	8.2	7.6	29.5	19.4	163.4
Nepal	5.6	2.2	13.3	2.5	2.3
Fiji	8.0	3.9	17.4	12.7	a
Korea	3.0	1.4	8.5	1.3	1.1
Malaysia	5.7	6.2	22.9	6.3	59.5
Philippines	3.9	1.5	10.6	1.6	1.5
AMERICAS					
Guyana	5.4	0.8	10.4	2.7	2.8
Haiti	7.4	11.4	28.2	8.4	98.0
Jamaica	7.1	1.8	13.4	3.5	5.3
Trin. & Tob.	1.5	0.6	5.2	1.2	2.4
EUROPE					
Portugal	3.2	0.5	8.4	3.8	2.0

Notes: Single-month age ratio defined as

$$\frac{4 \times D_m}{(D_{m-2} + D_{m-1} + D_{m+1} + D_{m+2})}$$

a No deaths in neighboring months

A decrease in the proportion neo-natal at earlier time periods would in general occur if mortality were higher at those times, so one must be careful in judging a dataset to be subject to omission. Haiti shows a curious rise in the proportion neo-natal as the period is farther from the survey.

Sex differentials in mortality

It is suspected that if there is a greater preference for children of one sex than the other, greater omission occurs for the less preferred sex. Therefore, a study of sex differentials in mortality could reveal omission. We must be careful, however, since the presumed direction of preference may have the opposite effect in reporting. For example, greater care may be given to boys, but a greater reluctance to disclose such deaths may also occur. We must also be careful to distinguish omission from the effects of sampling errors.

Table 27 presents male and female mortality rates. We should look for abnormally high or low ratios of the male to female rates that would indicate sex selective omission. The West model life table at level 7 gives a ratio of male to female rates of 117 and a ratio at level 22 of 136. Since these levels are likely to encompass our rates, we will use these as limits to the normal range. Only one country, Portugal, has a ratio above 140 that would indicate omission of girls who died. However, several countries have ratios below 110: in Africa, Cameroon (107), Lesotho (106), Morocco (106) and Tunisia (102); in Asia, Nepal (103), Pakistan (105), Jordan (85), Syria (92) and Thailand (108); in the Americas, Peru (105), Paraguay (103) and Panama (109).

The cases of Jordan, Syria, Egypt and Tunisia seem to deserve special attention. If we look at the detailed tables from Rutstein (1983; 1984) for neo-natal and post-neonatal rates we find the following ratios:

Country	Neo-natal	Post-neonatal
Egypt	111.0	87.5
Jordan	113.2	60.5
Syria	106.7	76.0
Tunisia	146.2	84.5

There is the possibility of some omission of boys in Egypt, Syria and Jordan who have died during the neo-natal period but probably none in Tunisia. The low overall ratios are due to low ratios during the post-neonatal period, which could very well reflect differential care.

Mortality by birth order and by age of mother at birth

The pattern of infant and child mortality according to order of birth and age of mother is usually described as a J or a U in that as order and age rise, mortality first falls and then rises. These patterns can be disturbed by omission. In fact it is thought that first-born children and children of young mothers, especially those born some time before the survey, are more likely to have been omitted. Table 28 shows mortality rates according to birth order and table 29 according to the age of mother at birth. For infant mortality in the period 0–4 years before the survey, 17 countries have lower or about the same mortality for first births as for second and third births, but no countries show lower mortality for births to mothers at less than 20 years of age than at 20–29, although for Lesotho, Philippines and Jamaica the differences are small. The explanation seems to lie in the effect of birth intervals, since first births are not affected by the presence of an older child (see Hobcraft *et al* 1983).

Trends in mortality

Tables 30 and 31 show mortality levels for time periods in the past (restricted to children whose mothers were 20–29 years at their birth). Several countries show substantial rises in the most recent period in mortality

Table 26 Current levels of infant and child mortality (in the period 0–4 years before the survey)

Country	Date of Survey	Infant (1q0)	NN	P-NN	Under 5 (5q0)	Toddler (1q1)	Child (3q2)
Senegal	1978	111.8	49.6	62.1	262.4	73.9	103.4
Yemen A. R.	1979	161.5	58.4	103.1	236.5	41.6	50.0
Nepal	1976	142.3	75.4	66.9	234.6	53.7	57.0
Bangladesh	1975-6	135.0	73.7	61.3	221.6	34.6	67.9
Pakistan	1975	139.0	79.9	59.0	207.2	33.1	47.8
Benin	1981-2	107.6	49.7	57.9	204.2	36.7	74.3
Mauritania	1981-2	90.2	47.8	42.4	195.9	45.3	74.3
Cameroon	1978	104.6	45.3	59.3	191.2	40.1	59.0
Haiti	1977	122.7	60.5	62.2	191.1	29.5	49.9
Egypt	1980	132.3	58.7	73.7	190.6	37.1	31.2
Lesotho	1977	125.8	67.6	58.2	173.7	29.0	26.5
Turkey	1978	132.6	63.0	69.6	165.8	22.7	16.0
Ivory Coast	1980-2	113.1	54.0	59.2	161.8	17.2	38.4
Indonesia	1976	94.6	47.3	47.3	158.5	26.4	45.4
Sudan	1979-80	78.6	41.5	37.0	150.8	37.5	42.5
Peru	1977-8	96.5	43.8	52.7	149.3	31.3	28.0
Morocco	1980	91.2	50.3	40.9	141.8	30.3	26.2
Kenya	1977-8	86.6	37.8	48.8	141.6	27.9	33.3
Domin. Rep.	1975	88.6	--	--	128.5	25.3	18.9
Ghana	1979	73.4	38.0	35.3	127.2	24.7	34.3
Ecuador	1979-80	75.7	37.6	38.1	117.6	24.8	21.0
Colombia	1976	69.6	33.5	36.2	107.9	18.5	23.0
Tunisia	1978	79.8	38.9	40.9	107.2	16.2	13.8
Mexico	1976-7	71.6	40.9	30.7	96.0	12.5	14.0
Philippines	1978	58.3	24.5	33.7	92.9	15.5	21.6
Thailand	1975	65.1	38.9	26.2	90.9	8.6	19.2
Sri Lanka	1975	59.9	36.9	23.0	86.1	8.2	19.7
Syria	1978	64.6	15.2	49.4	86.1	12.2	10.9
Paraguay	1979	61.2	--	--	84.9	15.1	10.3
Jordan	1976	65.6	27.5	38.1	79.7	9.3	5.8
Guyana	1975	57.6	34.3	23.3	77.2	11.7	9.2
Venezuela	1977	53.1	--	--	63.7	5.5	5.7
Costa Rica	1976	53.3	24.8	28.5	61.3	3.9	4.6
Fiji	1974	47.0	--	--	58.5	5.4	6.7
Korea, Rep.	1974	41.7	23.0	18.7	56.1	6.9	8.1
Jamaica	1975-6	43.0	23.9	19.1	55.8	8.1	5.3
Malaysia	1974-5	36.1	13.9	22.2	49.8	5.5	8.7
Trin & Tob	1977	41.3	30.8	10.5	49.1	2.8	5.4
Panama	1976-7	32.8	20.5	12.3	45.7	5.6	7.9
Portugal	1979-80	33.3	23.3	10.0	36.6	1.8	1.6

Notes:
1. Rates are expressed per thousand.
2. Countries are ordered by level of Under Five Mortality (5q0).
3. -- indicates that the rate is not calculable.

Source: Rutstein, 1984

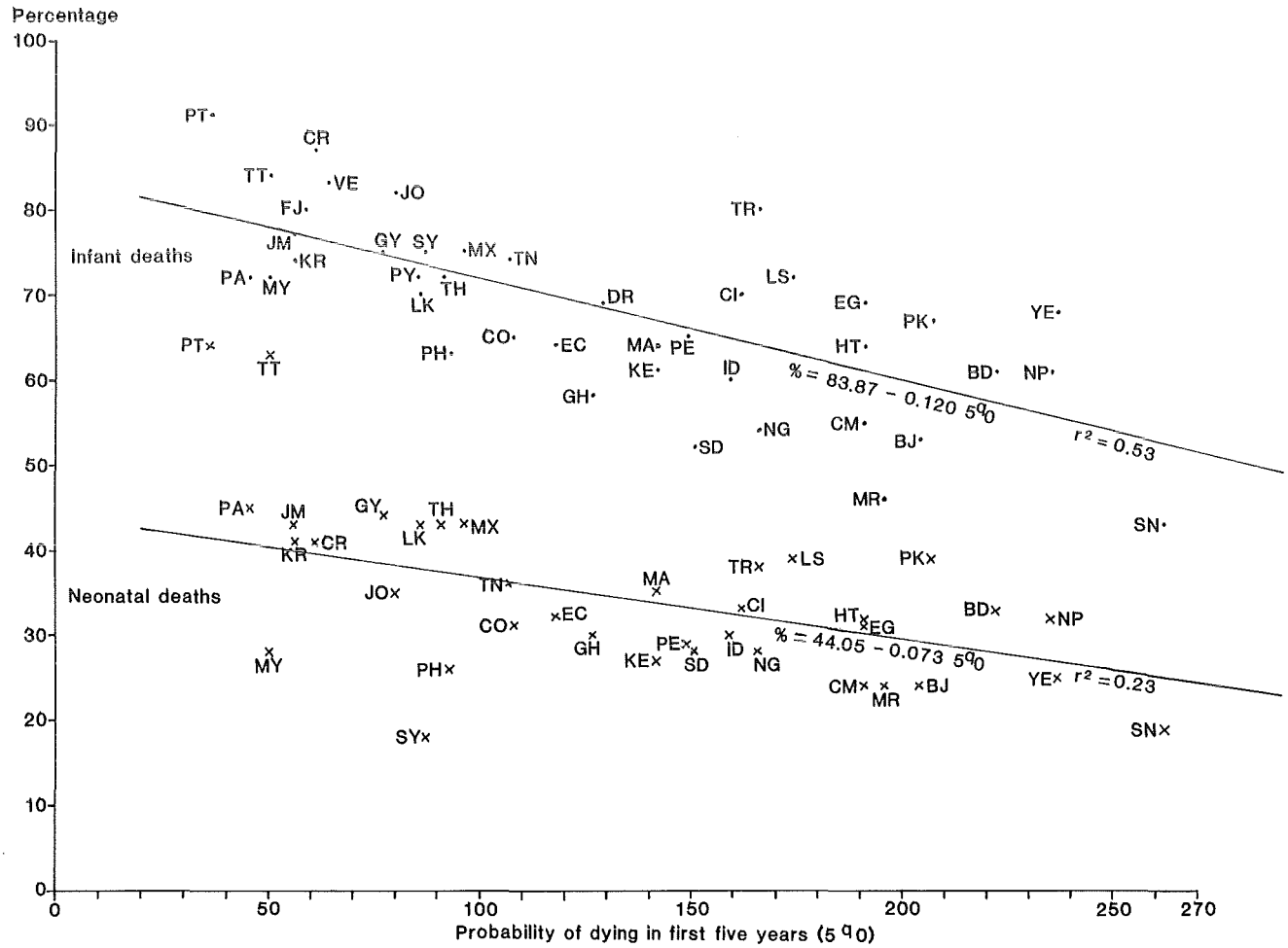

Figure 4 Percentage of deaths in the first month and in the first year out of all deaths in the first five years of life (based on calculated death probabilities), according to the probability of dying in the first five years of life

under five: Mauritania (23 point rise), Bangladesh (22), Pakistan (15), Paraguay (10), Guyana (10). Of these, only Mauritania, Bangladesh and Pakistan also show an increase in neo-natal rates.

Only four countries, Senegal, Lesotho, Paraguay and Costa Rica show lower (unbracketed) rates 15–19 years before the survey than in the next earlier period. We should be careful in concluding that mortality always declines and that any deviation is due to omission or other error. A study of mortality estimates of a second fertility survey in the Dominican Republic showed the same calendar patterns of mortality as the earlier survey (Hobcraft and Rodríguez 1982) that had previously been thought to be evidence of omission (Guzmán 1980).

Mortality by education

Table 32 shows mortality estimates by educational levels. Indonesia has lower mortality for mothers with no education than mothers with some education for all three rates shown. Mauritania, Sudan, Fiji and Egypt show lower mortality for two of the rates and Ecuador, Turkey, Sri Lanka and Philippines for one rate. Lower rates for the group with no education are not usually expected and could indicate omission by these women.

Comparison with indirect estimates from household data

Timæus (1984) has compared the proportions dead of children according to current age of mother from eleven household surveys with those of the individual survey. He finds that only in Korea and Colombia are the proportions very close. In Yemen AR the proportions are much lower and in the other eight countries the proportions are higher in the household survey. He is unable to provide a consistent explanation of the higher proportions. Comparing indirect estimates from the household survey data with direct estimates for mortality under age five, he finds that on the whole the figures are rather close, but that in Yemen AR, Morocco and Mauritania the trends diverge and in Mauritania, the household trends look much better (the household data show a small decline, while the individual data show a substantial rise).

Table 27 Male and female mortality rates (0–9 years before the survey)

Country	Infant (1q0)		Toddler (1q1)		Child (3q2)	
	Male	Female	Male	Female	Male	Female
Senegal	124.9	108.0	76.5	77.3	107.0	106.8
Yemen A. R.	173.1	154.7	47.6	53.5	56.1	60.6
Nepal	151.6	147.9	49.2	55.0	57.7	60.7
Bangladesh	143.7	121.5	26.0	35.4	57.7	68.6
Pakistan	140.7	134.6	26.1	40.4	36.9	54.4
Benin	129.7	110.1	42.9	39.7	83.4	77.8
Mauritania	95.2	78.1	40.6	44.3	69.3	75.9
Cameroon	107.7	101.1	41.5	39.8	61.5	62.0
Haiti	145.4	120.7	30.6	27.6	47.8	61.2
Egypt	139.4	137.4	40.1	56.5	38.5	40.9
Lesotho	132.6	125.4	35.3	24.4	29.3	26.6
Turkey	143.0	130.5	21.2	34.2	18.4	19.5
Ivory Coast	142.2	114.3	36.8	30.9	49.8	44.8
Indonesia	109.0	83.6	32.3	28.2	52.6	40.1
Peru	104.8	99.7	33.4	33.4	28.8	30.8
Morocco	99.0	93.2	29.5	33.4	31.4	28.4
Sudan	87.9	71.6	35.3	28.2	36.3	47.7
Kenya	96.5	87.7	32.9	28.2	36.4	35.7
Domin. Rep.	103.1	82.3	25.2	24.5	17.2	20.2
Ghana	81.1	66.4	26.1	22.6	35.9	37.6
Ecuador	87.8	72.4	29.5	28.5	19.9	23.0
Colombia	73.6	61.9	15.5	20.8	20.5	24.8
Tunisia	78.4	77.0	24.0	22.9	22.7	18.2
Mexico	82.9	66.4	14.8	17.2	14.7	16.7
Philippines	62.5	52.5	14.2	15.2	19.1	21.9
Thailand	76.9	71.4	10.4	7.3	17.3	26.8
Syria	63.9	69.5	11.9	11.3	9.3	14.6
Sri Lanka	65.6	52.9	7.6	11.2	16.3	18.7
Paraguay	58.1	56.4	13.4	12.5	13.3	7.9
Jordan	61.9	72.9	11.4	14.0	7.0	7.1
Guyana	65.5	50.3	10.0	9.6	8.9	8.4
Venezuela	55.8	43.9	6.7	5.9	7.6	8.4
Costa Rica	72.4	54.7	7.9	7.8	4.8	8.1
Fiji	53.4	44.8	4.4	4.8	5.3	5.1
Korea, Rep.	49.9	44.4	10.0	9.4	11.8	12.7
Jamaica	47.5	34.8	9.3	8.7	6.2	5.3
Trin. & Tob.	46.6	38.7	3.5	4.9	4.5	2.8
Malaysia	44.3	33.7	6.9	4.9	9.2	7.7
Panama	43.6	39.9	6.2	6.8	7.6	8.7
Portugal	46.8	31.5	3.8	2.5	1.7	2.9

Source: Rutstein, 1984

Table 28 Infant, toddler and child mortality rates by order of birth (0–9 years before the survey)

	Infant (1q0)				Toddler (1q1)				Child (3q2)			
Country	1	2–3	4–6	7+	1	2–3	4–6	7+	1	2–3	4–6	7+
Senegal	126.0	108.4	116.2	120.0	80.3	68.6	75.8	87.2	95.4	115.3	100.0	115.1
Yemen A. R.	185.9	152.0	148.5	189.1	40.8	44.9	60.7	52.6	62.0	61.0	57.0	(50.5)
Nepal	171.3	139.7	142.5	162.0	47.7	50.0	54.4	59.0	55.9	57.7	62.1	61.2
Bangladesh	173.1	138.7	109.4	126.6	28.7	25.5	32.8	36.6	54.6	58.5	72.2	60.9
Pakistan	170.2	140.2	125.3	129.3	23.3	32.6	34.9	37.9	33.2	45.1	51.6	45.0
Benin	106.7	103.7	126.6	162.3	34.4	37.9	53.5	32.2	82.4	83.4	75.9	82.9
Mauritania	98.3	77.9	69.8	122.9	32.7	40.5	45.4	51.3	54.8	71.0	74.3	95.9
Cameroon	122.1	92.6	94.1	125.3	42.1	43.7	37.9	38.3	56.3	54.3	66.2	77.6
Haiti	120.8	140.6	138.5	127.0	31.4	28.8	36.0	13.6	54.9	65.2	52.6	(33.9)
Egypt	135.1	127.8	137.1	162.2	39.5	48.7	49.5	53.1	20.5	39.8	48.0	44.6
Lesotho	112.5	117.6	135.0	178.8	28.9	31.2	27.9	32.5	36.5	25.4	30.4	(9.2)
Turkey	149.5	126.8	131.8	148.1	20.0	25.2	20.2	39.0	14.3	18.9	20.7	20.5
Ivory Coast	164.5	110.7	117.6	134.4	38.9	37.8	27.9	32.4	42.5	50.7	48.6	43.9
Indonesia	108.1	92.5	85.8	112.0	27.7	26.7	35.4	30.0	42.9	45.9	45.4	55.0
Peru	79.5	90.4	102.0	137.5	24.9	30.0	36.8	40.8	16.4	25.7	32.5	44.0
Morocco	102.7	89.4	81.3	116.2	23.1	36.3	33.3	29.0	24.7	30.7	28.7	34.0
Sudan	101.6	80.0	75.6	68.9	32.8	31.9	32.0	30.0	32.5	36.8	45.7	55.8
Kenya	102.7	85.7	82.7	105.5	32.4	31.0	29.9	27.5	28.6	32.0	35.7	48.0
Domin. Rep.	87.4	91.9	80.4	114.2	13.6	29.5	23.7	29.2	15.0	24.2	10.7	25.0
Ghana	78.1	60.9	76.7	90.5	19.7	24.7	27.6	23.5	43.7	31.1	35.6	42.8
Ecuador	62.0	75.8	78.6	105.9	15.8	29.2	36.7	30.9	15.3	20.9	23.3	25.7
Colombia	59.1	66.6	60.1	87.1	10.4	22.5	19.1	17.6	16.0	21.6	24.1	27.8
Tunisia	74.9	69.7	61.2	117.3	17.9	18.6	29.2	25.2	12.3	18.2	20.0	31.2
Mexico	69.6	64.7	77.0	88.0	10.2	15.4	18.1	18.2	11.6	12.7	20.1	16.8
Philippines	44.8	52.8	53.6	80.4	8.5	14.8	14.7	19.8	10.8	19.5	23.6	25.4
Thailand	70.8	65.1	68.9	102.9	2.6	9.4	9.1	14.7	13.1	18.9	28.5	26.0
Syria	82.2	59.5	59.2	74.2	6.2	12.8	11.6	13.8	9.2	11.5	12.8	13.0
Sri Lanka	51.6	57.1	59.3	72.7	9.3	6.8	10.6	12.2	8.5	17.6	17.1	28.5
Paraguay	50.8	50.2	53.0	79.8	6.4	15.5	13.5	15.4	8.5	10.4	9.0	15.4
Jordan	60.9	70.9	58.9	76.1	11.5	11.6	11.2	15.7	4.1	6.0	9.8	6.3
Guyana	50.5	52.9	59.4	72.2	8.0	8.3	9.4	14.3	5.2	8.3	9.0	11.5
Venezuela	36.0	45.0	59.3	65.0	5.1	5.3	5.9	11.2	6.5	7.4	10.9	6.4
Costa Rica	38.3	55.3	62.5	101.8	3.5	5.5	8.7	14.0	2.1	4.2	8.4	10.6
Fiji	51.3	42.3	49.9	60.2	2.9	4.4	4.9	6.6	2.1	5.1	7.2	5.4
Korea, Rep.	44.2	41.5	49.5	75.4	7.3	7.9	11.6	17.6	15.1	10.9	12.0	11.9
Jamaica	30.6	36.2	40.6	63.8	10.3	7.4	6.9	13.6	6.6	5.2	5.2	6.9
Trin. & Tob.	36.3	34.8	38.4	76.9	3.2	4.0	3.5	7.3	4.3	1.6	4.4	5.6
Malaysia	41.2	35.7	36.0	47.4	2.4	4.3	9.1	6.7	4.5	3.7	9.4	10.2
Panama	29.8	32.9	45.5	67.3	2.7	5.6	10.2	6.5	8.4	5.7	8.6	12.0
Portugal	29.7	38.4	53.9	(70.9)	1.6	1.7	8.2	(9.3)	1.9	1.7	4.2	(3.2)

Note: Parentheses indicate the base is less than 500 children.

Source: Rutstein, 1984

5.4 COMPARISON WITH INDIRECT ESTIMATES FROM EXTERNAL DATA

A comparison of indirect and life-table estimates prepared by the United States Bureau of the Census with directly calculated rates from the WFS for the same period was made (tabulation not shown). Because of the effects of sampling variation, we consider country estimates with differences of less than 15 deaths per thousand (15 points) to be essentially the same. Using the above criteria, in 13 of the 35 countries compared, the WFS rates are lower than the Census Bureau estimates, in 3 countries they are higher, and 19 are about the same. Large differences, over 25 points, occur in 7 countries with the WFS estimate lower and 3 countries where the WFS estimate is higher. The countries with large negative discrepancies are all in sub-Saharan Africa and the Near East: in sub-Saharan Africa they are Cameroon and Ghana, and in the Near East, they are Jordan, Mauritania, Morocco, Sudan and Tunisia.

There are perhaps five main causes of error that would result in the WFS estimate being substantially lower than indirect estimates. Possible causes of error in the WFS data are the misreporting of the age (or date) of death and the omission of dead children. Possible causes for the external data for indirect estimation are the

Table 29 Infant, toddler and child mortality by age of mother at birth (0–9 years before the survey)

Country	Infant (1q0)				Toddler (1q1)				Child (3q2)			
	<20	20-29	30-39	40+	<20	20-29	30-39	40+	<20	20-29	30-39	40+
Senegal	139.6	108.2	114.4	(114.2)	85.1	69.4	85.1	(68.4)	108.2	107.5	102.6	(132.2)
Yemen A. R.	204.4	157.2	143.3	(164.1)	35.0	57.0	50.9	(40.8)	40.8	75.1	51.7	51.8)
Nepal	198.7	145.3	129.0	(155.3)	56.3	49.9	56.4	(23.4)	61.6	59.6	57.4	(50.3)
Bangladesh	174.3	113.5	113.0	(124.0)	29.8	30.9	28.8	(62.5)	60.2	67.6	59.6	(39.7)
Pakistan	195.4	130.1	117.1	(136.0)	33.4	33.2	32.4	(34.1)	49.3	44.5	42.7	(70.9)
Benin	133.2	112.2	126.4	(146.0)	48.2	40.4	38.7	(40.3)	88.9	78.3	80.5	(71.0)
Mauritania	99.2	75.8	89.1	(149.1)	37.2	45.8	35.8	(72.4)	67.0	68.5	86.5	(97.5)
Cameroon	115.5	96.0	103.0	150.8	53.5	39.4	33.0	40.0	53.6	61.7	68.5	(62.5)
Haiti	(175.0)	134.6	121.6	(107.9)	(34.0)	32.1	22.7	(30.2)	(79.1)	53.5	51.2	(23.9)
Egypt	176.7	132.6	122.9	(174.6)	58.0	46.7	46.2	(21.2)	37.4	38.0	45.0	(39.6)
Lesotho	123.3	122.4	144.2	(126.4)	33.1	29.4	29.4	(26.0)	33.8	26.4	29.4	(9.3)
Turkey	175.4	123.4	130.8	(180.8)	35.6	24.1	31.2	(0.0)	13.8	21.5	17.9	(12.0)
Ivory Coast	159.1	115.2	125.8	(115.1)	38.6	35.8	27.2	(21.4)	53.8	46.7	39.1	(73.3)
Indonesia	125.2	88.1	88.6	(119.8)	34.5	29.3	30.9	(14.1)	54.4	47.6	39.1	(37.2)
Peru	108.6	95.3	105.4	140.8	32.6	33.4	34.6	(25.4)	28.9	26.5	33.4	(54.6)
Morocco	122.7	87.7	95.0	(110.1)	34.0	35.1	25.7	(16.1)	37.6	27.1	31.4	(23.3)
Sudan	114.3	69.6	74.6	(84.8)	41.9	28.7	28.1	(53.4)	42.4	36.6	54.2	(71.1)
Kenya	114.3	85.5	85.7	112.1	32.9	31.4	28.9	21.0	36.5	30.1	46.8	(40.1)
Domin. Rep.	98.2	89.0	93.8	(127.5)	23.7	27.2	20.4	(30.2)	22.2	16.0	22.9	(0.0)
Ghana	87.7	66.1	70.9	(120.2)	26.2	25.2	22.3	(20.1)	46.1	33.5	34.0	(66.0)
Ecuador	95.7	70.6	86.7	(105.6)	30.8	28.5	27.3	(43.6)	19.0	20.8	22.5	(44.2)
Colombia	80.0	60.4	73.5	(80.7)	22.9	16.9	13.7	(49.5)	23.4	20.7	25.4	(27.9)
Tunisia	99.6	74.3	73.3	(110.6)	16.4	24.4	24.0	(19.2)	14.1	18.4	24.7	(21.0)
Mexico	86.8	67.2	79.8	(96.6)	18.8	15.8	15.0	(14.9)	18.6	15.4	14.3	(22.2)
Philippines	55.5	52.9	62.4	79.7	17.9	14.0	13.5	27.7	19.0	21.0	20.4	(12.9)
Thailand	102.0	66.8	74.7	(87.2)	4.1	9.5	8.7	(15.5)	16.3	21.2	25.0	(20.6)
Syria	86.7	64.0	62.1	(57.6)	11.6	11.2	12.0	(14.2)	9.7	12.5	10.8	(25.1)
Sri Lanka	71.8	57.3	55.3	(96.2)	11.9	8.8	9.3	(11.5)	17.6	16.6	19.6	(8.2)
Paraguay	60.3	49.0	63.1	(101.6)	9.4	12.4	16.0	(9.8)	10.7	8.1	15.1	(5.8)
Jordan	83.4	63.8	63.7	(85.1)	14.6	11.4	14.4	(6.3)	9.3	6.2	6.9	(17.0)
Guyana	61.9	52.3	60.9	(141.4)	13.8	7.9	11.4	(8.0)	5.6	8.6	11.3	(0.0)
Venezuela	59.4	45.3	52.6	(70.6)	6.0	6.2	7.1	(0.0)	8.2	8.1	7.6	(0.0)
Costa Rica	66.0	52.0	79.9	(107.6)	9.2	6.7	8.9	(11.7)	2.5	6.1	9.3	(0.0)
Fiji	52.3	44.7	55.8	(81.2)	4.4	4.0	6.2	(5.8)	1.2	5.5	6.8	(6.8)
Korea, Rep.	(80.1)	42.9	50.8	(77.0)	(10.5)	9.5	10.3	(9.1)	(18.7)	14.4	7.8	(5.2)
Jamaica	38.5	34.6	56.6	(45.0)	11.4	7.6	7.3	(31.1)	8.7	3.9	6.5	(9.6)
Trin. & Tob.	50.2	36.5	54.0	(20.6)	3.2	4.2	5.2	(0.0)	2.9	4.1	2.2	(20.0)
Malaysia	57.9	37.0	35.8	(41.4)	4.6	5.7	7.4	(0.0)	9.1	7.0	10.2	(19.7)
Panama	41.7	35.0	54.6	(86.6)	4.7	5.7	8.8	(18.5)	11.8	5.9	11.6	(0.0)
Portugal	(45.2)	36.9	39.7	(69.3)	(0.0)	2.8	2.8	(17.7)	(3.6)	1.8	3.0	(0.0)

Note: Parentheses indicate the base is less than 500 children.

Source: Rutstein, 1984

omission of living children, the inclusion of stillborn children and the misreporting of the mother's current age. Each will be discussed in turn.

The omission of dead children in the WFS surveys is hard to detect except by comparison with reliable external sources. In the WFS surveys, well-trained interviewers asked a series of questions of each mother on the number of her children of each sex who were living with her, living away, and dead, in addition to a birth history with probes for periods between births of more than three years. In most external data sources used for indirect estimates, less well-trained interviewers or enumerators ask only two questions of the head of household or other adult: the number of children ever born and the number living. Common sense would dictate that the WFS approach is far less likely to omit children, whether living or dead. A heaping of age at death on month 12 does occur in substantial amounts in all seven of the countries where the WFS direct estimates fall far below the Census Bureau estimates. In this case a better estimate of infant mortality could be made by taking the direct estimate of either $_2q_0$ or $_5q_0$ and using these to calculate $_1q_0$ via a model life table as is normally done in direct estimation. However, care must be used to select the correct pattern of mortality implicit in the model (see Santow and Bioumla 1984).

Given that the data sources for indirect estimates are usually based on the two simple questions given above, it is easy to imagine that answers to one or both could be in error. If the number of living children were understated,

Table 30 Under-five and infant mortality for five-year periods before the survey (children with mothers aged 20–29 at birth)

Country	Date of Survey	Levels of Mortality for Years Prior to Survey: Mortality Under Age Five (5q0) 0-4	5-9	10-14	15-19	Infant Mortality (1q0) 0-4	5-9	10-14	15-19
Senegal	1978	250.6	269.7	293.7	267.9	102.0	115.7	115.2	105.7
Yemen A. R.	1979	234.8	268.8	(321.9)	(367.1)	162.8	154.2	186.4	(236.8)
Nepal	1976	232.7	241.1	294.0	293.1	142.1	149.3	181.5	171.6
Bangladesh	1975-6	208.9	187.4	205.1	230.0	117.0	109.8	129.7	139.5
Pakistan	1975	203.4	187.9	219.2	251.8	132.2	127.8	129.7	156.0
Benin	1981-2	196.1	240.3	254.1	(277.1)	101.8	126.2	139.4	156.0
Mauritania	1981-2	188.5	166.3	163.3	(227.6)	82.0	68.8	68.4	111.9
Cameroon	1978	181.3	191.9	238.0	258.1	95.0	96.2	137.2	149.5
Haiti	1977	186.6	234.0	254.7	(244.3)	124.3	148.7	157.0	143.0
Egypt	1980	182.1	230.7	240.9	265.7	124.3	142.6	135.3	139.4
Lesotho	1977	165.8	176.9	188.0	169.3	121.9	123.1	138.9	115.3
Turkey	1978	150.6	176.0	206.4	267.1	119.0	127.8	146.2	176.2
Ivory Coast	1980-2	159.0	222.5	245.6	289.4	101.3	133.3	154.2	169.8
Indonesia	1976	151.6	162.6	199.0	217.7	87.7	88.6	112.5	117.2
Peru	1977-8	140.7	157.5	192.9	210.9	89.4	101.8	112.4	121.9
Morocco	1980	134.3	153.7	172.9	188.1	84.4	91.6	98.5	102.5
Sudan	1978-9	129.4	123.0	140.4	(142.2)	66.6	72.2	71.3	49.1
Kenya	1977-8	134.8	148.1	156.5	193.0	83.2	88.2	96.1	121.0
Domin. Rep.	1975	120.7	135.7	162.0	(117.9)	80.9	97.7	105.2	72.3
Ghana	1979	116.7	124.1	157.8	147.3	64.8	67.7	85.9	78.3
Ecuador	1979-80	109.2	122.9	153.3	169.1	69.2	72.0	95.1	107.4
Colombia	1976	89.7	101.2	116.9	134.2	56.6	64.2	72.4	83.9
Tunisia	1978	101.6	126.0	138.3	186.1	74.4	74.1	78.4	105.6
Mexico	1976-7	84.4	108.8	118.6	139.1	60.2	74.8	80.5	86.3
Philippines	1978	85.4	86.3	86.3	90.9	52.3	53.6	49.6	54.6
Thailand	1975	82.9	107.5	121.6	137.5	56.8	76.5	86.4	95.4
Syria	1978	84.3	89.2	120.7	137.7	62.5	65.8	80.2	85.5
Sri Lanka	1975	81.0	81.4	87.6	102.0	57.9	56.7	58.7	60.7
Paraguay	1979	73.1	62.8	78.2	64.0	52.4	45.0	56.8	42.8
Jordan	1976	75.8	85.2	120.6	185.7	65.6	61.9	75.5	110.9
Guyana	1975	72.5	62.9	71.7	88.7	54.0	50.4	56.4	67.0
Venezuela	1977	55.0	63.3	57.7	(78.4)	45.4	45.1	41.2	44.5
Costa Rica	1976	50.5	76.2	100.1	90.0	44.2	59.0	81.2	60.1
Fiji	1974	51.5	55.9	61.0	69.8	41.5	48.0	49.6	59.3
Korea, Rep.	1974	51.1	81.3	100.9	113.9	35.2	51.2	53.0	64.0
Jamaica	1975-6	48.4	42.7	54.3	100.2	38.8	30.0	39.7	78.7
Trin. & Tob.	1977	40.9	49.9	46.4	60.1	33.3	40.7	38.7	53.6
Malaysia	1974-5	46.7	51.6	70.6	105.0	35.5	38.5	50.8	72.2
Panama	1975-6	36.1	56.0	61.6	82.7	26.5	43.1	38.7	60.3
Portugal	1979-80	36.0	46.4	52.1	83.3	32.1	41.1	43.3	64.2

Note: Parentheses indicate the base is less than 500 children.

Source: Rutstein, 1984

Table 31 Component rates of infant and child mortality for five-year periods before the survey (only children whose mothers were aged 20–29 at birth)

Country	Date of Survey	Neonatal mortality rate				Post-neonatal mortality rate				Toddler mortality rate (1q1)				Child mortality rate (3q2)			
		0-4	5-9	10-14	15-19	0-4	5-9	10-14	15-19	0-4	5-9	10-14	15-19	0-4	5-9	10-14	15-19
Senegal	1978	41.4	41.5	53.2	51.7	60.6	74.2	62.0	54.0	67.0	72.3	82.3	68.0	105.6	109.8	130.1	121.6
Yemen A. R.	1979	54.3	54.7	69.5	65.2	108.5	99.6	116.9	(171.6)	47.7	70.1	92.9	(75.0)	40.2	70.3	(81.2)	(103.5)
Nepal	1976	74.4	76.8	85.8	82.6	67.8	72.5	95.7	89.0	49.8	50.8	61.2	57.0	58.6	60.8	81.1	95.1
Bangladesh	1975-6	62.8	55.7	74.9	85.8	54.2	54.2	54.3	53.8	33.9	27.4	25.4	37.3	72.6	61.4	62.2	69.9
Pakistan	1975	76.9	70.3	62.4	86.3	55.3	57.5	67.2	69.6	33.9	32.3	56.7	61.2	49.8	37.8	49.0	55.8
Benin	1981-2	44.4	60.7	73.9	79.9	57.3	65.5	65.5	76.2	36.0	46.5	40.1	47.4	71.7	88.1	97.1	(108.8)
Mauritania	1981-2	42.2	37.6	33.5	61.2	39.9	31.3	34.9	50.7	48.5	42.5	37.6	51.3	70.9	64.9	66.8	(83.3)
Cameroon	1978	40.8	43.5	62.6	63.7	56.0	53.3	75.6	80.6	37.1	37.4	41.7	43.8	59.3	70.0	82.4	85.1
Haiti	1977	53.9	77.3	102.4	80.2	70.4	71.4	54.7	62.8	29.4	35.4	33.3	37.1	42.9	67.1	85.5	(84.3)
Egypt	1980	55.5	67.3	58.8	55.7	68.8	75.3	76.5	83.7	36.8	58.7	62.6	74.4	30.3	46.8	63.5	78.1
Lesotho	1977	65.7	71.9	71.7	60.8	56.2	51.2	67.2	54.5	26.4	33.1	32.2	27.7	24.2	29.2	25.7	34.3
Turkey	1978	59.2	47.6	55.7	67.2	59.9	80.3	98.5	107.1	19.4	29.2	36.4	64.8	16.8	26.7	35.4	48.7
Ivory Coast	1980-1	46.9	65.4	73.8	75.2	54.4	67.9	80.4	94.5	30.4	43.0	47.1	52.3	34.9	62.6	64.0	96.8
Indonesia	1976	44.7	42.3	52.4	48.3	43.0	46.4	70.1	68.9	24.5	34.3	42.6	51.7	46.8	48.5	57.2	65.3
Peru	1977-8	36.5	46.4	41.6	48.1	52.9	55.5	70.7	73.9	32.2	34.8	52.6	51.7	25.0	28.2	40.2	53.2
Morocco	1980	44.0	51.3	53.8	52.3	40.3	40.3	44.7	50.2	31.1	39.4	47.1	55.7	24.2	30.2	37.2	42.0
Sudan	1977	33.8	39.6	44.5	26.5	32.8	32.5	26.7	22.6	34.4	21.3	32.9	42.5	34.0	34.3	43.0	(57.8)
Kenya	1977-8	38.6	43.8	40.8	55.6	44.6	44.3	55.3	65.4	28.2	35.3	30.9	31.8	29.0	31.5	37.1	51.7
Domin. Rep.	1975	--	--	--	--	--	--	--	--	28.3	26.0	34.5	24.6	15.4	16.5	30.0	(25.2)
Ghana	1978	30.6	34.7	42.0	42.1	34.2	32.9	43.9	36.2	25.0	23.1	33.4	26.7	31.7	36.0	45.1	40.3
Ecuador	1979-80	34.0	32.8	44.2	43.0	35.2	39.2	50.9	62.2	24.6	32.7	36.2	39.2	18.9	22.7	29.2	31.2
Colombia	1976	25.9	31.8	34.8	39.3	30.7	32.4	37.6	44.5	16.2	17.6	24.0	31.5	17.2	22.4	24.6	24.2
Tunisia	1978	34.5	34.6	31.3	39.7	39.9	39.5	47.0	65.9	16.8	32.3	38.5	51.7	13.6	28.7	31.3	42.0
Mexico	1976-7	34.3	46.3	42.0	48.1	25.9	28.5	38.5	38.2	11.9	20.2	21.2	25.4	14.1	16.8	20.7	33.2
Philippines	1978	19.2	21.1	22.7	19.1	33.0	32.5	26.8	35.4	14.6	13.4	17.5	19.5	20.7	21.5	21.5	19.3
Thailand	1975	37.2	49.5	47.0	50.8	17.6	27.0	37.4	44.6	9.2	9.8	11.9	16.8	18.6	24.0	27.0	30.2
Syria	1978	16.8	16.6	16.8	16.8	45.6	49.2	63.4	68.7	14.4	8.2	21.1	23.1	9.1	16.9	23.4	34.7
Sri Lanka	1975	32.5	32.6	38.6	37.6	25.4	24.1	20.1	23.1	6.9	10.9	11.6	13.5	17.8	15.4	19.4	30.9
Paraguay	1979	--	--	--	--	--	--	--	--	14.6	9.7	12.4	8.4	7.4	9.0	10.5	13.8
Jordan	1976	21.7	29.7	31.5	44.0	43.8	32.2	44.0	66.8	6.6	16.8	32.0	44.6	4.4	8.2	17.3	41.3
Guyana	1975	29.7	29.9	31.6	35.9	24.3	20.5	24.8	31.1	11.2	4.3	11.9	18.2	8.4	8.9	4.4	5.1
Venezuela	1977	--	--	--	--	--	--	--	--	3.9	8.8	10.3	14.2	6.1	10.4	7.0	(21.5)
Costa Rica	1976	25.0	30.2	39.2	24.7	19.2	28.7	42.0	35.4	1.7	11.1	11.1	13.4	4.9	7.3	9.5	18.7
Fiji	1974	--	--	--	--	--	--	--	--	4.3	3.7	4.9	5.7	6.3	4.6	7.1	5.6
Korea, Rep.	1974	19.9	30.0	25.3	24.4	15.3	21.2	27.7	39.6	6.4	12.8	21.9	19.6	10.0	19.2	29.3	34.4
Jamaica	1975-6	23.0	18.7	22.1	38.7	15.9	11.3	17.6	40.0	6.3	7.0	6.5	17.4	3.6	4.1	8.7	6.0
Trin. & Tob.	1977	23.5	31.9	25.9	33.5	9.9	8.9	12.8	20.1	1.9	6.6	2.8	3.5	5.9	3.0	5.2	3.4
Malaysia	1974-5	16.0	12.1	17.0	19.8	19.5	26.4	33.8	52.3	5.0	6.4	8.0	11.8	6.7	7.3	13.0	23.9
Panama	1975-6	17.0	24.2	24.6	35.3	9.5	18.9	14.1	25.0	4.1	7.4	15.2	14.8	5.7	6.1	8.8	9.3
Portugal	1979-80	19.4	18.4	23.2	32.0	12.7	23.1	20.1	32.2	2.0	3.6	5.6	10.6	2.0	1.6	3.7	9.7

Notes: 1. Countries are ordered by level of Under Five Mortality.
2. -- means rate is not calculable.
3. Parentheses indicate that the base is less than 500 children.

Source: Rutstein, 1984

Table 32 Infant, toddler and child mortality by years of mother's education

Country	Infant mortality--1q0				Toddler mortality--1q1				Child mortality--3q2			
	0	1-3	4-6	7+	0	1-3	4-6	7+	0	1-3	4-6	7+
AFRICA												
Benin	127.5	(91.6)	(57.6)	(37.0)	42.8	(52.6)	(31.1)	(0.0)	83.3	(78.7)	(62.0)	(29.9)
Cameroon	115.7	88.3	82.7	63.7	43.4	42.5	37.0	20.2	68.9	46.7	42.7	(35.5)
Ghana	77.3	(62.2)	65.5	69.7	26.2	(30.2)	19.5	19.8	43.1	(40.3)	14.0	20.5
Ivory Coast	132.2	(151.7)	109.7	(71.3)	33.3	(27.3)	41.7	(36.6)	50.5	(24.9)	(22.2)	(30.6)
Kenya	103.9	89.3	82.0	69.9	37.1	33.0	18.3	21.2	42.5	35.4	27.3	22.1
Lesotho	(149.0)	133.5	129.6	118.2	(32.9)	39.8	28.2	27.0	(38.7)	27.6	30.0	17.9
Nigeria	94.0	93.3	98.1	52.0	38.0	38.8	30.5	18.3	50.1	45.3	42.8	24.9
Senegal	121.1	(71.1)	(94.3)	(30.9)	81.1	(71.7)	(25.5)	(7.5)	114.4	(16.7)	(17.1)	(27.4)
Egypt	147.4	143.2	125.2	77.9	51.2	57.6	40.0	20.0	43.0	46.4	34.3	5.1
Mauritania	82.9	91.5	(56.0)	(81.1)	40.0	44.4	(53.9)	(0.0)	86.3	64.1	(16.5)	(17.9)
Morocco	99.1	(100.2)	(54.1)	(80.2)	33.8	(16.1)	(12.6)	(0.0)	32.4	(14.5)	(7.2)	(0.0)
Sudan	79.7	87.8	(83.4)	(57.0)	32.6	38.8	(20.3)	(19.3)	46.3	(23.9)	(15.8)	(7.9)
Tunisia	79.3	(90.0)	67.1	(21.3)	25.2	(7.4)	15.4	(0.0)	22.9	(4.2)	6.1	(0.0)
THE AMERICAS												
Colombia	85.4	80.1	46.1	39.9	21.6	20.1	15.3	10.6	33.6	25.5	16.4	6.1
Ecuador	88.3	98.4	75.6	47.6	47.0	37.6	21.1	9.8	32.2	26.5	16.0	10.6
Paraguay	69.0	63.4	56.3	33.4	20.6	14.8	11.4	5.9	(21.5)	(14.6)	(6.0)	(1.7)
Peru	136.4	117.9	67.4	44.9	53.1	39.0	14.6	4.3	48.4	30.6	13.4	4.4
Venezuela	68.7	50.4	48.4	32.5	10.6	9.1	5.2	1.1	(13.1)	(11.8)	(5.7)	(2.7)
Costa Rica	100.9	71.2	62.0	32.3	18.0	9.1	5.6	4.2	15.0	8.5	4.4	0.0
Domin. Rep.	125.6	94.3	86.4	61.2	40.5	27.4	20.9	4.6	34.6	18.2	15.8	(5.8)
Mexico	89.6	79.6	65.2	47.3	28.5	16.7	7.3	4.0	31.4	14.1	6.8	1.6
Panama	71.0	62.4	33.5	33.7	14.5	11.9	5.6	2.5	23.6	13.8	5.2	4.4
Guyana	(44.3)	(80.9)	68.7	53.6	(5.1)	(8.4)	10.1	10.1	(16.3)	(15.9)	10.3	6.6
Haiti	136.7	109.1	(180.6)	(71.0)	30.9	(22.3)	(33.2)	(8.4)	60.1	(40.4)	(36.0)	(19.6)
Jamaica	(85.4)	(64.8)	48.1	37.5	(22.2)	(11.1)	13.2	7.5	(10.9)	(10.2)	6.9	5.0
Trin & Tob	(79.0)	(63.5)	48.0	39.2	(0.0)	(0.0)	8.4	3.8	(0.0)	(4.3)	3.7	3.9
ASIA AND THE PACIFIC												
Jordan	73.3	56.1	71.7	45.9	15.6	9.8	8.7	7.3	10.2	2.5	2.4	1.5
Syria	71.8	(78.7)	57.3	33.1	13.3	(5.5)	7.1	7.3	13.8	(8.4)	5.1	8.3
Turkey	144.0	145.9	128.7	(0.6)	34.2	31.3	12.9	(3.3)	21.8	28.5	11.3	(0.0)
Yemen	164.4	(189.9)	(92.4)	(131.9)	50.8	(0.0)	(0.0)	(0.0)	58.5	(0.0)	(0.0)	(0.0)
Bangladesh	135.9	131.1	114.1	(115.8)	32.2	26.8	26.5	(6.8)	68.5	51.8	34.8	(11.7)
Nepal	151.4	(138.3)	(124.7)	(83.1)	52.8	(73.5)	(27.7)	(7.6)	60.5	(10.2)	(22.3)	(18.3)
Pakistan	140.1	(114.9)	(124.2)	(111.9)	35.3	(22.0)	(13.7)	(3.0)	47.4	(23.3)	(27.3)	(14.1)
Sri Lanka	76.8	70.2	58.5	39.4	9.6	12.8	10.4	5.8	28.8	19.0	14.2	8.3
Fiji	64.5	54.4	54.1	38.1	0.9	6.1	6.8	4.3	3.4	5.9	6.1	5.3
Indonesia	102.7	108.8	81.5	54.6	31.9	35.9	27.9	8.1	50.3	56.2	35.8	11.9
Korea	57.4	51.1	45.0	40.8	16.4	10.5	9.1	3.5	16.9	17.2	9.5	8.7
Malaysia	42.8	35.6	41.1	24.8	9.2	5.3	3.9	1.1	11.8	7.4	5.3	1.4
Philippines	97.4	73.1	60.5	38.0	30.8	21.7	14.8	7.1	25.3	30.6	22.3	10.4
Thailand	96.6	(76.1)	70.8	(18.1)	14.4	(8.3)	7.5	(4.6)	30.0	(32.8)	18.8	(4.2)
EUROPE												
Portugal	63.3	40.1	36.9	29.5	9.6	5.3	1.3	0.0	2.7	1.8	1.9	3.8

Note: Parentheses indicate the base is less than 500 children.

Source: Rutstein, 1984

perhaps because of the omission of children living away, then mortality estimates would be overstated. It does appear that in some external data sources this error has occurred, since reconstructed numbers of children ever born from the WFS surveys often exceed those of the other sources. (See chapter 4 and the various country-specific evaluation reports.) However, we would expect that the numbers of children living away of women aged 20–24, the cohort most used to make indirect estimates of infant mortality, would be quite small so that even some omission of them would not be likely to produce the discrepancies we see for the seven countries.

Another possible source of error is the erroneous inclusion of stillbirths in the number of children ever born, especially as the data sources of indirect estimates rarely asked separately about stillbirths or pregnancy losses in general. In the cleaning of the Rwanda Fertility Survey (non-WFS) a number of stillborn children were found to have been included in the total number of children ever born (J. Otto, personal communication). In the WFS surveys, 1–3 per cent of pregnancies were found to have ended in a loss at 7–9 months' gestation. If all of these had been classified as children ever born, the infant mortality rate would have been raised by a similar amount in the indirect estimation.

The final but perhaps most likely source of error in the

external data used for indirect estimation is the misreporting of women's ages at the time of the census or survey. Indirect estimates of mortality are heavily dependent upon correct age reporting of mothers, especially those in age groups 20–29. An underestimation of women's ages, moving older women into these groups, would raise the proportions dead of children and upwardly bias the mortality rates as well as causing a too late dating of the time to which the rates apply.

From the evaluation of age reporting in the WFS surveys in the seven countries, four appear to have excessive numbers in the lower age groups and six have unacceptable amounts of age heaping (see chapter 2). Egypt is the only country in which the WFS rates exceed the Census Bureau estimates by a very large amount. Here Coale (1983) has found evidence that young married women have overestimated their ages. Such misreporting of age would downwardly bias indirect estimates of mortality.

As mentioned above, there are structual reasons to believe that indirect estimates based on the age group 20–24 and to a lesser extent 25–29 are biased upwards, apart from reporting errors. The author has made calculations (unpublished) of mean age at birth, mean birth order and mean birth interval for all children born to women currently 20–24 from the WFS individual survey data. The results show that the means for these women are heavily weighted by teenage births, first births and births after short interbirth intervals, all factors associated with higher than average mortality.

In view of these possible sources of discrepancy in the rates, we feel that the likely sources of discrepancies are misreporting of age at death in the WFS survey and under-reporting of age at survey of mothers in the external sources used for indirect estimation.

5.5 EXTERNAL COMPARISONS WITH VITAL STATISTICS

Comparisons with the rates from the United Nations Demographic Yearbooks, made by Rutstein (1983), have shown that the direct estimates of mortality from the birth histories are as high or higher than vital statistics (see figure 5). The principal differences lie in the neo-natal rates which, except for the countries that asked date of death, are substantially higher than those of the vital statistics.

The survey of Trinidad and Tobago illustrates the point. In his evaluation of the survey, Hunte (1983) indicates a decreasing coverage of the vital registration system of neo-natal deaths, such that for 1975 the survey

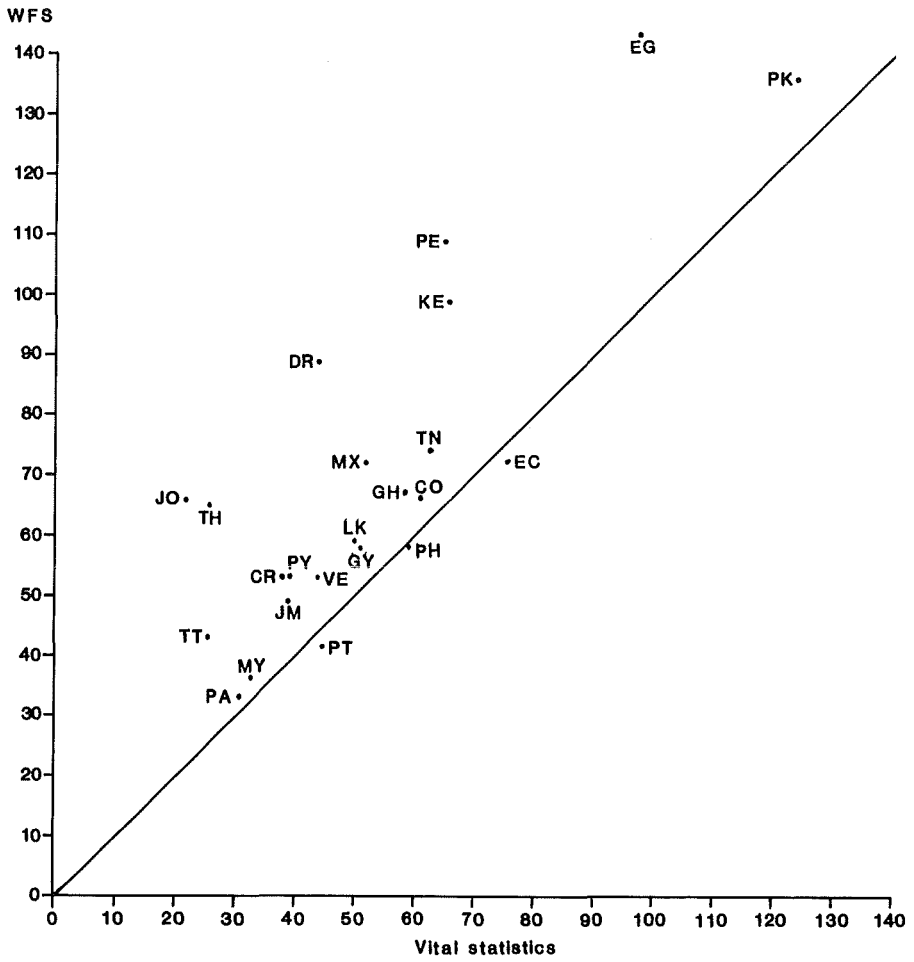

Figure 5 Comparison of infant mortality rates from the WFS surveys with vital statistics reported in the United Nations *Demographic Yearbook 1978*

shows a rate of 36 deaths per thousand births and the vital statistics show only 26 per thousand. The evaluation of Guyana (Balkaran 1982) tells a similar tale.

The evaluation of the survey in Portugal (Conim, forthcoming) tells a different story. Portugal has a good vital statistics system and the estimates from the survey are about the same for the periods close to the date of the survey. However, the survey rates increasingly underestimate the vital statistics rates as the period of time is further into the past. Correction for the truncation bias reduces the divergence but does not eliminate it. Perhaps this is evidence of omission, but it could also be because only surviving women were interviewed.

5.6 CONCLUSIONS AND RECOMMENDATIONS

There is no one test of the quality of the data for estimating infant and child mortality other than, ideally, a comparison with a complete vital statistics system. We have applied several checks to the data designed to look for misreporting of ages at death and evidence of omission. Omission is the most serious of the possible errors, but it is the hardest to detect since patterns which we presume to be the result of omission may in fact be real.

Based on the checks above, some surveys indicate deficiencies in several checks. These countries in alphabetical order are Egypt, Fiji, Indonesia, Lesotho, Mauritania, Paraguay, Philippines, Sudan, Syria, Tunisia and Yemen AR. But it should be stressed that: (1) practically all surveys showed discrepancies in one or more tests; (2) the evaluation reports have shown that most of the serious errors of omission occur more than 15 years before the survey, when truncation begins to affect the data seriously; and (3) comparisons with vital statistics and other external sources show that the data on mortality collected by the WFS are by far the best yet collected for most countries, including most of those in the list above.

Based on the findings above, we make the following recommendations:

- Obtain age at death wherever possible rather than date of death.
- Code both month and year of age at death rather than groups.
- For most countries, analysis should be limited to the period up to at most 20 years before the survey due to structural biases and the possibility of omission.

6 Conclusions

Beyond the details of evaluating each individual topic, it would be helpful to make some general statements about the quality of WFS survey data. Four questions of interest emerge. How did the surveys perform relative to external sources? Are there any groupings of countries according to data quality? Are current estimates accurate? And are data on trends over the past 15–20 years usable?

On the questions of comparable quality with external sources, survey results were usually found to be better, with one exception. In coverage of live births and infant and child deaths, as well as in the recording of exposure within unions, the surveys did better than external sources. In the case of informal unions in societies where they are common, the surveys achieved considerably better coverage than external sources. However surveys were not as successful in obtaining high quality data on age: digit preference was the same or lower in WFS household surveys as compared with censuses or other sources, but the UN age index showed that about half of WFS household surveys were more distorted than the external source. In comparison, age reporting in the individual survey by respondents was better, but we do not usually have a comparison with external sources for this restricted age range.

It will come as no surprise to hear that the countries with most problems of data quality are mainly African; but in addition, a few countries from the south Asian and American regions also had poor results. Using only age reporting and fertility results to rank countries, since these are the two most crucial and problematic areas, we find that seven countries had severe problems in both: Kenya, Lesotho, Sudan, Yemen AR, Bangladesh, Nepal and Haiti. Three countries had severe problems on one and some problems with the other of these two main topics (Benin, Cameroon and Dominican Republic). A further two countries had marked problems principally with age reporting (Senegal and Paraguay), while five others had marked problems mainly with fertility (Ivory Coast, Morocco, Mauritania, Pakistan and Indonesia). Finally the age group 45–49 is biased for one or more substantive topics for the majority of countries.

Current estimates of fertility and of infant and child mortality are of good quality in the majority of countries, often superior to estimates from vital statistics and other external sources. However rates based on single calendar years are not to be recommended because of the high sampling variation. Rates for the last five years are reasonable, and even two- or three-year rates can be used, but a tendency for heaping of births in the year preceding the survey has been observed.

Reliable fertility trends for a 15–20 year period before the survey was one of the major expected benefits of using a complete birth history. However, one type of reporting error that commonly occurred in such histories was event displacement, particularly in the form of a shift by older women in distant births towards the survey date. In more than half of all surveys (mainly in Latin America and some part of Asia), such displacement is minor and produces distortions only in the earliest periods. Thus, for these countries, trends for the past 15–20 years can be used without difficulty. However, in a number of surveys (mainly in Africa and in south Asia), spurious trends were found for the most recent 10 or 15 years, because of event displacement alone or the combination of displacement and age misstatement. These reporting errors are manifested in the form of a trend of rising fertility, from the earliest periods up to the periods 5–9 or 10–14 years before the survey, then either stability or a smaller decline. One qualification to the general conclusion that such a trend is evidence of reporting errors is that some countries or parts of countries have in fact experienced a true increase in fertility: thus, especially in the case of African countries, part of the observed trend, though probably not all of it, may be real (Lesthaeghe 1984).

The decision of the WFS to apply the retrospective birth history in surveys of developing countries was an innovative one at the time it was taken in the early 1970s. A large part of the demographic world was very sceptical of the possibility of success with this demanding technique for collecting fertility information in countries where any data collection was difficult. This was especially true of specialists in techniques of indirect estimation. However, the decision has been vindicated by the quality of the results obtained and their richness in all but a few countries. This has now been recognized by some previous sceptics (eg Preston 1985). In the few most problematic countries, it is possible that the history would have been better omitted and a simpler approach used. The high quality of the trend data on infant and child mortality was a further unexpected outcome of the use of retrospective histories.

Perhaps because of fears about the quality of data that would be produced by WFS surveys, the organization was guided by its Programme Steering Committee into putting a great deal of resources first into the development of the methodology of evaluation, and then into its application in each country. Proceeding in this direction was both necessary and useful. However, ultimately, the stress in the national evaluation reports fell on the application of a number of detailed tests or checks on quality, instead of being placed on reaching a final series of best estimates. It is hoped that more emphasis will be put on the production of a set of preferred estimates, as one of the goals of future evaluations of surveys' data.

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