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Evaluation of the Yemen Arab Republic Fertility Survey 1979

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The World Fertility Survey 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 cooperation 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.
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El proyecto está a cargo del Instituto Internacional de Estadística en cooperación con la Unión Internacional para el Estudio Científico de la Población y con la colaboración de las Naciones Unidas. 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.
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Preface

One of the major objectives of the World Fertility Survey programme is to assist the participating countries in obtaining high quality data through national fertility surveys. The high standards set by the WFS are expected to yield 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. It is recognized that such an evaluation will not only alert the analysts by identifying defects, if any, in the data, but also throw light on the shortcomings of the WFS approach, which can be taken into account in the design of future fertility surveys.

It is in this context that, as part of its analysis policy, the WFS is conducting a systematic programme for a scientific assessment of the quality of the data from each survey. A series of data evaluation workshops is being organized at the WFS London headquarters with the dual objective of expediting this part of the work and of providing training in techniques of analysis to researchers from the participating countries. Working in close collaboration with WFS staff and consultants, participants from a number of countries evaluate the data from their respective surveys after receiving formal training in the relevant demographic and data processing techniques.

The seventh such workshop, involving six countries – Benin, Ivory Coast, Mauritania, Morocco, Sudan and Yemen Arab Republic – was held between September and December 1983. The present document reports on the results of the evaluation of the data of the Yemen AR Fertility Survey of 1979 and was prepared by Abdel-Malik Al-Tohamy (who participated on behalf of Yemen AR) and Ishmael Kalule-Sabiti.

Dr Shea Oscar Rutstein, as the co-ordinator of the workshop, assumed a major responsibility in the successful completion of the work. Edmonde Naulleau and Andrew Westlake provided much valuable assistance, and many other staff members also made significant contributions. We are indebted to Dr Neil Thomas of the University Population Centre, University College, Cardiff, who reviewed the manuscript and made many helpful suggestions.

HALVOR GILLE
Project Director

1 Introduction

1.1 BACKGROUND

The lack of reliable statistical information has caused major concern among aid-giving agencies, researchers and many third world governments. This not only complicates needs assessments for these Third World countries but also makes development planning, implementation and evaluation of programmes almost impossible. It is acknowledged that any development plans which lack detailed information about the people for whom the plans are intended can only be considered unrealistic.

Recognizing this problem and the need for up-to-date demographic statistics, the Yemen Arab Republic, faced with immense problems of resources and lack of expertise, decided to participate in the World Fertility Survey Programme, organized by the International Statistical Institute.

Situated in the south-west corner of the Arabian Peninsula with an area of approximately 200,000 km^2, the Yemen AR is bordered on the north by Saudi Arabia, on the south and south-east by the People's Democratic Republic of Yemen and on the west by the Red Sea. The first ever census in 1975 gave a total of 6.5 million people including 1.2 million Yemenis abroad. About 90 per cent of the total population were found to be rural, dependent on subsistence agriculture. The urban population is concentrated in the three main cities of Sana'a, Ta'iz and Al Hodiedah. And like many of the developing countries, the Yemeni population is a young one, with about 50 per cent below the age of 15. Its crude birth and crude death rates were estimated at 53 and 23 per 1000 population, yielding a rate of natural increase of 3 per cent per year. The overall density of population is about 30 persons per square kilometre, with greater concentrations in the southern Highlands and less concentration in the great Arabian desert in the east.

One of the most remarkable demographic characteristics of Yemen AR is the large emigration of young males to other rich Arab countries, mainly Saudi Arabia, for work opportunities. About a third of the male work force aged 15–34 are out of the country, thus exerting constraints on the country's socio-economic development.

Illiteracy is still high in the Yemen AR. By the 1975 Census among the population aged 10 and over it was estimated at 65 per cent for men and 97 per cent for women, with an overall average of 83 per cent. Contraceptive use is negligible as a means of population control.

1.2 THE WORLD FERTILITY SURVEY

The World Fertility Survey (WFS), an organ of the International Statistical Institute (ISI), is an international programme with a task of conducting fertility research with the collaboration of the United Nations and the International Union for the Scientific Study of Population. The main objectives of the programme are as follows:

1 to assist developing countries in carrying out well-planned and scientifically designed sample surveys in order to provide high-quality data on fertility levels, trends and differentials;
2 to assist and step up the participating countries' capability to analyse their fertility and related topics such as nuptiality and infant and child mortality;
3 to provide data for comparability among participating countries.

1.3 THE YEMEN ARAB REPUBLIC FERTILITY SURVEY (YARFS)

The Yemen Arab Republic Fertility Survey (YARFS) was conducted by the Central Planning Organization (DOS) of the government of the Yemen AR in 1979 as part of the WFS programme. It was undertaken with financial assistance from the Overseas Development Agency of the United Kingdom Government through the International Statistical Institute World Fertility Survey. Before this survey was carried out, the only important source of information on general aspects of the Yemeni population, especially the proportional age structure, was the 1975 National Planning Census. Unfortunately this census did not have the usual retrospective questions on mortality and fertility to give a comparative indication of the trend in fertility and infant mortality and prove an external source of comparison with the data from the YARFS. The only source of information on fertility and mortality is the socio-economic survey of Sana'a City conducted in August 1972 by the Central Planning Organization and the United Nations Economic Committee for Western Asia. Obviously this survey cannot be accepted as representative of a cross-section of the population as a whole but it is, nevertheless, a valuable starting point. Another source of data is the Survey of Clinic Attendants carried out in April/May 1976 in a rural and urban maternal and child Health Centre in Yemen (for details see Allman and Hill 1978). This survey was also unrepresentative of the total population. As a result there has been a lack of reliable and useful statistical information. The 1979 YARFS has gone a long way towards rectifying this situation and is by far the most important source of information on fertility, nuptiality and infant and child mortality. The YARFS was carried out with the following objectives:

1 to obtain data on fertility, nuptiality, mortality and migration and other related factors;
2 to enhance understanding of the changing dynamics of the population of Yemen;
3 to obtain demographic information that would be used as a guide to government development planning;
4 to provide demographic data on Yemen that would be a reliable source of comparison at an international level;
5 to serve as an effective mechanism in training personnel at various levels to carry out future surveys.

The YARFS used two types of questionnaires, the household and individual schedules. The household schedule served three purposes, namely (1) identification of eligible women (all ever married) to be interviewed in the individual questionnaire, (2) collecting information on age, sex and marital status for each member of the household, (3) collecting information that might be related to fertility, such as housing conditions, ownership of 'modern objects', membership of a cultural or socio-economic group, etc. The questionnaire was applied to 13 495 households.

The individual questionnaire consisted of the WFS core questionnaire and incorporated the WFS module on factors other than contraception affecting fertility. The aim of this questionnaire was to collect detailed information from eligible women. The answers were given by the respondents themselves except in special circumstances related to the reporting of age and other dates of events. It was administered to 2605 respondents who had been legally married and were aged 10–50.

The individual questionnaire was divided into seven sections:

1 Respondent's background
2 Marriage history
3 Maternity history
4 Knowledge of use of contraception
5 Factors affecting fertility: lactation, contraception and temporary separation
6 Work history
7 Current (last) husband's background

1.4 OBJECTIVES OF THE ANALYSIS

This report is concerned with four main topics, namely: age and reporting of dates; nuptiality; fertility; and infant and child mortality. It is acknowledged that in analysing data concerned with the above topics, the interpretation and the conclusions drawn are affected by the quality of those data.

In the YARFS there are questions dealing with age; marital status and relevant dates; dates of birth of children; and dates of death of children who have died. In evaluating the quality, each type of data is tested for internal consistency, and where possible external sources, mainly the 1975 Census data, are used for comparison. By applying various types of tests as described in respective chapters, efforts are made to establish the likely sources of error. These may derive either from the respondents themselves or from the interviewers. Some errors may be due to sampling procedures. Errors due to respondents can be detected more easily. However, the difficulty of assessing the interviews as a major source of error is generally acknowledged.

The other area of concern is the likely effects of errors. Errors in age reporting, for instance, have a harmful effect on the estimation of fertility rates as well as on nuptiality estimates.

1.5 SOURCE OF DATA

Data on age were derived from information collected from a question on month and year of birth. In most cases, however, the respondents in the YARFS were not able to give the exact date of their birth, or even their approximate age. As a result the interviewer had to estimate the respondent's age by using the historical calendar of events or sometimes even resort to guessing, based on the respondent's parity, marital duration or even physical appearance. This explains why for all events, births, unions and deaths, dates were mainly recorded in 'Year Only' – a reflection of the interviewer's estimate or guesswork.

On the pregnancy history, details of each pregnancy (such as whether it resulted in a live or a non-live birth) were sought. Such information included birth date, sex of child and, if the result of the pregnancy was a non-live birth, date of death. This kind of information was only relevant for deriving estimates of fertility, nuptiality and infant and child mortality as well as interbirth intervals.

In the union history, each ever-married woman was asked to state the date of the inception of the first union, type of union, the state of union (whether currently in union, divorced/separated or widowed), and where she stated that the marriage had ended, to give the date at which this happened. A general discussion on nuptiality is contained in the introductory section of the relevant chapter.

1.6 TYPES OF SOURCES OF ERROR

Selection procedures

Of the sources of errors, the selection of who is eligible for the individual interview is the first to consider. In some WFS surveys all women whether ever married or single in the child-bearing ages 15–49 are included for interview in the individual schedule. In other surveys only the women who have ever married are interviewed. The YARFS only included a subsample of ever-married women aged 10–50 inclusive. Where premarital births are common, the characteristics of those selected may be compared with those not included in the interview in order to establish the biases resulting from selection procedures. This, however, does not apply to the Yemen AR, where consummation before marriage is unheard of.

Obviously only those women who have survived could be included in the individual survey. If the marriage and childbearing experience of these women is different from those who have died there will there will be a bias in derived demographic estimates. This bias is inherent in

the selection procedure. Another similar source of error results from the non-response of some of the sample. Bias will result if the history of these women differs from that of the remainder of the sample.

Age and date reporting errors

Errors resulting from age reporting can have serious effects not only on the recorded age structure but also on nuptiality, fertility and mortality rates. The bias of course depends on the direction of the shifting or transference age (ie to younger or older age groups). The misreporting may be deliberate, or due to ignorance or memory lapse. The latter is more common among older respondents who experienced events many years in the past. Errors in age reporting, as mentioned earlier, may be either the interviewer's fault or a result of the way the questions concerning age were asked. The usual questions in WFS are, 'How old were you on your last birthday?', 'What is your month and year of birth?' or 'How old are you?'. It is possible for each of those questions to yield different answers, and where dates cannot be remembered correctly the problem of estimation on the part of the interviewer becomes important.

Preference mainly for numbers ending in digits 0 and 5 and to a lesser extent ending in even numbers 2, 4 and 8 were evident in the data from the YARFS. For about 98 per cent of the respondents age was recorded by calendar year of birth. This is related to the interviewer's use of a historical calendar in estimating age since, as mentioned before, very few respondents knew their ages. In some cases guesswork based on physical appearance, parity or years since marriage was used. The situation was made even more difficult by the fact that almost all the respondents were illiterate and with a dominantly rural and subsistence agricultural background. Under these circumstances, a woman may appear older than her actual age. And assessed from the point of view of parity, many such women may be entirely excluded from being interviewed. Women of high parity may therefore have their ages overestimated from under to over fifty.

The problem of estimating and guessing dates on the part of the interviewer has another dimension. Some unpleasant events such as unsuccessful first unions followed by more stable and happy ones, or infant and child deaths, are always not easy to put in proper perspective, so much so that questions such as 'How old were you when . . .?' or 'How long ago . . .?' may yield incorrect answers.

The effect of using the local chart of events may be a tendency for respondents to leap on certain important dates like the year of independence or the year in which an important revolution or *coup d'état*, famine or drought took place.

Omissions

Omission of past events is a common feature of birth or union histories. It is more common as a result of memory lapse among older women whose births or marriage happened many years in the past, especially if such events were surrounded by unpleasant circumstances. Premarital births or pregnancies, for instance, are often bound to be forgotten and omitted. Also children who died in early infancy or those who are still living but staying away from home may also be omitted. Unions which did not last long or were very unhappy but were later followed by happy ones are also likely to be omitted.

Lack of strict privacy due perhaps to the presence of an adult of the opposite sex, grown-up children or a husband may be a cause of omission. This is especially true where a respondent does not wish others including her husband to know about some events in her past history such as premarital births, abortions or consensual unions that occurred before the present union or during long absences of a husband away from home.

In addition, the failure of the respondent to understand the questions being asked may lead to omission.

1.7 EFFECTS OF ERRORS

Reporting of age and ommissions

Misreporting of age will affect a population's age structure as well as sex ratios. The effect is particularly substantial when it comes to deriving estimates such as fertility, nuptiality and infant and child mortality rates where age accuracy is essential. The distortion of the single-year age distribution caused by age misreporting can of course always be minimized by using five-year age groups instead.

The misdating of events for specific periods may result in artificially increased or reduced rates depending on the direction of the transference, thereby creating wrong impressions about the trend in fertility, nuptiality or infant and child mortality. For instance, if women in the age group 45–49 understated their ages and reported themselves as 40–44, the recipient age group 40–44 would have a lower than expected fertility since the transferred women are older with lower or reduced fertility rates. If the events in the birth and marriage history have been reported correctly but ages misreported, this will affect the estimation of fertility and nuptiality in the related intervals. For instance, if a woman reports her date of first union and first live birth correctly but understates her age, the result will be to show an older age at first union. This would also affect age at first birth, although the interval between first union and first birth would not change.

Likewise, omission of live births or dead children can have a serious effect on fertility, and on infant and child mortality rates. Nuptiality data can also give a biased picture. Nuptiality appears to change with time when some unions have been omitted. Omission of births in the period shortly before the interview results in an underestimation of fertility, giving an impression of declining fertility in the recent period. If, on the other hand, it is the births of older women which occurred many years in the past which have been omitted, the fertility of these older women in the past will be underestimated, giving an impression of rising fertility with time.

1.8 EFFECTS OF ERRORS ON EVALUATION OF DATA

As mentioned before, one of the difficulties of evaluating data of this type is determining the sources of error. One general observation is that when data on age reporting are poor, this will affect other data on nuptiality, fertility and mortality.

In evaluating retrospective survey data, internal consistency checks are carried out mainly by comparing individual and household survey data. Some tests applied to the data involve fitting theoretical models under specified assumptions. Where possible, external sources of data such as non-WFS surveys and censuses are compared with WFS data. However, the major difficulty in comparing the external sources of data is the determination of which source is to be regarded as more correct. It is generally acknowledged that surveys are more carefully executed, with resulting smaller margins of error, than say censuses. In any case, many of the detailed questions included in a survey are not possible in a census.

2 Age Reporting

2.1 INTRODUCTION

The poor quality of data on age from censuses and surveys in most third world countries is a major source of concern since it may adversely affect estimates of many other demographic measures such as fertility and mortality. Despite efforts to minimize this source of error, the quality of age data remains unsatisfactory. Distortions arise largely from the fact that exact age has had little cultural significance in many traditional societies and hence many respondents cannot recall their ages or dates of birth accurately. The problem is aggravated when the respondent is giving information on someone else.

In particular, age misstatement of the female population in the reproductive ages can have serious implications for the estimation of fertility on which population projections are based, with implications for social and economic planning within the country. For instance, it has been shown that recorded fertility rates have been distorted in the age range 20–35 either because of the tendency for younger females to overstate their ages or through older women shifting their ages to lower age groups and thereby causing an expansion of the central ages of childbearing. Such features indicate the need to evaluate not only data on age reporting but also on other demographic measures.

In evaluating age reporting in the YARFS, data for all members of the household, both males and females, are examined but emphasis is placed on women in the childbearing ages 15–50. The data on age from the 1975 census are used for comparison. The household data were reconstructed to match the total population by age and sex in 1979 and the cohorts were compared with those from the 1975 census. The data were also checked for consistency of age reporting between the household and individual surveys for women in the reproductive ages 15–50.

The main measures used in evaluating data on age are (1) the percentage distribution by single years and by five years for males and females by sex ratios for the various age groups and comparison with an expected configuration (theoretical population of West–Coale–Demeny models, level 13), and (2) the measurement of age heaping by means of indexes such as Myers', Whipple's and the United Nations indexes.

2.2 SINGLE YEARS OF AGE

An examination of the single-year age data from the household survey (figure 1) shows that the pattern of age reporting for both males and females in the household questionnaire exhibited typical irregularities associated with age misstatement in most developing countries. The data are affected by digit preference at ages ending in 0 and 5. There is also less pronounced heaping at ages ending in digits 2 and 8 except after 60.

Age heaping involves preference for, or dislike of, certain digits. The phenomenon assumes unbiased error, implying that the average age of broad cohorts will be correct since those who understate their ages are expected to counteract the effect of those who overstate their ages. This phenomenon should not be confused with age shifting, which involves a bias in the recorded age structure.

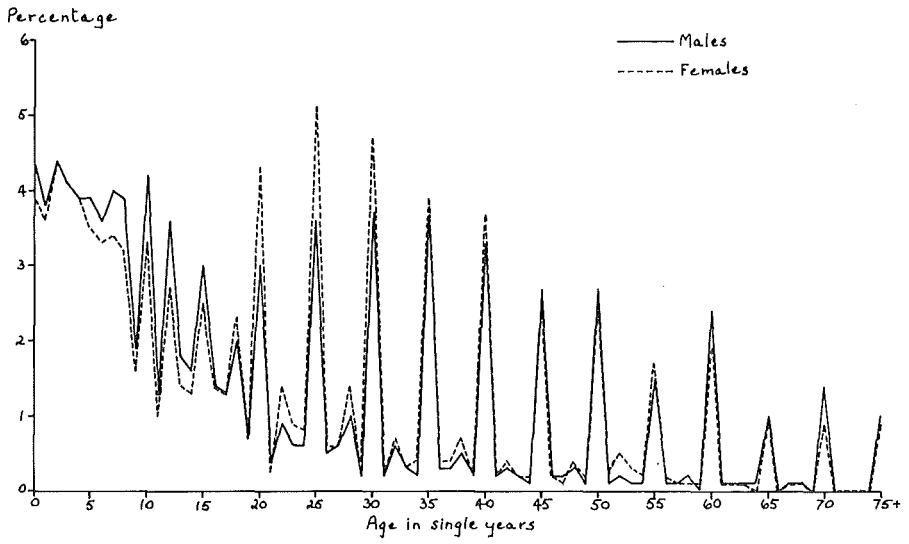

Figure 1 Percentage distribution of the population by sex and single years of age, household survey

Table 1 Digit preference (deviation from 10 per cent) and Myers' index for respondents in the household survey 1979

Digit	Total		Type of place of residence			
	Males	Females	Urban		Rural	
			Males	Females	Males	Females
0	+24.5	+23.3	+16.5	+19.6	+25.5	+23.7
1	−7.5	−7.4	−6.9	−7.5	−7.6	−7.4
2	−3.5	−3.0	−1.9	−1.3	−3.7	−3.2
3	−6.0	−5.8	−5.4	−6.2	−6.1	−5.7
4	−6.2	−6.0	−5.1	−6.0	−6.4	−6.0
5	+19.2	+18.5	+15.6	+16.1	+19.7	+18.8
6	−5.6	−5.6	−5.3	−5.0	−5.6	−5.7
7	−5.2	−5.9	−1.7	−4.4	−5.6	−6.1
8	−2.2	−1.1	−0.3	−0.6	−2.4	−1.1
9	−7.5	−6.9	−5.6	−4.7	−7.7	−7.2
Myers' index	87.4	83.5	64.3	−71.4	90.3	85.0

Myers' index reflects the preference for, or dislike of, each of ten digits from 0 through 9 and takes the values 0 (indicating no preference) and 160 (when only ages ending in digits 0 and 5 are reported). The results of this index presented separately for males and females and for rural and urban (table 1) reinforce our earlier observation in figure 1 that 0 and 5 are the most preferred digits and that there is distinctive heaping at ages 10, 15, 20, 25, 30 and so on. Overall, digit preference is the same among both males and females, though slightly higher among males (87.4 compared with 83.5). In the urban areas age reporting is better for males (64.3 compared with 71.4). However, among the rural population, digit preference is higher among females than males (104.7 compared with 90.3).

When we examine the individual questionnaire data, Myers' index (this is not 'blended') also shows that digits ending in 0 and 5 were most preferred among ever-married females aged 10–50. Digits ending in 1 and 3 were least preferred. The overall index was 63.9 (table 2).

Whipple's index is obtained by adding numbers reported at ages between 23 and 62 and calculating the proportion of the respondents who reported their ages as ending in digits 0 and 5. The index has values ranging between 100 (showing no concentration) and 500 (if all ages were concentrated only at digits ending in 0 and 5). Although this index has the disadvantage of showing preference for only two digits 0 and 5, it has the advantage of being precise and easy to compute. The values show a similar pattern of age preference for digits 0 and 5 among males and females and for rural and urban residence. These results are compared with those from other countries where similar evaluative exercises have been done (table 3).

2.3 FIVE-YEAR AGE GROUPS

Where age shifting occurs, the average recorded age for the groups of people affected will be above or below the true value depending upon the nature of the shifting. These shifts in ages may prove difficult to measure even approximately, with a view to correction, but this is clearly an important error with far-reaching implications.

Table 2 Digit preference (deviation from column 3) (and Myers' index) for ever-married women in the individual survey 1979

Digit	No of times each last digit will occur in an ever-married sample 10–50	% of total in col. 2	% in the last digit	Deviation of col. 4 from col. 3
(1)	(2)	(3)	(4)	(5)
0	5	12.2	27.1	+14.9
1	4	9.8	2.7	−7.1
2	4	9.8	5.8	−4.0
3	4	9.8	3.7	−6.1
4	4	9.8	6.8	3.0
5	4	9.8	26.6	+16.8
6	4	9.8	5.1	−4.7
7	4	9.8	6.0	−3.8
8	4	9.8	7.6	−2.2
9	4	9.8	8.5	−1.3
Total	41			63.9
Myers' (non-blended) index 63.9				

Table 3 Comparison of the estimates of indexes of age heaping/preference with other countries, household survey

Country		Indexes (total population)			No enumerated in survey
		Whipple	Myers	UN	
Yemen AR	M	361.6	87.4	76.8	72 686
	F	343.8	83.5		
Ivory Coast	M	131.1	13.5	61.6	31 578
	F	127.3	14.1		
Sudan (North)	M	290.0	57.2	69.9	63 208
	F	286.0	58.4		
Morocco	M	179.0	26.9	49.3	103 542
	F	209.0	34.7		
Mauritania	M	230.0	41.0	50.5	85 908
	F	250.0	49.5		

When single-year age data are grouped into five-year age groups (figure 2), a somewhat better picture of age structure is observed although some irregularities still remain. An undercount of children under one year of age is a common feature of many African and Asian censuses and surveys. It is also a common feature for large numbers to be reported as 0–9 followed by a sharp drop in the age groups 10–14 and 15–19. Thereafter the sizes of successive cohorts decrease gradually for both males and females. This may, in part, be a genuine feature of most African and Asian age distributions as a result of high fertility and a drastic reduction in infant and child mortality causing an increase in the proportions surviving from birth to early ages. This, however, may not be a satisfactory explanation since this type of age distribution has been noted even in those countries with long histories of census-taking. For instance, a similar age distribution pattern was noted in the Indian censuses of 1901 and 1911 when relatively little improvement in the levels of infant and child mortality had been effected. On the contrary, in those countries – such as the Malagasy Republic – where the standard of age reporting is higher than in many African and Asian countries, there has been a tendency for the 0–9 bulge to move up into the 10–14 and 15–19 year age groups, indicating that the phenomenon is partly a result of age misstatement.

Figure 2 shows that between ages 15 and 44 females exceed males, probably an indication of international migration among the male population. There is also some possibility of age heaping on age groups 25–29, 35–39, 50–54 and 60–64 for both sexes.

Figure 3 shows the percentage distribution of all women by five-year age groups for the YARFS and the 1975 census. The pattern of age reporting is similar in both the survey and the census. The age group 0–4 is substantially smaller in the census than in the YARFS, and this can only be explained by underenumeration in the census. There are clearly some distortions in the age structure in the early adult years, but it is hard to know the extent to which this is due to age shifting, or else to international migration.

In figure 4 the percentage distributions of ever-married women aged 10–49 years in the 1975 census and the household and individual surveys are compared. The age distributions revealed in the two surveys are quite similar. The greatest difference is between the census and the individual survey. The age structure of the census sample is substantially older. This may be due to the under-reporting of age in the survey.

A comparison of sex ratios by five-year age groups for the survey and the 1975 census is presented in table 4. In general, the low sex ratios confirm the existence of large-

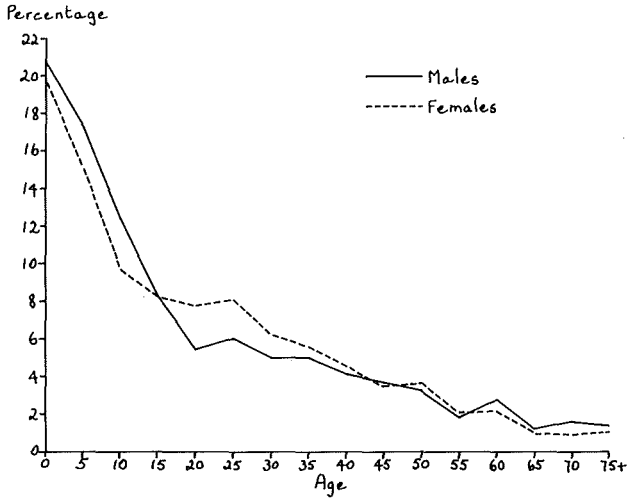

Figure 2 Percentage distribution of all respondents by five-year age groups, household survey 1979

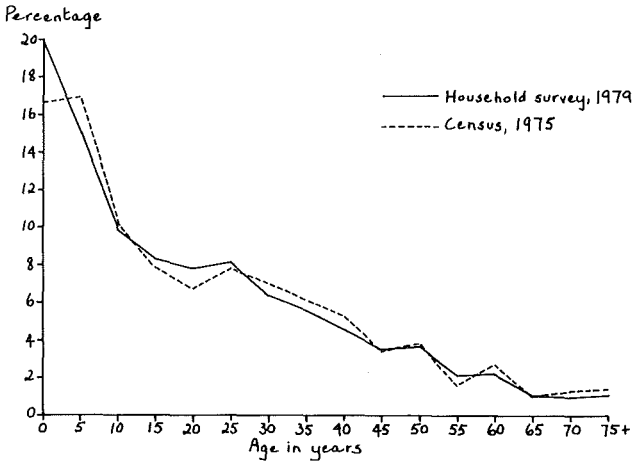

Figure 3 Percentage distribution of all women by five-year age groups, household survey, 1979 and 1975 census

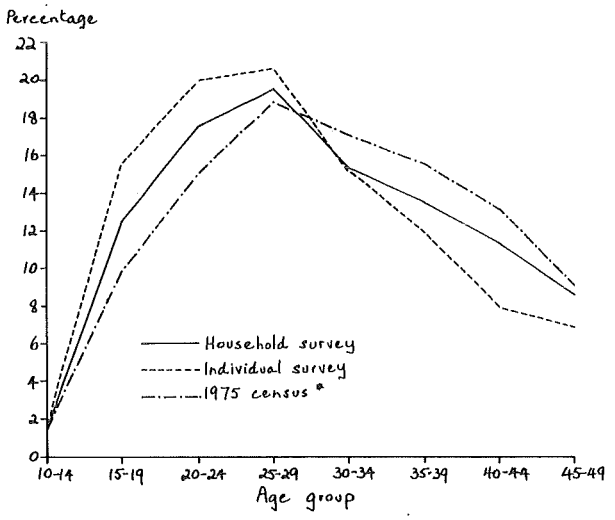

Figure 4 Percentage distribution of ever-married women 10–49 years of age by five-year age groups, household, individual surveys and 1975 census. *Preliminary figures 1975, derived from 3 per cent random sample of the population census, see final report of the Swiss Airphoto interpretation team, April 1978

scale international migration among men. The low sex ratios among males in the ages 15–54 are precisely what would be expected. At the same time, however, the table has some striking features other than this. The high sex ratios at young ages suggest that females are over-reporting their ages, especially from the 10–14 into the 15–19 age group. The omission of girls can also account for this. The high sex ratio for 45–49 year olds in the YARFS may be caused by the common tendency of women to have their ages over-reported, perhaps by the interviewer, so that they will not be included in the individual survey.

Table 4 Sex ratios for five-year age groups, 1975 census and 1979 YARFS

Age group	Males per 100 females	
	1975 census	1979 YARFS
0–4	99.7	101.3
5–9	107.7	111.4
10–14	115.4	124.4
15–19	82.6	97.4
20–24	63.6	68.1
25–29	64.8	71.7
30–34	68.6	77.9
35–39	81.7	87.8
40–44	83.2	86.3
45–49	92.4	102.4
50–54	89.9	88.2
55–59	101.8	88.8
60–64	91.7	121.7
65–69	107.3	108.6
70–74	89.4	149.3
75+	90.9	129.5
All	91.0	97.5

It is very noticeable that sex ratios are fairly consistently lower in the census than in the survey and this may be the result of the omission of women in the survey, so as to avoid interview in the individual survey.

Table 5 present the results of the UN age-accuracy indexes for the YARFS. This index, as the name implies, measures the age accuracy based on deviations from the expected cohort size, and the sex ratio for each cohort. Unlike both the Whipple's and Myers' indexes, it takes into account sex ratios and age ratios for both sexes in its calculations. Its value is three times the mean of the absolute difference in reported sex ratios from one age group to the other plus the mean absolute deviations from 100 of the age ratio for males and for females. When the index is under 20 it indicates that the data are 'accurate', 20–40 'inaccurate' and over 40 'highly inaccurate'. Comparable results from this index for other countries are given in table 3.

Although the index is exceptionally high compared with other countries, it must be realized that much of this apparent erraticness in age structure and sex ratios reflects the reality resulting from migration. To some extent therefore the high value of the index is misleading if it is taken to imply only incorrect age reporting.

Table 6 shows the comparison of the age structure from the household survey with that of the stable population based on the family of West–Coale–Demeny models (life tables level 13.) Among males, age groups 0–4, 5–9, 60–64, 70–74 as well as 75+ were highly overstated, while all other age groups but 10–14 were probably under-reported or shifted to ages 60–64, 70–74 and over 75. Among females, shifting might also have occurred to age groups 50–54, 60–64 and 75+.

When the household data are reconstructed (or expanded) to match the total population by five-year age group (1979) and the cohorts are compared with those of the 1975 census (table 7), the pattern for both sexes is similar. Any erratic features of the age structure are either the result of systematic age misstatement or omission, or else of genuine demographic events including age- and sex-selective international migration. In both cases such irregularities are likely to have persisted between 1975 and 1979, causing erratic survival ratios which do not merely reflect mortality. Unfortunately, it is not at all easy to disentangle the separate effects of age misstatement and demographic peculiarities. This exercise reveals probable age shifting to age groups 24–28, 59–63 and 69–73, as can also be inferred from the two age distributions alone. More to the point perhaps is that these two age structures reveal very similar irregularities by sex and age.

In figure 5 the distribution of ages of women in the individual survey is presented by format of the reporting of age. Evidently, heaping by age is due to the usual preference for numbers ending in digits 0 and 5, as we saw earlier. Heaping at calendar year of birth is even more exaggerated and there is a preference for even numbers. The fact that 1979 was the year in which the YARFS was conducted may be the reason why many of the dates ended in digits 4 and 9. The dates 1948/49, 1954/55 and 1959 are of historical significance, as *coups d'état* took place then. Also the period 1942–48 saw one of the worst economic crises and a series of famines. It

Table 5 UN age-accuracy index, YARFS 1979

Age	Reported number		Analysis of sex ratios		Analysis of age ratios (males)		Analysis of age ratios (females)	
	Males	Females	Sex ratios	Successive differences	Ratio	Deviation from 100	Ratio	Deviation from 100
	(1)	(2)	(3) = (1)/(2)	(4)	(5)	(6)		
0–4	7410	7313	101.3	–	–	–	–	–
5–9	6172	5538	111.4	−10.1	104.2	+4.2	101.8	+1.8
10–14	4436	3565	124.4	−13.0	96.9	−3.1	82.9	−17.1
15–19	2983	3064	97.4	+27.0	93.5	−6.5	95.4	−4.6
20–24	1948	2860	68.1	+29.3	76.0	−24.0	94.5	−5.5
25–29	2141	2987	71.7	−3.6	114.1	+14.1	115.4	+15.4
30–34	1806	2317	77.9	−6.2	91.7	−8.3	92.1	−7.9
35–39	1796	2045	87.8	−9.9	109.6	+9.6	101.7	+1.7
40–44	1470	1704	86.3	+1.5	94.5	−5.5	102.3	+2.3
45–49	1316	1285	102.4	−16.1	98.9	−1.1	84.1	−15.9
50–54	1192	1351	88.2	+14.2	118.7	+18.7	130.9	+30.9
55–59	692	779	88.8	−0.6	63.0	−37.0	71.6	−28.4
60–64	1005	826	121.7	−32.9	179.5	+79.5	140.8	+40.8
65–69	428	394	108.6	+13.1	54.6	−45.4	65.5	−34.5
70–74	563	377	–	–	–	–	–	–
Total (irrespective of sign)				177.5		257.0		206.8
Mean (total divided by 13)				13.7		19.8		15.9
Index (3 times mean difference sex ratios plus mean deviations of male and female age ratios) i.e. (3 × 13.7) + 19.8 + 15.9						76.8		

should be emphasized at this point that most respondents did not know their ages and so the interviewers often had to estimate ages by reference to historical events, using a historical calendar. In some cases ages were guessed merely by judging from the physical appearance of the respondents. Therefore the 97.7 per cent of the respondents recorded as giving their birth date in years only is reflective of the interviewers' guesses.

Lastly, the household and individual data were compared for consistency in age reporting by five-year age group (table 8). The data in the table show some inconsistency in the reporting of age between the two surveys. Only 82.9 per cent reported their ages to be within the same age group in both cases. Consistency was lowest among women in the age group less than 20 (77.1 per cent), followed by 20–24 (81.7 per cent) and 25–29 (82.5

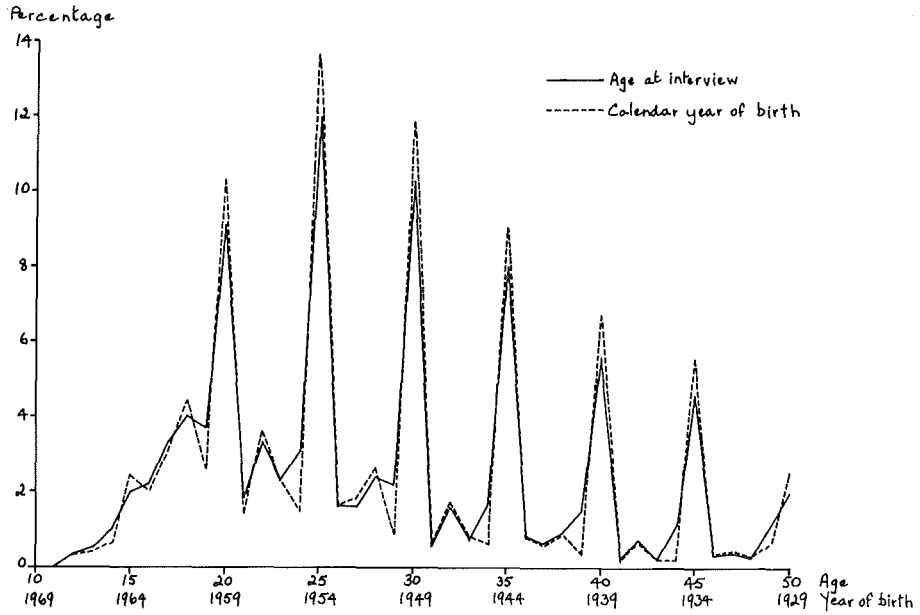

Figure 5 Percentage distribution of women ever in union, 10–50 years of age by single years of age and by year of birth

Table 6 Comparison of the reported female five-year age distribution from the household survey with the stable population

Age	Per cent distribution					
	C(x) Reported females	C(s) Stable pop.	C(x)/C(s) (females)	C(x) Reported males	C(s) Stable pop.	C(x)/C(s) (males)
Total	100.0	100.0	1.00	100.0	100.0	1.00
0–4	19.9	16.4	1.21	20.7	16.7	1.24
5–9	15.0	13.7	1.09	17.2	13.9	1.24
10–14	9.7	11.8	0.82	12.4	12.0	1.03
15–19	8.3	10.3	0.81	8.3	10.4	0.80
20–24	7.8	8.8	0.89	5.4	9.0	0.60
25–29	8.1	7.5	1.08	6.0	7.6	0.79
30–34	6.3	6.4	0.98	5.0	6.5	0.92
35–39	5.6	5.4	1.04	5.0	5.5	0.91
40–44	4.6	4.6	1.00	4.1	4.6	0.89
45–49	3.5	3.9	0.95	3.7	3.8	0.97
50–54	3.7	3.2	1.16	3.3	3.1	1.06
55–59	2.1	2.6	0.81	1.9	2.4	0.79
60–64	2.2	2.0	1.10	2.8	1.8	1.56
65–69	1.1	1.5	0.73	1.2	1.3	0.92
70–74	1.0	1.0	1.00	1.6	0.8	2.00
75+	1.1	0.9	1.22	1.4	0.6	2.33

per cent), perhaps reflecting the fact that another person gave ages for the young women in the household schedule. Contrary to expectation, relatively higher consistency was found among older women, 45–50 (89.6 per cent). Perhaps these women were more likely to report their own ages in the household survey. The data also show that 86.9 per cent of ages reported in the household and individual questionnaires were within one age group of each other.

When the data are considered on the basis of proxy reporting in the household survey, consistency was seen to be higher among women who reported their own ages (table 8, last two columns).

Table 7 Reconstruction of the household survey population to the total population by age and comparison of cohorts with 1975 census

Age (census 1975)	Census 1975, reported		Age adjusted	H/h survey 1979, expanded		Survival ratios	
	Males (1)	Females (2)		Males (3)	Females (4)	Males (3)/(1)	Females (4)/(2)
0–4	392 947	393 969	4–8	418 151	386 299	1.064	0.981
5–9	432 284	401 496	9–13	276 907	224 668	0.641	0.560
10–14	281 036	243 576	14–18	200 764	196 820	0.714	0. 808
15–19	153 427	185 793	19–23	120 737	173 643	0.787	0.935
20–24	101 488	159 447	24–28	137 604	190 207	1.356	1.193
25–29	120 335	185 731	29–33	109 634	140 516	0.911	0.757
30–34	113 706	165 673	34–38	109 877	126 865	0.966	0.766
35–39	117 589	143 951	39–43	90 219	105 205	0.767	0.731
40–44	104 442	125 601	44–48	79 541	76 932	0.762	0.613
45–49	75 741	81 976	49–53	72 260	82 211	0.954	1.003
50–54	82 106	91 371	54–58	43 927	49 984	0.535	0.547
55–59	39 915	39 211	59–63	60 854	50 782	1.525	1.295
60–64	59 834	65 237	64–68	26 514	24 208	0.443	0.371
65–69	24 396	22 746	69–73	33 976	23 116	1.393	1.016
70–74	28 641	32 041	74–78	12 620	9 161	0.441	0.286
75+	30 904	33 994	79+	19 597	15 714	0.634	0.462
Not stated	4351	5294					
Total	2 163 142	2 337 107					

NOTES: Sampling fraction = 1/56; H/h = response rate = 92.3%; Expansion factor = 1/(1/56) × 0.923 = 60 672.

Table 8 Consistency of reporting age, household and individual surveys 1979

	Consistency	Within one age group	If another reported for women in h/h	
			Yes	No
Total	82.9	86.9		
Age group in individual survey				
Less than 20	77.1	90.7	93.0	88.3
20–24	81.7	89.9	87.8	91.0
25–29	82.5	90.0	89.0	90.4
30–34	85.8	90.3	77.2	94.0
35–39	85.0	89.3	91.2	88.7
40–44	83.7	86.6	74.3	90.1
45+	89.6	98.9	95.9	99.6

3 Nuptiality

3.1 INTRODUCTION

The study of nuptiality is important to demographers not only because it influences fertility patterns, but also because nuptiality variables, and in particular age at first marriage, have policy implications in terms of planning for household requirements, including residential houses and services. Newly wed couples, for instance, may require their own accommodation instead of continuing to live with parents, thus increasing pressure on the country's resources. Despite their importance, however, data on nuptiality are either lacking or inadequate for the majority of developing countries. Registration of marriage may exist but it is incomplete in most cases. Some recent censuses (Kuwait 1975 and Egypt 1976) collected data on age at marriage. However, for the majority of Arab countries such information is not available except from surveys.

In studying nuptiality in the third world, one is faced with immense conceptual difficulties. In the words of Radcliffe Brown, 'Marriage is a developing process and there are several stages between preliminary rites and the full recognition of the couple as a social unit'. In tropical Africa, for instance, one finds a whole range of marital situations varying both in their degree of permanence and in their relationship to law, religion and custom. In this respect, Van de Walle (1968) identified four different types of marriage: (1) casual, (2) consensual, (3) marriage on approval, (4) formal marriages. The timing of the latter type is easy to determine compared with the first three. Such multiplicity of marital situations as are found in tropical Africa, Latin America and the Caribbean pose a dilemma for enumerators and analysts. Equally beset with difficulty is the definition of various marital states. For instance, divorce/separation covers an array of situations ranging from protracted grass widowhood to divorce by a court decision. The definition of widowhood can be subject to uncertainties. In tropical Africa, for instance, the death of a husband may often not sever the ties between the two kinship groups involved.

In the Yemen AR, as in the whole of the Arab world, marriage has a recognizable starting point. It takes place in three stages: (1) the engagement or the equivalent of engagement, (2) the signing of the contract (including the specification of mahr or brideprice), and (3) the wedding ceremony followed without delay by consummation. These three stages help in establishing the exact begining of marital life even when marriage has not been registered with civil authorities. Despite this, nuptiality data are often distorted by age misstatement arising from the fact that respondents do not know their ages.

The YARFS collected information on five types of marital status – the never married, married, widowed, divorced and separated. In evaluating these data emphasis is given to the individual survey of the ever-married population aged 10–50. Where possible, data from the 1975 census are used for comparison.

3.2 AGE DISTRIBUTION

The per cent distribution of ever-married women 10–50 by single years is used to examine heaping in nuptiality data (figure 6). Preference for even numbers 20, 22, 24, 28 and 46 is evident, with no preference at odd ages, 21, 23, 29, 33 and 47, although heaping is quite minor. Table 9 shows percentages of women 10–50 by age and marital status at the time of the survey. The proportions single come from the household schedule. Since the individual

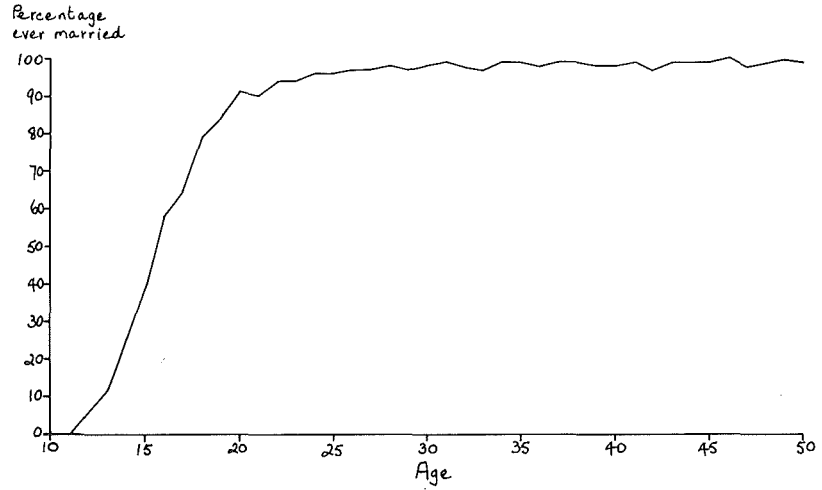

Figure 6 Percentage ever married by single years of age

Table 9 Percentage distribution of women by marital status and five-year age

Marital status	Five-year age group							
	Total	–20	20–24	25–29	30–34	35–39	40–44	45–50
Single	24.1	68.8	7.9	3.3	1.9	1.1	2.1	1.0
Married	71.5	30.1	87.0	93.9	93.2	88.5	89.4	89.5
Widowed	2.0	0.1	0.8	1.2	1.8	6.3	7.2	6.9
Divorced	1.6	0.4	3.0	0.8	2.6	3.4	0.7	2.2
Separated	0.8	0.6	1.2	0.9	0.5	0.7	0.5	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0

survey was an ever-married sample only, it was necessary to adjust the proportions for each marital status in each age group from the individual survey by those single women recorded in the household schedule to obtain the distribution for the current marital status in the individual survey with respect to the total female population. The pattern is much as one would expect. There are certainly fluctuations in proportions widowed and divorced with age, but it is possible that the differences are not really significant, given such small numbers. On the other hand, selective over-reporting of age among widows would produce the pattern shown.

When the data are examined in terms of format of reporting date of energy into first union (table 10), it is shown that in 70 per cent of cases the date was recorded as calendar year only rather than as year and month or age at event. This is consistent with the format of reporting date of birth as we saw in the previous chapter. This is reflective of the interviewer's guesses of dates by the use of events in the historical calendar. The proportion of respondents recorded as providing month and year varies across age groups from 24 per cent of young women below age 20 to 0.4 per cent for older women (45–50). This pattern is not surprising since younger women are more likely to have better education than their older counterparts and their marriages are more recent. The pattern according to marital status is really a reflection of the relationship between marital status and age.

3.3 DIGIT PREFERENCE IN NUPTIALITY REPORTING

Figure 7 gives the per cent distribution of ever-married women 10–50 by year of first union and according to whether it was recorded as month and year, year only or age at event. The purpose is to detect date heaping in nuptiality. The source of the heaping is not at all clear. For those events recorded according to the format in which the year only is given there appears to be considerable heaping on some years which are periods prior to the survey divisible by five. So few women reported the year and month of marriage that irregularities are probably mostly the result of sampling error.

The distribution of year of first marriage for ever-married women 10–50 by calendar year of first union (figure 8) shows a similar pattern for total and rural populations, with heaping at 1941, 44, 46, 49, 52, 54, 59, 62, 64, 67, 69, 72, 74 and 77. In the urban area, on the other hand, heaping occurs at 1943, 47, 49, 52, 56, 59, 61, 66, 71, 73 and 77. It is especially pronounced at 1959 and 1966. Clearly, heaping was most common on years ending in 4 and 9 because the survey was done in 1979. It also occurred on important dates in the historical calendar and the usual preference for even numbers was present. It was noted earlier (table 10) that the older women were, the more of them reported their age at marriage, rather than the year in which they were married. This trend would reduce the extent of heaping on years a long time before the survey. Nearer the present, however, most women either gave the year and month of marriage, or the year only. The fact that heaping on years ending in 4 and 9 is quite marked suggests that quite a high proportion of these data derived from information on the number of years before the survey, rather than on the reporting of the year immediately.

In both urban and rural areas the reporting of age at first marriage was concentrated at age 15, with lesser concentrations at ages 13 and 14. There is a sharp and unexpected drop in the proportion who first married at age 16. Some heaping at age 24 is evident for rural residents. Among the urban dwellers, ages 18, 22, 29 and 30 were also preferred.

3.4 AGE AT FIRST MARRIAGE

Age at first marriage, as mentioned earlier, is a very important aspect of nuptiality. In YARFS the mean age at first marriage was computed from the date of birth and

Table 10 Format of reporting first union entry date

Format	Total	Five-year age groups							Current marital status			
		–20	20–24	25–29	30–34	35–39	40–44	45+	Married	Widowed	Divorced	Separated
Year and month	7.2	24.2	10.6	2.3	2.3	0.7	1.0	0.4	7.4	1.4	7.3	4.0
Year only	69.6	65.6	75.9	75.7	72.5	70.3	54.7	57.0	70.3	58.6	49.1	76.0
Age at event	23.2	10.2	13.5	22.1	25.3	29.1	44.3	42.5	22.3	40.0	43.6	20.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

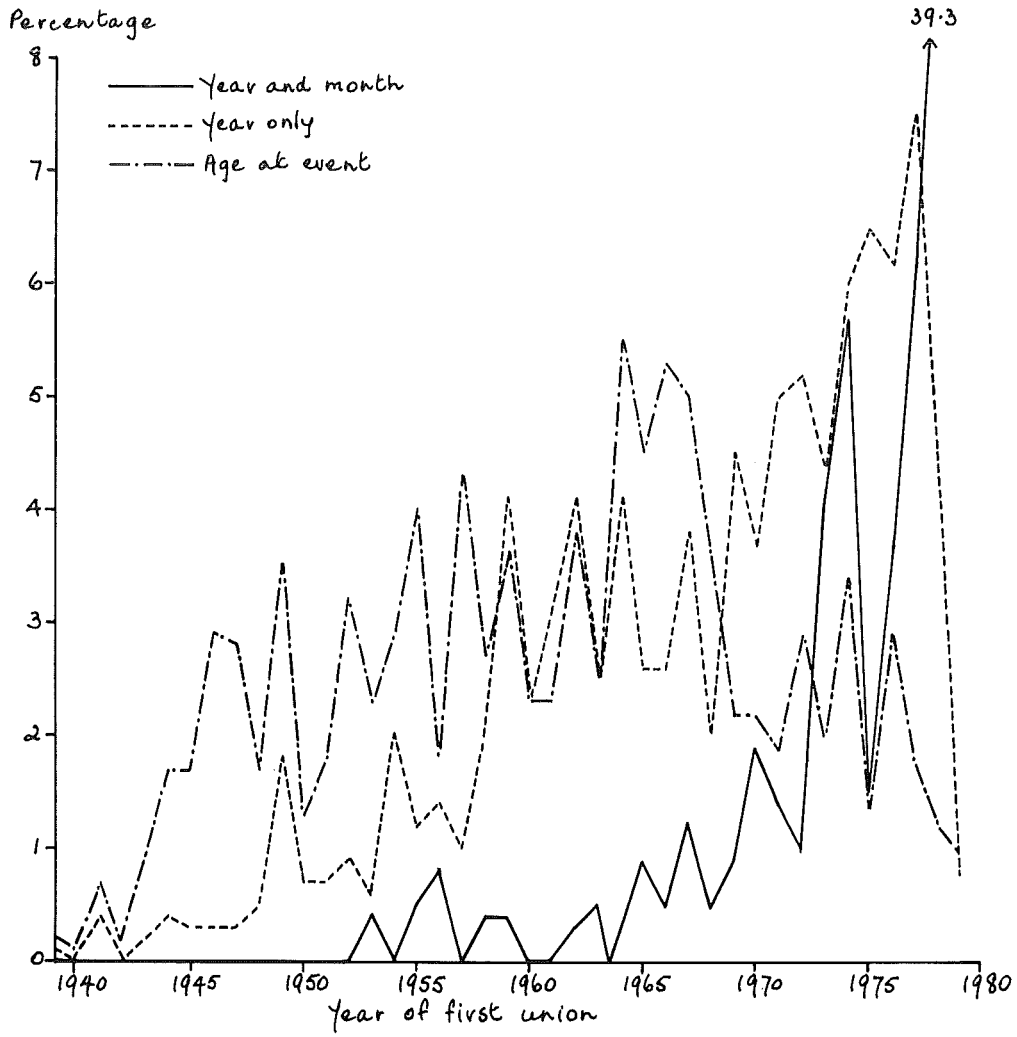

Figure 7 Percentage ever married 10–50 by year of first union according to whether it was recorded as month and year, year only and/or age at event

the date of first union. Table 11 shows the reconstruction of nuptiality changes for each cohort. It gives the cumulative proportions ever married by specified ages for each five-year cohort. These proportions are truncated at various ages because women have been exposed to different lengths of marriage depending on the cohort to which they belong. One important feature of the distribution in table 11 is that the proportions ever married fluctuate appreciably across cohorts, thus complicating any analysis of the trend. For instance, by exact age 15 slightly over 50 per cent of the ever-married women aged 35–39 at the time of the survey had entered the first union. Nearly 60 per cent of the women aged 30–34 at the time of the interview had ever married as compared to only 50 per cent in the cohort over 45 at exact age 15. Such inconsistencies only confirm our earlier assertions that dates were misreported. This is particularly evident among the cohort 45–49, where marriages occurred many years in the past. Another possibility is sampling errors resulting from a small sample. One thing is, however, certain from these data. Women entered first unions at very early ages in the past and there is not much evidence that this pattern has changed.

When data on percentages of a cohort ever in a union by years before the date of the interview are examined (figure 9) the pattern reveals further inconsistencies. For instance, the percentage ever in a union for the cohort 45–50 at 35–39 years before the survey is too high at 14.9 per cent, and so is 13.5 per cent for the cohort 40–45 years in the period 30–34 years before the survey. The percentage ever in a union for the cohort 45–50 at 25–29 years before the survey is 79.3 per cent. This is lower than for the cohort 40–44 years at 20–24 years before the interview. There is probably a tendency for all cohorts to pull their dates of first marriage near the date of the survey. Thus in general terms the inconsistencies as reflected in table 11 and figure 9 may be attributable to either shifting of dates, omission of unions, misreporting of ages and/or sampling problems resulting from a small sample of women.

3.5 COMPARISON WITH THE CENSUS

In order to evaluate the quality of the data on marital status obtained from the survey, it is necessary to compare with data from external sources, in this case the 1975 census (table 12). To do this the proportion of ever-

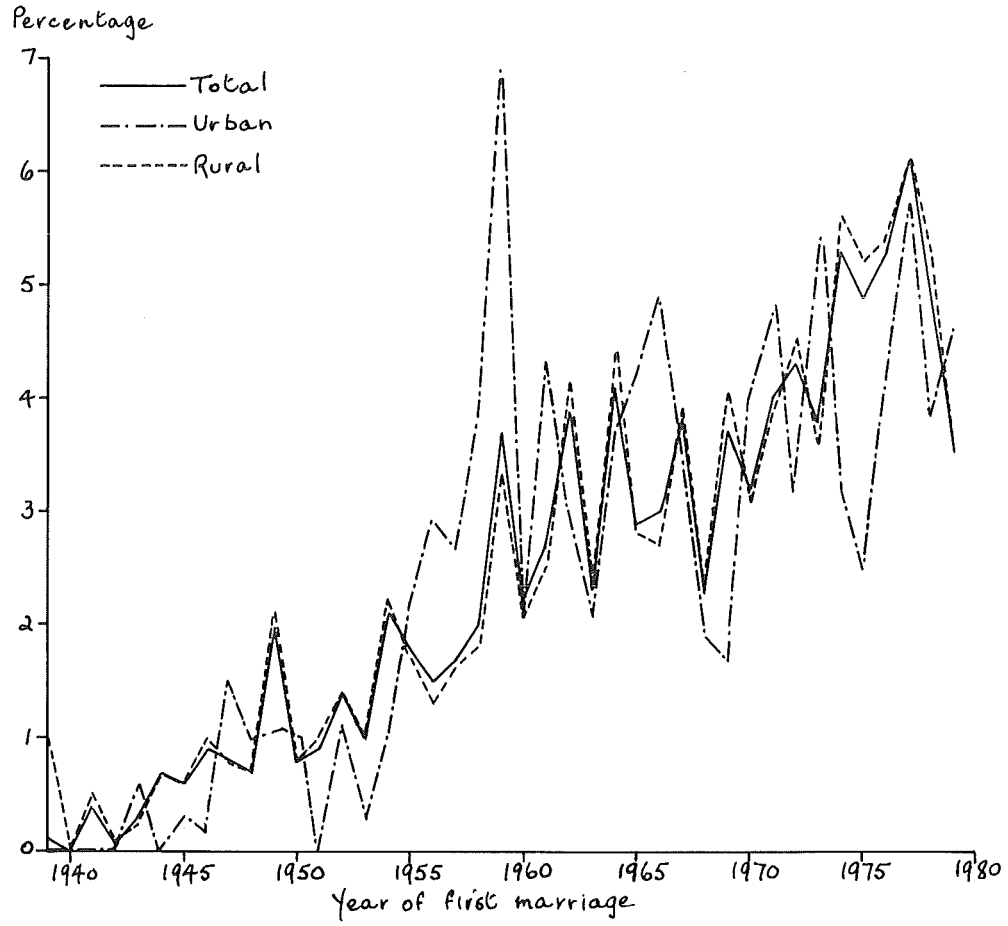

Figure 8 Per cent distribution of ever-married women (10–50) by calendar year of first union for total population and type of place of residence

married women at the time of the 1975 census was reconstructed from the survey data. Information from the individual questionnaire on date of marriage for all ever-married women and the percentage of single women by age from the household questionnaire were utilized. The age range considered in the individual survey was 10–49.

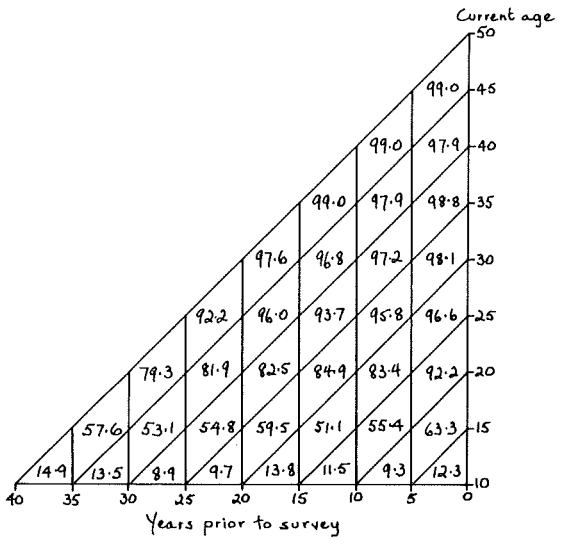

Figure 9 Percentage of women ever in union by current age for given years prior to survey

Two major discrepancies stand out. Firstly, the proportion currently in union is substantially lower in the census for the two younger age groups. A possible cause of this would be the overstatement of age of young women of this age in the census, especially among those who are married. Perhaps in the survey ages were ascertained more accurately.

The other outstanding feature is the higher proportion widowed according to the census at all ages over 20, but most obviously in the two oldest age groups. It is not easy to explain this by the misplacement of the deaths of husbands in time in the survey, nor indeed by the small sample size, as the differences are very large. The combination of these factors and the overstatement of age in the survey by women in their forties may be the explanation.

3.6 CONSISTENCY OF REPORTING MARITAL STATUS

On the whole, consistency of reporting marital status in both household and individual schedules was very high. About 99.4 per cent of the ever-married women reported the same marital status (table 13). Lower consistency observed among women in age groups 20–24, 30–34 and 45–50 may be attributed to the divorced women in age groups 20–24 and 30–34 and to the widowed in age group

Table 11 Cumulative per cent ever married by age at first marriage by cohort

Age at first marriage	Cohort							
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50
9	1.2	1.8	1.7	2.1	1.8	2.1	2.8	4.4
10	2.5	6.6	8.0	5.3	5.6	6.8	7.1	6.1
11	5.1	10.6	13.7	11.4	7.8	14.1	16.3	9.0
12	8.0	16.7	22.0	22.2	16.1	25.3	20.7	15.9
13	17.6	24.5	30.2	37.3	27.0	33.8	27.0	18.7
14	32.3	34.7	38.9	47.9	39.0	44.8	35.5	22.1
15		48.0	48.2	58.0	53.1	57.9	49.6	28.2
16		57.7	57.6	66.7	60.2	64.4	58.2	37.0
17		70.1	65.8	70.7	68.6	68.7	63.4	44.3
18		78.6	73.6	76.3	73.6	74.2	69.6	55.9
19		83.7	80.0	82.0	80.4	77.1	74.2	63.1
20			84.4	85.2	83.3	83.5	80.0	75.4
21			88.9	86.4	87.1	86.6	81.8	76.9
22			92.3	89.1	89.2	89.8	84.8	78.4
23			94.1	90.6	90.8	91.4	87.3	78.4
24			95.9	93.2	91.5	95.3	90.0	81.2
25				95.4	94.9	97.3	92.2	82.7
26				96.8	95.6	97.3	94.4	84.9
27				96.8	95.8	98.0	95.9	84.9
28				97.4	96.9	98.0	95.9	86.4
29				97.4	97.2	98.0	97.0	90.7
30					97.5	98.6	97.0	96.4
31					98.4	99.1	97.0	97.9
32					98.4		98.3	97.9
33					98.5		98.3	97.9
34					98.5		98.3	99.2
35							98.8	

Table 12 Reconstruction of marital status at time of 1975 census from the survey

Age at census	Marital status – per cent ever married									
	% ever married		% in union		% widowed		% divoriced/separated		% single	
	Survey	Census[a]	Survey	Census[a]	Survey	Census[a]	Survey	Census[a]	Survey	Census[a]
10–14	10.3	5.3	10.0	5.3	0.0	0.0	0.3	0.0	89.7	94.7
15–19	57.5	50.1	54.1	48.0	0.7	0.7	2.7	1.4	42.5	49.7
20–24	86.7	87.8	82.5	83.6	0.7	1.0	3.5	3.2	13.3	12.2
25–29	96.4	95.7	90.6	91.0	1.1	2.3	4.7	2.4	3.3	4.3
30–34	97.7	97.7	92.5	90.7	2.7	4.3	2.6	2.7	2.3	2.4
35–39	97.2	98.4	90.5	89.9	4.2	6.4	2.5	2.1	2.8	1.6
40–44	98.7	98.7	92.3	82.3	5.0	13.4	1.4	3.0	1.3	1.3
45–49	99.3	97.7	89.2	76.7	6.9	18.3	3.2	2.7	0.7	2.3

[a]Derived from the preliminary results obtained from 3 per cent random sample of the 1975 population census.
Source: Yemen Arab Republic Final Report on the Airphoto Interpretation Project of the Swiss Technical Co-operation Service, Berne, Zurich, April 1978.

Table 13 Consistency of reporting current marital status in household and individual surveys by cohort

Consistency in reporting	Cohort								
	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–50	N
Same status	100.0	99.4	99.0	99.6	99.2	100.0	100.0	99.1	99.4 (2 590)
Different status	0.0	0.6	1.0	0.4	0.8	0.0	0.0	0.9	0.6 (15)

Table 14 Consistency of reporting current marital status in household and individual surveys according to marital status and cohort

Current marital status	Total	Age						
		–20	20–24	25–29	30–34	35–39	40–44	45–50
Married	99.8	99.6	99.8	99.6	99.7	100.0	100.0	100.0
Widowed	95.6	–	100.0	100.0	100.0	100.0	100.0	87.5
Divorced	91.5	100.0	79.5	100.0	89.1	100.0	100.0	100.0
Separated	93.4	100.0	89.1	100.0	50.2	100.0	100.0	100.0

45–50 (table 14). The suspiciously low percentage (50.2) reporting themselves separated for both schedules in the age group 30–34 may be due to the very small number of cases involved.

3.7 MEAN NUMBER OF UNIONS

Table 15 shows data on the number of unions for each five-year cohort. Mean number of unions is useful in detecting any omissions of unions that occurred many years in the past. The data in the table show a slight increase in the number of unions from 1.0 to only 1.3 between cohorts 10–14 and 45–50, with no or very little change from the cohorts 25–29 to 45–50. This suggests omission of some unions that occurred among older age groups above 35 and among some middle-aged women 25–34.

Examination of the mean length of interval in months between first marriage and first birth by age of cohort helps to detect omission or misdating of first marriage and/or first births.

The data in table 16 show a steady increase from the youngest cohort 10–14 to the oldest cohort 45–49. However, the jump from 28 months to 36 months for women 15–19 and 20–24 and the increase from 51 months to 67 months and then 86 months for cohorts 35–39, 40–44 and 45–49 look highly unrealistic. This very strong pattern could best be explained by omission of first births. Likewise, the misdating of these events could be responsible. On the other hand, it has already been observed (table 11) that the pattern of early marriage has not changed a great deal according to the data. Therefore the omission or misdating of marriages cannot be a major factor. Similarly, we cannot say that the first birth interval among older women is very long because of very early marriages and the consequent inability of the women to bear children. It seems likely, then, that this apparent trend in first birth interval is the result of misreporting or omission of first births.

Table 15 Mean number of unions by age

Cohort	Mean no of unions	Number
10–14	1.0	46
15–19	1.0	396
20–24	1.1	511
25–29	1.2	526
30–34	1.2	388
35–39	1.3	306
40–44	1.3	203
45–50	1.3	228

3.8 CONCLUSION

Like data on age reporting, data on nuptiality are characterized by discrepancies originating from (1) shifting of dates, (2) preference for certain digits 0, 5 and even numbers, as well as the attraction to some important dates in the historical calendar, (3) gross age misreporting (4) omission of some unions and (5) sampling errors arising from the small size of the sample of women interviewed in the individual survey.

Table 16 Mean length of interval in months between date of first union and first birth by cohort

Cohort	Mean no of months	Number
10–14	10.9	2
15–19	27.9	176
20–24	35.5	402
25–29	42.5	497
30–34	46.4	370
35–39	50.7	301
40–44	67.4	198
45–50	86.3	224

4 Fertility

One of the main objectives of the Yemen Arab Republic Fertility Survey is to estimate and evaluate levels, trends and differentials in fertility. This is particularly important for a developing country like Yemen where routine vital statistics are absent. Unfortunately the 1975 census did not include the usual retrospective questions on either mortality or fertility, which would have provided a useful source of comparison and information about the natural increase of the Yemeni population. In consequence, there remains some uncertainty about the fertility levels, trends and differentials estimated from other sources. In the YARFS, data on fertility were obtained by means of a detailed maternity history for each woman interviewed through the individual questionnaire, which was administered to ever-married women aged 10–50 years. To obtain information on the number of children ever born a sequence of questions was asked, concerning: (1) the number of sons living at home, (2) the number of sons living away, (3) the number of daughters living at home, (4) the number of daughters living away, and (5) the number of deceased children by sex. This was intended to minimize omissions which may arise when a single question on number of children ever born is asked, due to memory lapse, especially among older women. For each live birth the date of its occurrence, the date of death if this occurred, and age of mother at birth were ascertained.

Despite the precautions taken to minimize error and to maximize the recall of events, data on fertility are affected by various types of errors including omission of births and of mothers; misstatement of birth dates; shifting of births; errors resulting from non-coverage of respondents; errors in age reporting as well as in nuptiality reporting; and errors due to sampling bias. It is appreciated that events that occurred a long time ago tend to be misreported or omitted (Potter 1977) and births that occurred recently can be misreported (Brass 1978).

This evaluative exercise will assess the extent of omission by looking at sex ratios at birth and children ever born; internal consistency of data by comparing time trends and cohorts for total and rural–urban residence; and trends in fertility by looking at age-specific fertility rates, cohort–period fertility rates, birth cohorts, marriage cohorts, P/F ratios and birth intervals.

Table 17 Mean number of children ever born to women by age group, YARFS 1979

Current age of woman	Children ever born
10–14	0.01
15–19	0.43
20–24	1.67
25–29	3.24
30–34	4.95
35–39	6.01
40–44	6.45
45–49	7.03
All	3.05

4.1 CHILDREN EVER BORN

The number of children ever born is a retrospective fertility measure based on births women have had throughout their reproductive life up to the time of the interview. Despite its limitations of not making any reference to the timing of fertility, it is one of the most commonly used measures of fertility.

Table 17 gives data on children ever born by age of mother from the YARFS. Had the 1975 census contained retrospective questions on fertility, it would have been possible to compare the number of children ever born with that reconstructed for the time of the census from the YARFS. As it did not, this exercise was not carried out. The only fertility data available were from the socio-economic survey of Sana's City conducted in 1972 by the Central Planning Organization and the United Nations Economic Commission for Western Asia. This survey covered over 18 000 households and more than 89 000 individuals and included special questions for ever-married women on fertility and mortality (Allman and Hill 1978). However, attempts to reconstruct information on children ever born from the YARFS for Sana'a City to match the 1972 socio-economic survey were unsuccessful due to the small sample size for Sana'a.

Figure 10 shows a similar pattern of heaping of births for urban and rural women. The main difference is the tendency among urban women to misplace recent births a year or so further back in time. Although there is heaping of births on 10, 15, 20, 25 and 30 years ago, it also occurs on some other irregular numbers as well. This may be due to chance fluctuations because of the small number involved.

There is heaping too on maternal ages 17, 19, 21 and 23 at the birth of their children (figure 11). This tendency is far less marked among rural women, for whom there is a much larger sample, thereby giving more meaningful results. If any explanation is required it may be that women reporting their ages as 25 and 35 tended to heap births on periods prior to the survey which were an even number of years.

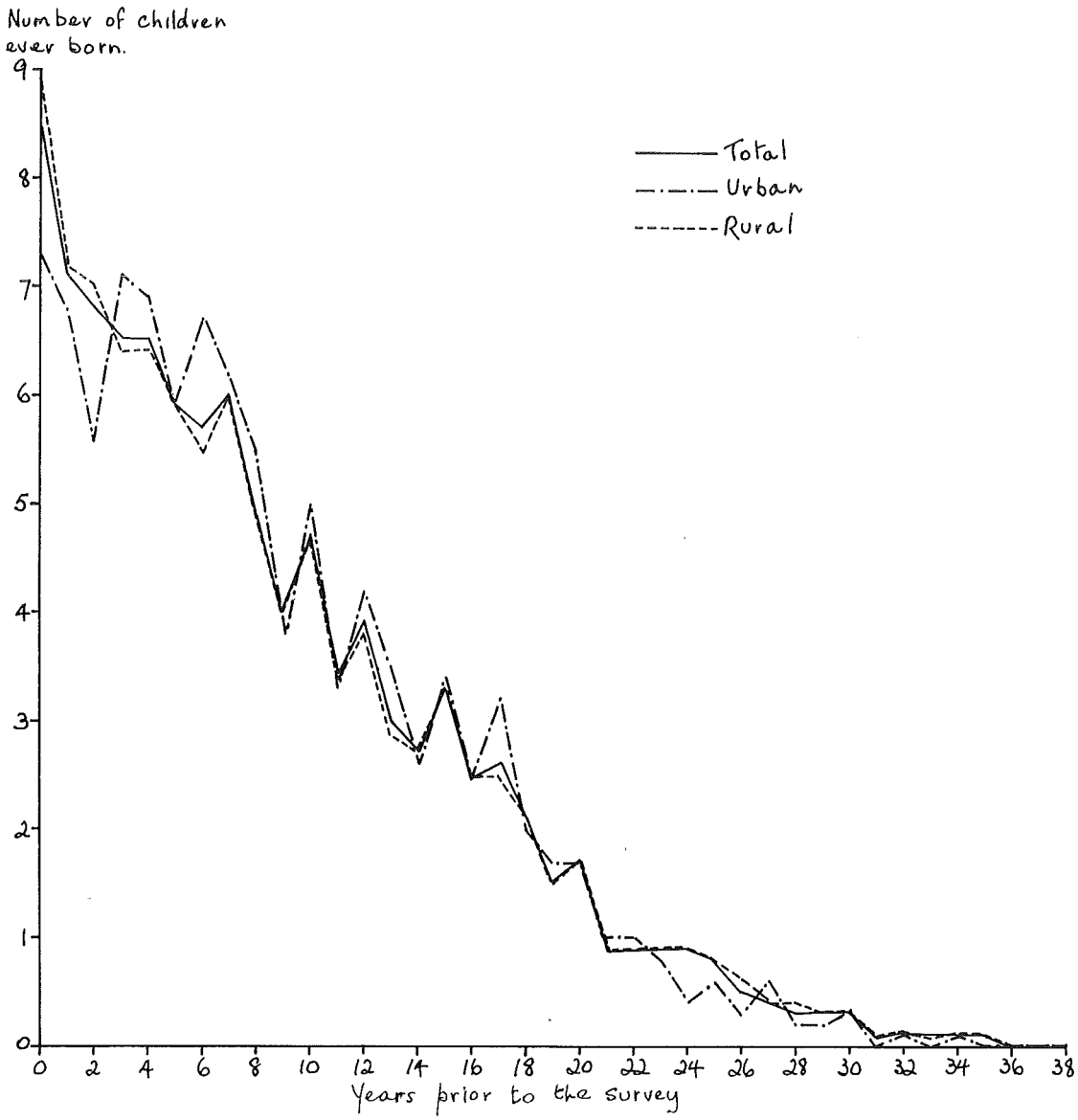

Figure 10 Children ever born by years since birth of a child, total and type of place of residence

The distribution of birth intervals in months, shown in figure 12, shows marked heaping on periods which are a multiple of six months, and in particular on an interval of one year. There are at the same time some unexpected preferred intervals, including 15, 19, 21, 23 and 39 months.

The highly erratic fluctuations of number of children ever born by age of woman (figure 13) are unlikely to reflect reality. It will be noticed that the most extreme fluctuations are found at older ages. This is probably because the number of women stating their ages as anything other than 40, 45 or 50 is extremely small indeed. It is quite possible therefore that the fluctuations, especially the very low trough at age 44, are merely the result of random sampling and have no significance at all.

Heaping at younger ages may be more meaningful, and perhaps the popularity of ages 30, 31 and 32 is the result of age shifting among women in their late twenties with an unusually large number of children. Another strong feature is the decline in the number of births to women in their late forties, and this may be due to the over-reporting of age of women 45–50 into their fifties, a likelihood mentioned in an earlier chapter. Omission of births by women in this cohort is also likely.

4.2 RECENT TRENDS AND CURRENT LEVELS OF FERTILITY

This section attempts to assess the quality of data on current fertility by looking at past trends in age-specific fertility rates. The rates are calculated for calender years 1948–1978 and were derived by dividing the total number of live births according to year of birth and age of mother at the time of birth by women-years of corresponding period and age. Those rates enable us to study the changes in fertility behaviour, if any, that have occurred over time (table 18). The data show irregularities, with no consistent trend towards an increase or decrease in fertility. Many are, however, consistently higher than for adjacent years, indicating the possibility of heaping when the births dates were calculated (these were based on the

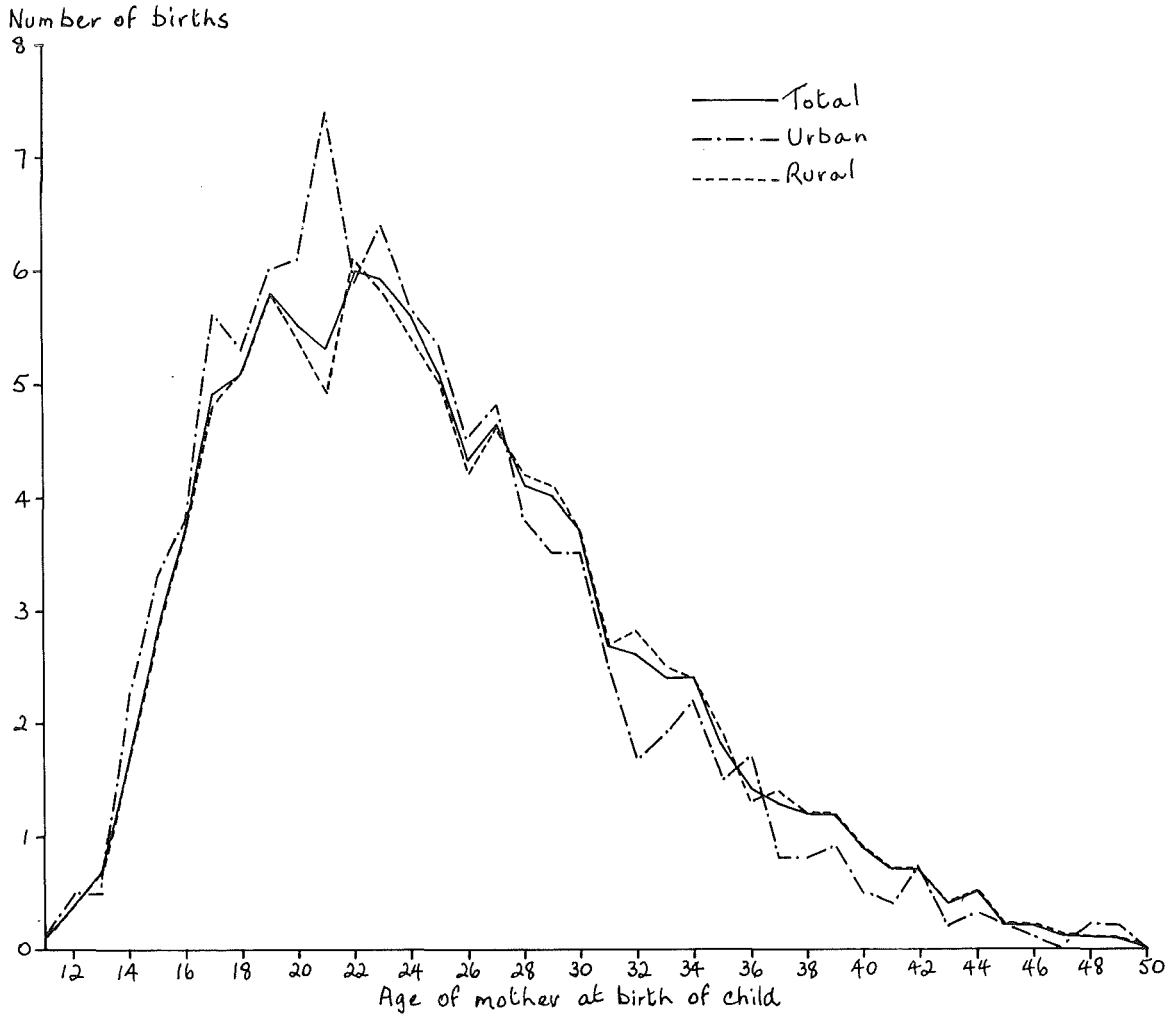

Figure 11 Children ever born by age of mother at birth, total population and type of place of residence

child's age). To minimize the irregularities three-year moving averages were calculated (table 19) and the graphic presentation of the results is shown in figure 14. There is still no clear indication that fertility has changed in the last 25–30 years, although data for age groups 20–24 and 25–29 may convey an impression of a slight increase. It is possible that women in these age groups might have shifted the birth dates of children closer to the

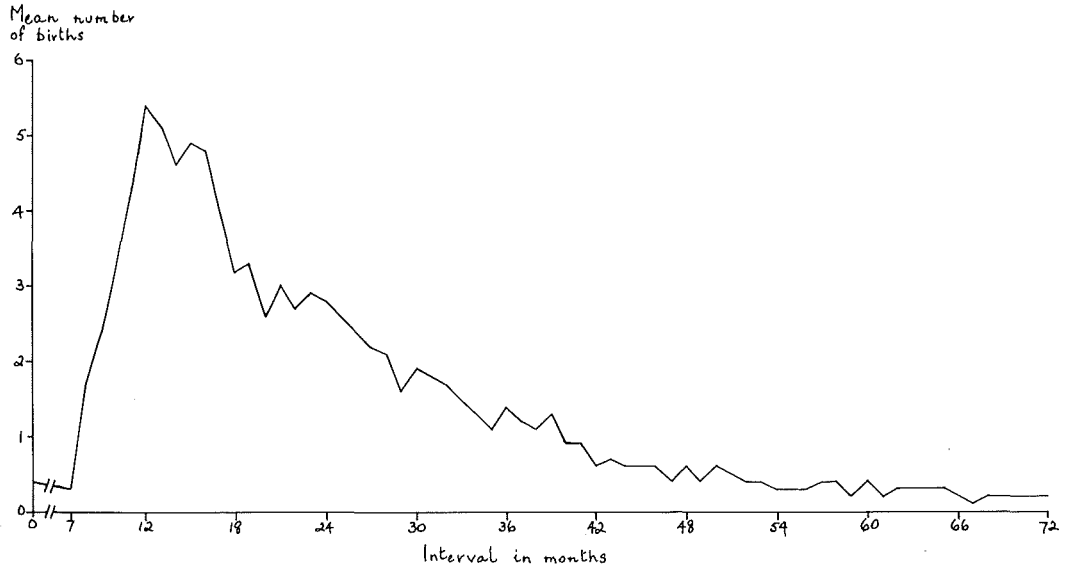

Figure 12 Children ever born according to inter-birth intervals (in months)

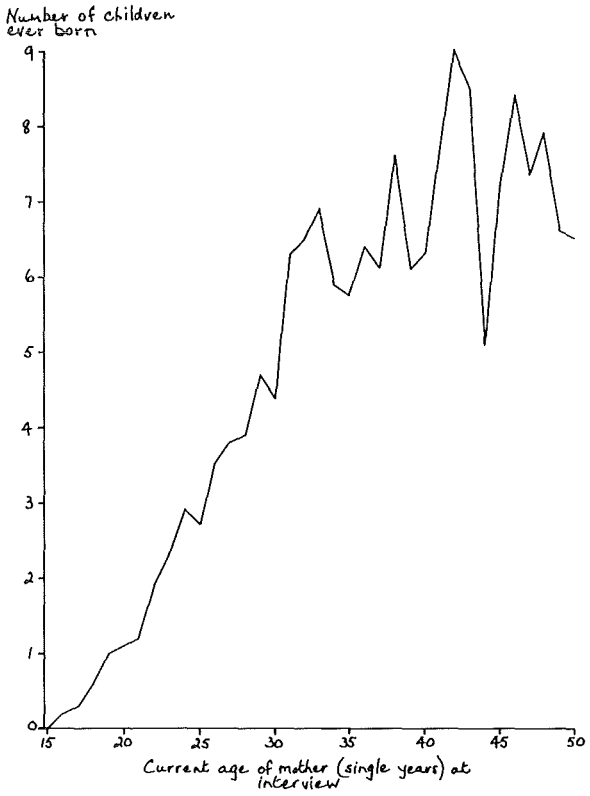

Figure 13 Children ever born by single year of age of mother at interview

date of the interview, thus supporting Potter's hypothesis. This effect, however, is not reflected in the older age groups 30–34, 35–39 and 40–45 or even in the young age groups 15–19, which all show relatively low figures for the years 1976–78. The tables analysed in this section suggest substantial misreporting of the ages of the women and/or their children.

4.3 COHORT–PERIOD FERTILITY RATES

The measures of fertility that we have so far used to evaluate the fertility data, namely children ever born to a woman and age-specific fertility rates, are the most commonly employed indices in fertility analysis. However, they are not without methodological disadvantages. Children ever born, for instance, represents the total number of children ever born to a woman since the beginning of her reproductive age up to the time of the interview. This period before the interview is different for each woman in each age group. The numerators or births used in calculating age-specific fertility rates are classified according to the year in which they took place and to the age of the woman at the time of birth. These women, who also form the denominators, however, came from two different cohorts each with different past experience.

In this section, cohort–period fertility rates are assessed with a view to detecting errors in maternity history data. These rates have an advantage over the previous two measures of fertility in that a selected group of women born or married at the same time are examined and their reproductive behaviour studied throughout

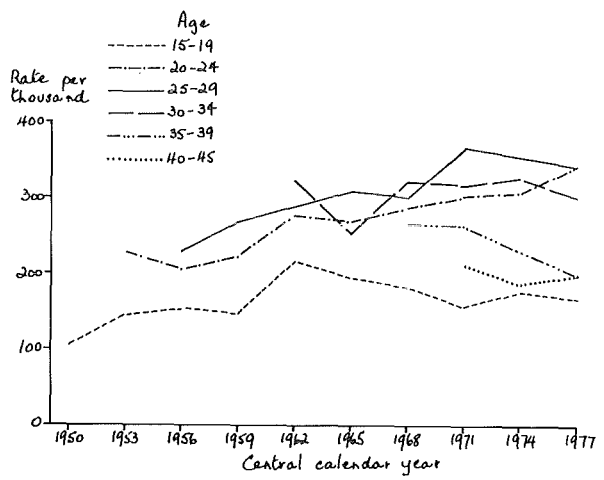

Figure 14 Age-specific fertility for three-year calendar periods

their childbearing period. These cohorts of women are defined according to their age at the time of the survey. In estimating these rates the births required are obtained taking into consideration the date they occurred and the age of mother at time of interview.

Table 20 presents cohort–period fertility rates by cohorts and periods, and their ratios. When cohort-period fertility rates are cumulated vertically for each period, cumulative rates of synthetic cohorts, Fi, are derived. These rates can throw light on any significant changes in fertility. Cumulating the cohort–period fertility rates horizontally yields cumulative fertility rates for each cohort, Pi. These cumulative rates help us to discern whether any observed changes in cohort–period fertility are real or caused by omission, birth transference or misreporting of ages. When the cumulative fertility rates for synthetic cohorts, Fi, are substantially higher than the cumulative fertility rates of real cohorts, Pi, this may indicate that fertility is rising. The ratio Pi/Fi summarizes the relationship between the period and the cumulative measures. A ratio of 1.0 suggests constant fertility. A ratio which increases with successive age groups may indicate declining fertility, and if the ratio is observed to be declining with successive age groups fertility may be increasing. Alternatively, declining ratios may be indicative of data defects, including increasing omission of past births among older women.

A look at the cumulative fertility rates for synthetic cohorts (table 20, band C) reveals that these are substantially higher than the cumulative fertility rates for real cohorts, Pi. At central ages 20, 25, 30, 35 and 40 fertility has increased by 14, 10, 6, 5 and 1 per cent respectively. This increase is further reflected in Pi/Fi ratios which get lower with successive age groups. Table 21 shows the percentage increase of cohort fertility rates between five-year periods. The data in this table reveal that the biggest increase occurred in the period 15–19 years before the survey. The pattern of increase is not consistent but the presence of age misreporting and transference of birth dates is evident. For instance, the big increase in cohort fertility of 16.6 per cent in the age group 15–24 in the period 20–24 years before the survey may be due to a transference of women of high parity in that age group to

Table 18 Age-specific and cumulative fertility rates by calendar year, 1948–78, YARFS 1979

Years	Age-specific fertility rates							Cumulative rates up to exact age					
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	25	30	35	40	45	50
1948	136.0												
1949	109.0												
1950	87.1	199.2						1.4					
1951	117.9	185.3						1.5					
1952	96.3	217.5						1.6					
1953	146.7	266.1						2.1					
1954	192.4	217.1	418.4					2.1	4.1				
1955	127.5	192.2	250.8					1.6	2.9				
1956	192.3	211.4	123.4					2.0	2.6				
1957	141.9	210.1	307.1					1.8	3.3				
1958	125.4	203.0	224.8					1.6	2.8				
1959	179.4	290.7	326.3					2.4	4.0				
1960	132.7	131.7	250.2	237.2				1.5	2.8	4.0			
1961	158.0	287.3	263.0	387.5				2.2	3.5	5.5			
1962	259.5	300.8	333.3	280.3				2.8	4.5	5.9			
1963	230.6	246.2	264.7	301.8				2.4	3.7	5.2			
1964	240.2	312.3	326.3	320.0				2.8	4.4	6.0			
1965	164.0	228.4	260.2	268.0	165.6			2.0	3.3	4.6	5.4		
1966	180.7	262.1	330.6	166.4	191.6			2.2	3.9	4.7	5.7		
1967	172.4	320.6	344.6	340.9	280.2			2.5	4.2	5.9	7.3		
1968	191.7	245.3	238.3	218.8	221.3			2.2	3.4	4.5	5.6		
1969	183.2	301.0	322.8	405.4	294.4			2.4	4.0	6.1	7.5		
1970	133.0	226.7	302.0	266.9	255.0	183.9		1.8	3.3	4.6	5.9	6.8	
1971	144.8	298.8	396.4	352.6	264.7	259.8		2.2	4.2	6.0	7.3	8.6	
1972	195.1	379.9	395.8	336.1	265.2	190.1		2.9	4.9	6.5	7.9	8.8	
1973	198.2	308.3	359.7	298.9	277.8	106.6		2.5	4.3	5.9	7.2	7.7	
1974	158.2	298.4	352.0	321.2	316.1	245.1		2.3	4.0	5.6	7.2	8.5	
1975	172.2	319.1	354.3	355.4	254.5	202.1	96.8	2.5	4.2	6.0	7.3	8.3	8.8
1976	142.8	336.7	341.8	325.4	221.4	192.0	91.4	2.4	4.1	5.7	6.8	7.8	8.2
1977	174.9	368.8	345.7	305.9	151.3	221.6	47.6	2.7	4.4	6.0	6.7	7.8	8.1
1978	187.0	324.2	333.0	296.4	221.2	177.7	87.1	2.6	4.2	5.6	6.7	7.6	8.0

age group 20–29 in the period 15–19 years before the survey. The big decrease in the age group 35–44 in the period 0–4 may also indicate transference of women to higher ages. This fact was evident in chapter 2 on age data.

Whether the above observed increasing trend is real or due to errors in the maternity history data can be determined by closely examining cumulative fertility rates of real cohorts, Pi. Since older women are likely to be more affected than the younger women, it will be sufficient to look at cohorts 30–34, 35–39, 40–44 and 45–49. The figures show substantial increase up to central age 35 and a small increase at central age 40, where fertility rises from 6.2 to only 6.5. It seems likely that old women in particular transferred births belonging to one period to earlier or later periods. This transference error is not easy

Table 19 Fertility rates by age groups and cumulative rates, by three-year periods 1949–78, YARFS 1979

Three-year periods	Age-specific fertility rates						Cumulative number of children up to exact age				
	15–19	20–24	25–29	30–34	35–39	40–45	25	30	35	40	45
1949–51	105.0										
1952–54	145.1	233.8					1.9				
1955–57	153.9	204.6	227.1				1.8	2.9			
1958–60	145.8	221.8	267.1				1.8	3.2			
1961–63	216.0	278.1	287.0	323.2			2.5	3.9	5.5		
1964–66	195.0	267.6	305.7	251.5			2.3	3.9	5.1		
1967–69	182.4	289.0	301.9	321.7	265.3		2.4	3.9	5.5	6.8	
1970–72	157.6	301.8	364.7	318.5	261.6	211.3	2.3	4.1	5.7	7.0	8.1
1973–75	176.2	308.6	355.3	325.2	282.8	184.6	2.4	4.2	5.8	7.2	8.2
1976–78	168.2	343.2	340.2	302.6	198.0	197.1	2.6	4.2	5.8	6.7	7.7

Table 20 Cohort–period fertility rates by cohorts and periods and their ratios

Cohort	Five-year periods prior to survey								No of women
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	
A Cohort–period fertility rates (per 1000 women)									
15–19	72	4							698
20–24	259	62	6						554
25–29	342	223	74	9					545
30–34	352	323	218	96	3				396
35–39	294	356	277	214	59	2			310
40–44	199	286	299	280	169	55	3		207
45–49	170	254	268	285	226	145	49	8	231
B Cumulative cohort rates (Pi)									
15–19	0.379	0.018							
20–24	1.666	0.368	0.028						
25–29	3.244	1.532	0.417	0.045					
30–34	4.954	3.196	1.582	0.493	0.015				
35–39	6.013	4.541	2.762	1.377	0.306	0.012			
40–44	6.452	5.455	4.026	2.533	1.134	0.290	0.014		
45–49	7.024	6.174	4.906	3.565	2.141	1.011	0.285	0.042	
C Cumulative period rates (Fi)									
15–19	0.379	0.018							
20–24	1.676	0.358	0.028						
25–29	3.388	1.474	0.399	0.045					
30–34	5.146	3.087	1.488	0.523	0.015				
35–39	6.618	4.866	2.873	1.594	0.310	0.012			
40–44	7.615	6.295	4.367	2.993	1.153	0.288	0.014		
45–49	8.465	7.564	5.708	4.416	2.283	1.014	0.257	0.042	
D P/F ratios									
15–19	1.000	1.000							
20–24	0.994	1.028							
25–29	0.958	1.039	1.043						
30–34	0.963	1.035	1.063	0.943					
35–39	0.909	0.933	0.961	0.864	0.990				
40–44	0.847	0.867	0.922	0.846	0.983	1.008			
45–49	0.830	0.816	0.859	0.807	0.938	0.997	1.108		

to substantiate clearly. However, a combination of age misreporting or shifting of women and birth dates is consistent with earlier findings in the previous chapters and is probably responsible for the observed increase in fertility. Through tables 22 and 23 it is possible to examine fertility trends according to duration of marriage and motherhood respectively, rather than by age of mother. The effect on fertility of changing age at marriage is therefore removed.

Sections A and B of table 22 show clearly a very regular increase in fertility for each fixed duration of time since marriage, for progressively younger cohorts. This suggests either that marital fertility has been increasing steadily for all durations of marriage, or – more likely – births have tended to be brought forward towards the time of the survey more by older women than by younger women, especially into periods less than ten years before the survey.

Table 21 Percentage of increases of cohort fertility rates between five-year periods, YARFS 1979

Age of women	Years before survey					
	0–4	5–9	10–14	15–19	20–24	25–29
10–19	16.1	−16.2	−22.9	62.7	7.3	12.2
15–24	16.1	2.3	1.9	26.6	16.6	
20–29	5.9	16.6	−1.1	23.9		
25–34	−1.1	19.1	4.9			
30–39	2.8	6.7				
35–44	−21.7					

NOTE: − indicates a decrease.

Table 22 Marriage–cohort fertility rates by duration and periods and their ratios

Duration at survey	Five-year periods prior to survey							No of women
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	
A Marriage-cohort fertility rates (per 1000 women)								
0–4	253							664
5–9	356	229						534
10–14	370	344	210					410
15–19	349	370	309	284				397
20–24	254	328	321	311	193			273
25–29	202	274	263	289	278	181		159
30–34	158	241	262	290	234	197	93	131
B Cumulative fertility of real cohorts (P)								
0–4	0.633							
5–9	2.307	0.526						
10–14	4.087	2.236	0.516					
15–19	5.788	4.045	2.195	0.652				
20–24	6.478	5.209	3.568	1.963	0.408			
25–29	6.198	5.908	4.537	3.224	1.779	0.388		
30–34	7.099	6.307	5.100	3.791	2.343	1.172	0.189	
C Cumulative fertility of synthetic cohorts (F)								
0–4	0.633							
5–9	2.413	0.526						
10–14	4.265	2.246	0.516					
15–19	6.008	4.096	2.059	0.652				
20–24	7.277	5.736	3.665	2.207	0.408			
25–29	8.287	7.108	4.978	3.652	1.798	0.388		
30–34	9.079	8.315	6.287	5.100	2.969	1.371	0.189	
D P/F ratios								
5–9	0.956							
10–14	0.958	0.995						
15–19	0.963	0.988	1.066					
20–24	0.890	0.908	0.974	0.889				

The P/F ratios in table 22 are also revealing. For the most recent period there is consistency among the first three duration groups but then a substantial fall for marriage duration 20–24. This suggests omission of births and/or overstatement of marriage duration, amongst older women; both errors would produce such a trend.

In addition, sections C and D provide evidence not only that births have been brought forward in time but also that the 10–14 year period prior to the survey is unpopular, and this is supported by sections C and D in table 23. On the whole, very similar conclusions can be drawn from table 23 as from table 22.

4.4 FERTILITY ACCORDING TO BIRTH ORDER

In a similar manner to the above, we can detect any real changes in fertility or changes due to errors in the data by analysing fertility rates according to birth order. In theory, if there is any substantial change in fertility, less change is expected in first birth rates than at higher order births. Tables 24 and 25 present fertility rates for births of first and fourth or higher order respectively. Looking at band A, table 24 (cohort–period fertility rates for first births), it will be noted that the rates for cohorts 35–39 and 40–44 at central ages 20 and 25 in the period 15–19 are higher (0.074 and 0.061) than the surrounding rates. This may be due to the shifting of birth dates (this is the opposite of Potter's 1977 theory). When the cumulative rates of real cohorts, P, are examined carefully, it is possible to confirm whether the rise in fertility observed in the total fertility is due to omissions of births, transference of births, misstatement of ages or a combination of all these. These cumulated rates (band B) represent the proportion of women who became mothers in each cohort by given central ages. When the proportions who become mothers for older cohorts show a tendency to decrease with time, this may be indicative of omission. This assumption is based on the fact that the proportions should not change much for a country like Yemen, which is not characterized by late marriage or primary sterility.

An analysis of the proportions who become mothers, P (band B), in the two older cohorts 40–44 and 45–49 shows that at central age 40, about 96 per cent become mothers in both cohorts; the proportions also show little inconsistency at central ages 35 (93 and 95 per cent become mothers for cohorts 45–49 and 40–44 respectively). However, at central ages 20, 25 and 30, the

Table 23 Motherhood–cohort fertility rates by duration and periods and their ratios

Duration at survey	Five-year periods prior to survey							No of women
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	
A Motherhood-cohort fertility rates (per 1000 women)								
0–4	288							672
5–9	408	354						496
10–14	341	341	354					355
15–19	274	358	372	385				338
20–24	202	265	305	402	360			176
25–29	139	251	223	290	367	368		95
30–34	93	195	269	272	260	381	254	33
B Cumulative fertility of real cohorts (P)								
0–4	0.661							
5–9	2.857	0.819						
10–14	4.464	2.757	0.802					
15–19	5.840	4.472	2.683	0.821				
20–24	6.590	5.582	4.259	2.735	0.724			
25–29	7.003	6.305	5.052	3.935	2.486	0.649		
30–34	7.785	7.318	6.345	5.001	3.641	2.343	0.437	
C Cumulative fertility of synthetic cohorts (F)								
0–4	0.661							
5–9	2.699	0.819						
10–14	4.407	2.774	0.802					
15–19	5.774	4.563	2.663	0.821				
20–24	7.277	5.736	3.665	2.207	0.408			
25–29	7.480	7.139	5.304	4.281	2.561	0.649		
30–34	7.947	8.113	6.647	5.642	3.858	2.556	0.437	
D P/F ratios								
5–9	1.058							
10–14	1.013	0.994						
15–19	1.011	0.980	1.007					
20–24	0.972	0.948	1.017	0.965				

proportions who have become mothers are higher for cohort 40–44, reflecting some omissions of first births. The cumulated fertility to central ages 10, 15, 20, 25 and 30 increases from the cohort 45–49 to 30–34. This may be indicative of increasing omission of first births as we go from cohorts 30–34 through to 45–49. An alternative explanation in terms of a change in the age of marriage can be rejected by referring to band B in table 22, which shows an identical pattern.

There is a striking increase in P in the last column among young age cohorts, suggesting that women have recently begun embarking on motherhood at an earlier age. This is unlikely, and as the reported marital fertility of these same cohorts has not changed (see table 22) it would appear that these women are not omitting first births, but rather bringing them forward in time. It is also noted that the proportion who become mothers for the cohort 35–39 at central age 35 in the period 0–4 years before the survey is higher than that for the cohort 40–44 in the same period 0–4 years before the survey. This is probably due to the shifting of the ages of women from the younger age group 30–34 to the next group 35–39 and out of age group 40–44 to 45–49. As we have said, it is assumed that first birth rates will be quite invariant with time, and any reported irregularities will be the result of errors and not of real trends. A comparison of cumulated fertility of synthetic cohorts (band C) up to particular central ages shows exaggeration of numbers in the most recent period and in the period 15–19 years prior to the survey. The general pattern seems to suggest omission and/or misplacement of distant first births towards the 15–19 year period, and of those in the 15 years prior to the survey towards the most recent times. The P/F ratios shown in table 24 support the latter kind of error.

In table 25 trends in cohort–period fertility rates for births of order four or more are examined. A comparison of the two columns representing the most recent periods reveals that cumulative cohort fertility has fallen for women under 30 and increased for older women. This suggests that late-order births are being misplaced in time towards the present among older women.

In band D it can be seen that P/F ratios fall among older women, again suggesting either omission or the misplacement of births in the way described.

4.5 P/F RATIOS FOR COHORT FERTILITY

P/F ratios can often be used to detect errors in the birth history data (Brass 1978). As we noted earlier, P values

Table 24 Cohort–period fertility rates for first births

Age at survey	No of women	Years before survey							
		0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39
A Birth–cohort fertility rates									
15–19	698	0.049	0.002						
20–24	554	0.101	0.041	0.004					
25–29	545	0.060	0.079	0.039	0.005				
30–34	396	0.022	0.050	0.060	0.053	0.003			
35–39	310	0.007	0.027	0.048	0.074	0.036	0.002		
40–44	207	0.002	0.013	0.022	0.061	0.056	0.035	0.003	
45–49	231	0.002	0.007	0.021	0.036	0.049	0.048	0.026	0.006
B Cumulative fertility of real cohorts (P)									
15–19		0.256	0.012						
20–24		0.727	0.221	0.019					
25–29		0.912	0.613	0.220	0.026				
30–34		0.935	0.825	0.577	0.279	0.015			
35–39		0.972	0.935	0.799	0.559	0.191	0.009		
40–44		0.957	0.947	0.883	0.774	0.471	0.191	0.014	
45–49		0.972	0.964	0.931	0.827	0.645	0.402	0.161	0.032
C Cumulative fertility of synthetic cohorts (F)									
15–19		0.256	0.012						
20–24		0.761	0.214	0.019					
25–29		1.060	0.607	0.213	0.026				
30–34		1.169	0.855	0.510	0.290	0.015			
35–39		1.206	0.991	0.750	0.659	0.196	0.009		
40–44		1.216	1.055	0.859	0.962	0.476	0.186	0.014	
45–49		1.225	1.088	0.963	1.144	0.720	0.427	0.143	0.032
D P/F ratios									
20–24		0.955	1.032						
25–29		0.860	1.009	1.035					
30–34		0.799	0.965	1.131	0.962				
35–39		0.806	0.943	1.065	0.849	0.971			
40–44		0.787	0.897	1.028	0.805	0.989	1.026		
45–49		0.794	0.886	0.967	0.723	0.896	0.941	1.123	

are derived by cumulating fertility rates up to the end of the period for each of the cohorts. F-values are obtained by cumulating fertility rates for different cohorts up to a certain age for each of the periods. When fertility remains constant, the ratio P/F equals 1.0 if the data are free from any biases. This situation is not usually met with in the real world. So if the P/F ratios diverge from 1.0, the magnitude and pattern of divergence will tell us whether the changes in fertility are real or due to errors. For instance, a value of P/F less than one indicates either increasing current fertility or that births were wrongly reported (ie reported births actually belong to the period before the one under observation or to another period altogether) or omitted. Those born long ago in the past are especially liable to be omitted.

Table 26 presents P/F ratios for the period 0–4 years before the survey for all births and for births of specific orders. The figures are less than 1.0 and decrease with age, confirming that fertility is either increasing (as reflected in cohort–period fertility rates) or the births reported for the period 0–4 years before the survey belong to earlier periods or that some births were omitted. A combination of all these biases was evident in the data. The pattern for birth order four or higher is however different. In the age groups 20–24 to 30–34 (inclusive) the P/F ratios are close to 1.0 (ie fertility slightly declining or constant in these age groups) and less than 1.0 in the age groups 35–39 to 45–49 (inclusive) (ie fertility increasing or omission by older women). This apparent increase in fertility would seem implausible if there were supporting evidence about the impact of a number of variables, associated with modernization, on the behaviour of the P/F ratios. Unfortunately, because of sampling problems, the analysis could not be done for subgroups based on rural–urban, education or literacy, because there are too few women who either have some education, are urban or literate. The point to emerge from the analysis of P/F ratios is that the rise in fertility may either be due to omission, transference or misdating of births or a combination of all these factors. On the other hand, however, it may be real. But this is difficult to establish.

Figure 15 presents the cumulative proportions of mothers at specific ages at motherhood by cohort. Little or no sign of omission is evident here but displacement of women is substantial. For instance, it is possible that women aged 40–44 were displaced to the older age group

Table 25 Cohort–period fertility rates for births of order four or higher

Age at survey	No of women	Years before survey							
		0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39
A Birth–cohort fertility rates									
15–19	698	0.001	0.000						
20–24	554	0.036	0.004	0.000					
25–29	545	0.144	0.041	0.007	0.000				
30–34	396	0.251	0.151	0.057	0.005	0.000			
35–39	310	0.249	0.231	0.122	0.034	0.004	0.000		
40–44	207	0.183	0.223	0.190	0.096	0.039	0.001	0.000	
45–49	231	0.157	0.214	0.188	0.159	0.083	0.035	0.002	0.000
B Cumulative fertility of real cohorts (P)									
15–19		0.004							
20–24		0.201	0.020						
25–29		0.959	0.236	0.033					
30–34		2.319	1.062	0.307	0.024				
35–39		3.196	1.951	0.798	0.190	0.021			
40–44		3.658	2.745	1.631	0.680	0.202	0.004		
45–49		4.198	3.411	2.341	1.399	0.602	0.186	0.010	
C Cumulative fertility of synthetic cohorts (F)									
15–19		0.004							
20–24		0.186	0.020						
25–29		0.908	0.224	0.033					
30–34		2.165	0.978	0.316	0.024				
35–39		3.410	2.131	0.924	0.192	0.021			
40–44		4.323	3.246	1.875	0.671	0.218	0.004		
45–49		5.110	4.316	2.817	1.468	0.634	0.180	0.010	
D P/F ratios									
20–24		1.085	1.000						
25–29		1.056	1.056	1.000					
30–34		1.071	1.085	0.971	1.000				
35–39		0.937	0.915	0.863	0.985	1.000			
40–44		0.846	0.846	0.870	1.014	0.924	1.000		
45–49		0.822	0.790	0.831	0.953	0.950	1.033	1.000	

45–49. The shifting from 45–49 to age group 50–54 was evident in the age data in the second chapter.

4.6 DETECTING OMISSION AND DISPLACEMENT OF LIVE BIRTHS

That retrospective surveys, such as those investigating maternity history, are subject to various types of errors, among them omission, is a well-known demographic fact. It is also known that children, especially those who were born many years in the past, are more likely to be omitted than recent births; those who died, especially shortly after birth, and those living away from home, are also more likely to be omitted. Lastly, pre- and extra-marital births are more likely to be omitted, and girls more likely than boys. The bias of omission has already been observed. In the analysis that follows, an attempt will be made to detect the extent of omission in the YARFS. To do this we shall examine the sex ratios at

Table 26 P/F ratios for the period 0–5 years before the survey for all births and by birth order

Cohort	Total births			Births of order one		Births of order four or more		P/F	
	P	F	P/F	P	F	P	F	Births of order one	Births of order 4+
20–24	1.666	1.676	0.994	0.727	0.761	0.201	0.186	0.955	1.085
25–29	3.244	3.388	0.958	0.912	1.060	0.959	0.908	0.860	1.056
30–34	4.954	5.146	0.963	0.935	1.169	2.319	2.165	0.799	1.071
35–39	6.013	6.618	0.909	0.972	1.206	3.196	3.410	0.806	0.937
40–44	6.452	7.615	0.847	0.957	1.216	3.658	4.323	0.787	0.846
45–49	7.024	8.465	0.830	0.972	1.225	4.198	5.110	0.794	0.822

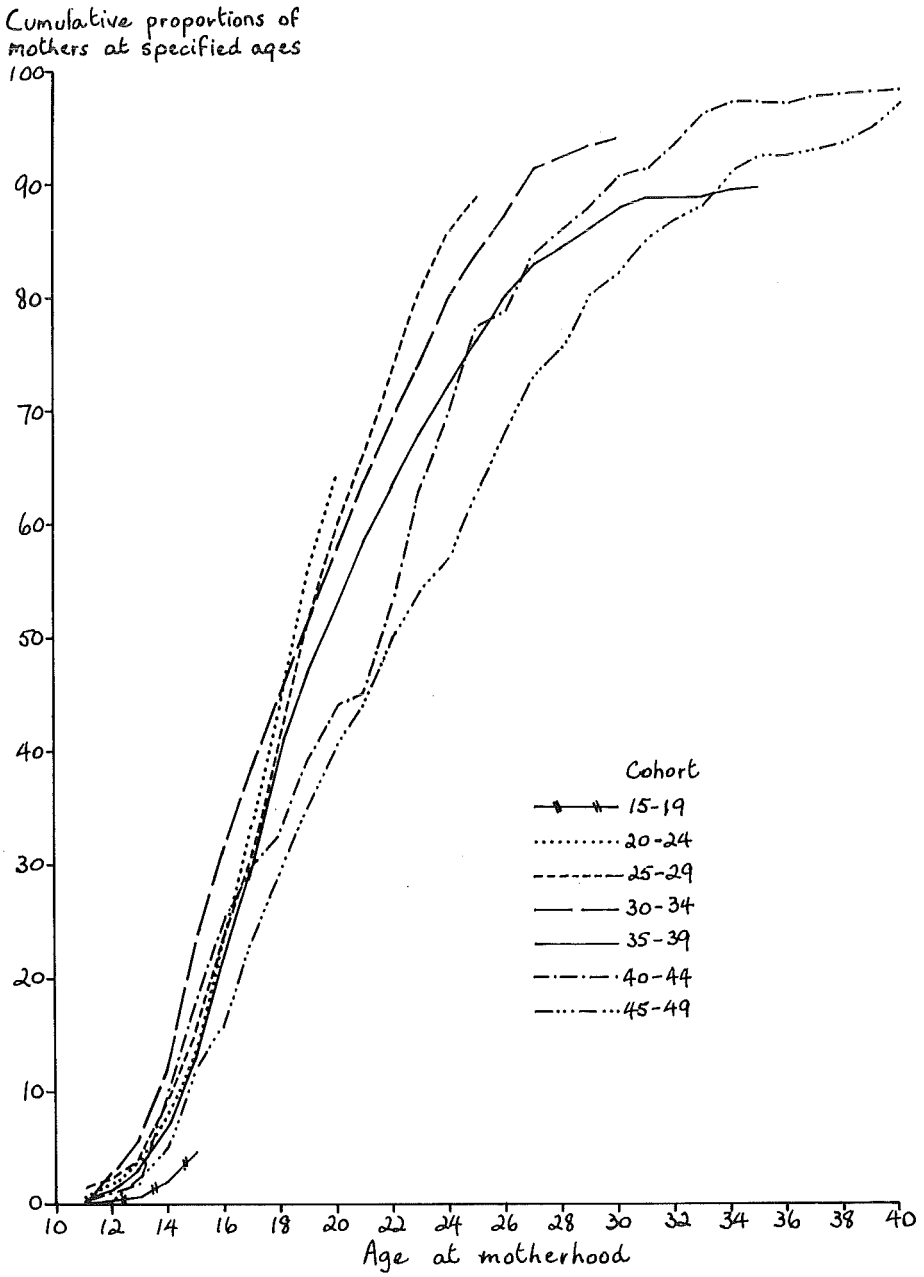

Figure 15 Cumulative proportions of mothers at specific ages at motherhood by cohort

birth and the proportions of all children ever born alive who have died.

Sex ratio at birth

The overall sex ratio at birth for all live births is 110.9 (table 27) indicating selective omission of girls. Eliminating age group 15–19 (because sex ratios are sensitive to small sample size), selective omission of girls is particularly evident in the age groups 20–24 and 40–44 (sex ratios at birth 124.6 and 114.5 respectively). When the sex ratios are looked at according to five-year periods of birth prior to the survey, further deviations from the average emerge. Many of the reported sex ratios at birth vary greatly from one period, and from one cohort, to another. This appears to be quite arbitrary, except that sex ratios are unusually high for nearly all cohorts at central age 20, suggesting omission of female births a long time in the past.

Proportions of children dead

As mentioned earlier in this section, another way of testing for omission is by examining the proportion of all children dead. This can be done by mothers' current age (five-year age group). What we would expect is that as age increases the proportion of children dead increases because children born by older women have been exposed longer than those of younger mothers. Secondly, older women had their children further back in the past, when mortality was probably higher.

Table 28 presents data on proportion of all children dead by current age of mother and sex of child. If we ignore the proportion for age group 10–14 (small sample

Table 27 Sex ratios at birth by five-year cohorts of women and five-year periods of birth prior to survey

Cohort of women	Sex ratio at birth (total)	Five-year periods of birth prior to survey						
		0–4	5–9	10–14	15–19	20–24	25–29	30–34
All	110.9							
15–19	124.3	121.0						
20–24	124.6	119.4	156.2					
25–29	107.2	102.3	115.3	115.8				
30–34	107.8	105.3	97.4	128.8	107.1			
35–39	109.1	106.3	108.6	125.3	100.5	95.0		
40–44	114.5	100.9	112.2	128.4	114.6	122.3	78.0	
45–49	106.9	117.4	101.6	108.3	107.5	81.9	140.6	134.7
50–54	112.7	109.6	106.2	104.7	100.9	134.6	100.1	

size), the overall proportions do not reveal much evidence of omission. As expected, the proportions increase with age of mother. When, however, the proportions are considered for different sexes, differences emerge. The proportions of dead sons do not show inconsistencies, but biases in the proportions of daughters dead are evident. For instance, age group 15–19 has higher proportions of daughters dead than the next age group 20–24. The jump in the proportion dead from 21.7 to 28.2 per cent for age groups 25–29 and 30–34 is too big and probably reflects errors in the data. In addition age groups 30–34 and 35–39 show no change in the proportion, which is also indicative of bias. Such irregularities could be explained by the omission of daughters who ultimately died, to women in their twenties in particular. This would seem rather surprising in so far as omission is more often associated with older women. Perhaps a more likely explanation is the overstatement of age by women in their late teens and early twenties, which would not be an unusual source of error.

4.7 CONSISTENCY IN REPORTING PARITY – COMPARISON BETWEEN INDIVIDUAL AND HOUSEHOLD SURVEYS; FORMAT OF REPORTING BIRTH DATES

Table 29 gives data on the consistency between individual and household surveys of the reporting of the mean number of children ever born, mean number dead by sex and type of place of residence. The consistency of reporting parity was high, with values of 97.4 per cent for respondents reporting the same number of children ever born in household and individual surveys, 97.3 per cent for number of children dead, 96.1 per cent for both sons dead and daughters dead. There are lower levels of consistency among older women in the age groups 40–44 and 45–49 in all cases. There is very little or no difference in the consistency of reporting dead sons and dead daughters. However, differences emerge between urban and rural residents. Older women (35–39, 40–44 and 45–49) residing in rural areas tend to have higher consistency figures for dead children according to sex than those in urban areas.

The examination of the mean number of children ever born per woman, living and dead children per woman and proportions dead of all ever born children reported in the individual and household surveys (table 30) reveals evidence of considerable omission in the household survey.

Finally, in table 31 the respondents are distributed according to the format of reporting date of birth by birth order. In 86 per cent of cases the date of first birth was recorded in year only, while for a substantial percentage of young women under 20 (45 per cent) their date of first birth was recorded in year and month. In about 91 and 60 per cent of the respondents the dates of their penultimate birth and last birth respectively were recorded by year only. It should be emphasized that local calendars were used by interviewers and the table should not be misunderstood to imply that respondents were in a position to tell the interviewers the right year or year and month of either their first, penultimate or last births.

Table 28 Proportion of all children dead by current age of mother and sex of child

Current age of mother	Total	Sex of child	
		Sons	Daughters
All	28.4	29.3	27.4
10–14	46.1	46.1	–
15–19	20.6	20.1	21.4
20–24	20.7	22.2	16.8
25–29	23.7	25.5	21.7
30–34	28.3	28.3	28.2
35–39	29.0	29.9	27.9
40–44	32.8	32.9	32.8
45–49	36.3	37.4	35.0

4.8 CONCLUSIONS

The maternity history data have shown that fertility in the Yemen AR has been consistently high. They also point to a slight increase over the past 15 years. It is difficult to say which subgroups of the population are responsible for this upward trend due to the small numbers of cases involved. For instance, there are very few women in the individual survey who are literate or have some education or are urban. The crucial point to consider, however, is whether this upward trend in fertility is real or due to errors in the data. It must be noted

Table 29 Consistency in reporting mean number of children ever born, number dead by sex and types of place of residence by current age of mother between individual and household surveys

Reporting the same number in individual as in household surveys	Current age of respondents									Total
	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50	
Total										
Number of children ever born	100.0	98.0	98.6	97.9	98.5	96.1	94.2	93.0	100.0	97.4
Number of children dead	100.0	99.2	99.0	97.1	97.4	96.1	94.2	93.0	96.4	97.3
Number of sons dead	100.0	94.0	99.4	96.7	95.1	92.8	91.8	89.5	96.4	96.1
Number of daughters dead	100.0	99.2	99.2	96.5	96.7	91.8	91.3	90.6	92.7	96.1
Urban										
Number of children ever born	100.0	97.8	100.0	96.9	95.8	92.7	91.3	100.0	100.0	96.7
Number of children dead	100.0	100.0	100.0	98.4	95.8	95.1	91.3	91.7	100.0	97.3
Number of sons dead	100.0	100.0	100.0	96.9	95.8	87.8	87.0	75.0	100.0	95.0
Number of daughters dead	100.0	100.0	100.0	95.3	95.8	85.4	87.0	83.3	100.0	94.7
Rural										
Number of children ever born	100.0	98.0	98.5	98.0	98.8	96.6	94.6	92.5	100.0	97.5
Number of children dead	100.0	99.1	98.9	96.9	97.7	96.2	94.6	93.1	95.9	97.3
Number of sons dead	100.0	98.8	99.3	96.7	95.0	93.6	92.4	90.6	95.9	96.2
Number of daughters dead	100.0	99.1	99.1	96.7	96.8	92.8	91.8	91.2	91.8	96.3

that the quality of the data on the reporting of age and nuptiality as we saw in the previous chapters was rather low and is directly related to the quality of the data on maternity histories. Analysis of cohort–period fertility rates has revealed that a combination of the effects of omission, misplacement, age misreporting and sampling error may largely be able to account for the apparent increase in fertility. On the other hand, however, the changes may be genuine although this is difficult to establish, particularly in the light of the fact that the modernizing factors of education, literacy and urbanization have had a negligible effect on demographic trends. In a non-contracepting society like Yemen AR (where sterility is also negligible), the only major factors that influence the level of fertility are lactation and abstinence. However, neither of these have undergone substantial changes which would have supported the assumption of fertility increase.

Data from external sources such as vital statistics and censuses were lacking and so the quality of the fertility data from YARFS could not be evaluated through comparison.

Table 30 Mean number of children ever born by age group of woman in individual and household surveys

Age group of woman	Individual survey	Household survey
15–19	0.4	0.3
20–24	1.7	1.5
25–29	3.4	2.9
30–34	5.0	4.3
35–39	6.0	5.5
40–44	6.5	5.8
45–49	7.0	6.1

NOTE: Means for individual survey calculated by assuming the same proportions of women ever married as in household survey.

Table 31 Format of reporting birth date

	Survey age							Type of Place of Residence		Literacy		Total
	Under 20	20–24	25–29	30–34	35–39	40–44	45–50	Rural	Urban	Literate	Illiterate	
First birth												
Year & month	44.9	23.7	10.4	6.9	9.0	3.9	6.8	13.2	14.0	38.6	13.3	13.9
Year only	55.1	7.6	89.6	92.5	90.7	95.6	93.2	86.8	85.7	61.4	86.5	85.8
Interval from 1st marriage	–	0.2	–	0.5	0.3	0.5	–	–	0.3	–	0.2	0.2
Total	100.0	99.9	100.0	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Penultimate births												
Year & month	18.7	15.2	10.4	9.2	5.4	6.0	3.6	8.8	9.0	20.6	8.8	
Year only	81.3	84.8	89.6	90.5	94.6	93.5	96.4	91.2	90.8	79.4	91.1	
Interval from 1st marriage	–	–	–	0.3	–	0.5	–	–	0.1	–	0.1	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.0	100.0	100.0	
Last child												
Year & month	61.9	52.1	42.8	42.1	34.6	26.0	13.1	38.0	40.7	56.1	39.9	
Year only	38.1	47.9	57.2	57.9	65.4	74.0	86.9	62.0	59.3	43.9	60.1	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

5 Infant and Child Mortality

Infant and child mortality rates are very important indices of mortality, for three reasons in particular:

1 their contribution to the total loss of years of human life is substantial, not only because it occurs early in life but also because the levels are still high in many developing countries;
2 the causes of infant and child mortality are distinctly different from those which operate at older ages;
3 the levels of infant and child mortality are a major indication of the state of socio-economic improvement, particularly the standard of health and living of a country.

The measurement of infant and child mortality in many developing countries is severely limited by the lack of reliable and adequate information due to the inadequacy of vital registration systems. However, this may not be an intractable problem since in the absence of such vital registration data indirect estimation techniques such as those developed by Brass *et al* (1968) and later modified by several others, including Sullivan (1972) and Trussell (1975), to determine infant and childhood mortality can be used. These techniques make use of information on the total number of children ever born and the number still surviving tabulated by age of woman. The proportions dead of children ever born are converted into life table measures. The basic assumptions involved in these techniques are:

1 mortality does not change with time
2 childhood mortality does not change with the age of mother at birth
3 mortality does not change with birth order
4 fertility has not recently changed.

The basic problem involved here is that the estimation procedures do not fit the data for a particular country due to lack of full knowledge about the age pattern of mortality for the population under study. The techniques are also sensitive to poor responses to direct questions concerning deaths and births, as they were in the YARFS, especially in specific reference periods. The problem is aggravated even further when the information is collected from the household questionnaires, where usually the head of a household is giving information on a dead person (the dead do not answer for themselves). Because of such problems, it has been found necessary to use model life tables and model fertility schedules sometimes supplemented by questions on orphanhood and widowhood.

Infant and child mortality rates can also be estimated directly from the dead children (numerators) and live births (denominators) from the birth history data in the individual schedules. Here maternity histories are collected in detail and in chronological order. Nevertheless, biases still do occur in locating events in their proper periods as a result of respondents underestimating or overestimating the time periods relative to the date of the interview (Potter 1977, Brass 1977). Information collected on the maternity histories of each eligible woman in the YARFS included the date of birth of each child, the sex, and, if the child is dead, the date of death. From such information, it is possible to estimate rates for single years of age as well as trends in child mortality (${}_1q_0$, ${}_4q_1$ and ${}_5q_0$). Conventionally, rates based on period measures are estimated, but rates based on real birth cohorts of surviving children can also be calculated using the direct method.

As was the case with data on nuptiality and fertility which we examined in the previous chapters, data on mortality are also affected by the misreporting of dates of events (birth dates and death dates) and by the omission of births and deaths. While in fertility analysis only two dates are important, the birth date of a child and birth dates of mother, in mortality three dates – namely the birth date and death date of a child and the birth date of the mother – are important. It is well accepted that infant mortality in particular is more affected by errors of omissions and misreporting than child mortality estimates. This is so not only because mortality events are not happy events and are therefore more likely to be omitted or displaced in time but also because they occur very early in life and are likely to be forgotten easily. Mortality experiences occurring to older women are more likely to be affected or suffer from memory lapse since they occurred long ago in the past. Omission of deaths and the misreporting of dates of events are related to the educational level of the mother, type of place of residence and socio-economic status. Unfortunately, however, because of sampling problems, the analysis of infant and child mortality that follows will not be done for subgroups of the population. The analysis will include examination of the presence of heaping in data on mortality and checks on omission by looking at proportions dead by cohort, time trends and patterns, followed by the indirect estimation of infant and child mortality using the Brass–Trussell model.

5.1 HEAPING

In order to study the heaping in data on mortality, the distribution of children according to age in months at death was looked at in figure 16. It is noticeable in this figure that the proportion dying in the first month of

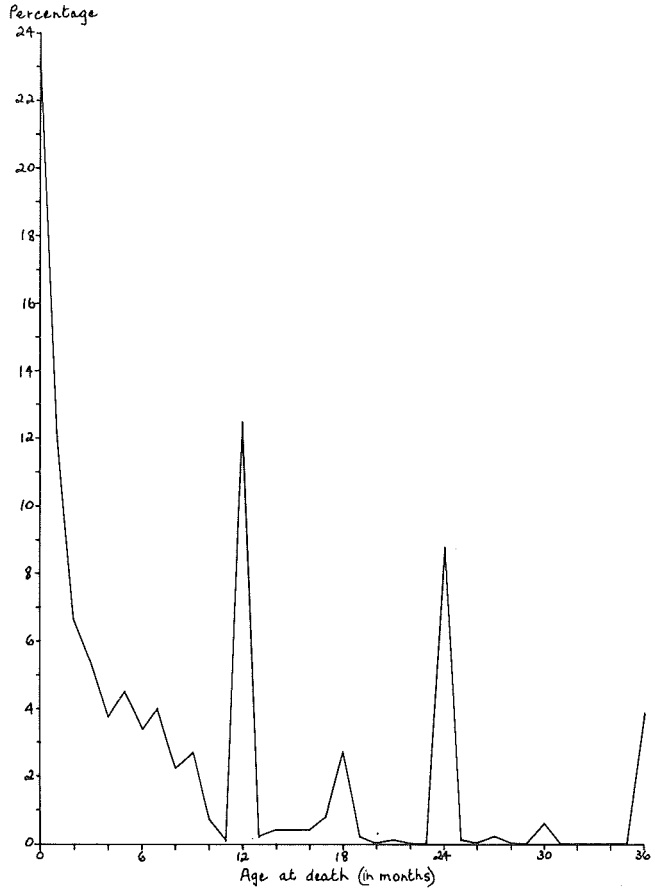

Figure 16 Percentage distribution of children who died in a period of three years after birth by age at death (in months)

life (0 month) is quite high, drops considerably up to the eleventh month and is then concentrated on the twelfth, eighteenth, twenty-fourth, thirtieth and thirty-sixth months. It is not clear why there is heaping at months 15 and 17 for urban residents (not illustrated).

Figure 17 shows the distribution of children by year of birth. The patterns for both the dead and living children are as would be expected. There is, however, more pronounced heaping for living children then for dead.

Figure 18 presents the distribution of children according to inter-birth intervals in months by whether the child is still surviving or dead. Heaping among living children is on 12, 15, 24, 30, 39 and 50 months, most of which are simple fractions of a year. Among dead children, however, heaping is less pronounced, except at 12 and 16 months. It also appears that the distribution is more heavily concentrated at short intervals among dead children than those living.

Using data from the YARFS, direct estimates of infant mortality ($_1q_0$), child mortality ($_5q_0$) and the probability of dying between the first and fifth year ($_4q_1$) were made. Figure 19 presents estimates of $_1q_0$, $_4q_1$ and $_5q_0$ for one-year periods of birth prior to survey (three-year moving averages). The figure reveals that the probability of dying before completing one year of age ($_1q_0$) is greater than between exact ages one and five years ($_4q_1$). It is clear from the figure that both infant and child mortality are quite high, much higher 15–25 years ago than in the past 5–10 years. The deep trough in infant mortality at 19 years before the survey is difficult to explain. Figure 20 shows the distribution of children according to years since child's birth by survival status and this indicates that heaping is not substantial although it is present. The drop in infant and child mortality shown in figure 19, 19 years before the survey, could either be real or due to sampling problems.

Table 32 presents infant and child mortality rates for successive five-year periods from 1944 to 1978. Three-year moving averages were used to reduce random errors. The trend is that of declining infant and child mortality. For instance, infant mortality ($_1q_0$) declined from 581.4 deaths per 1000 births in 1944–48 to 153.4 deaths per 1000 births in 1974–78; child mortality from 721 deaths per 1000 births in 1944–48 to 200 deaths per 1000 births in 1974–78. The probabilities of dying

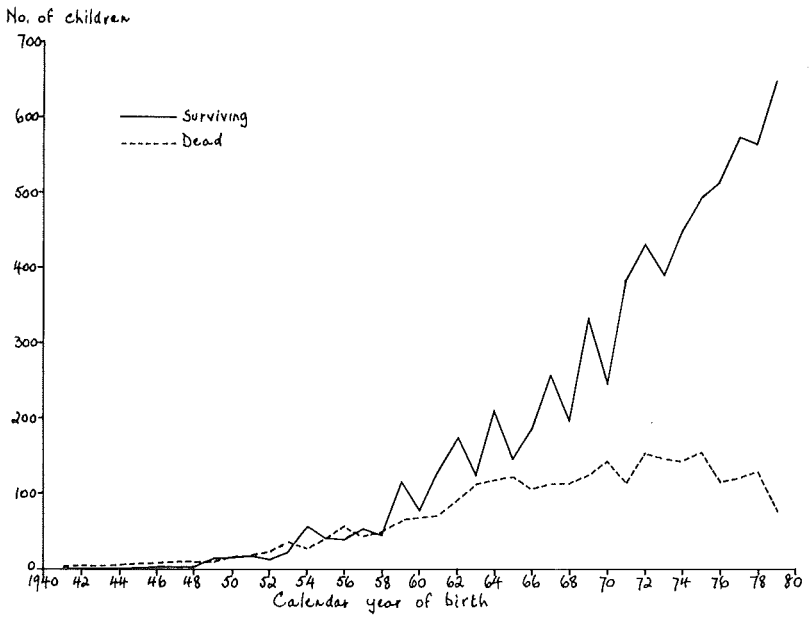

Figure 17 Distribution of children according to calendar year of birth by whether dead or surviving

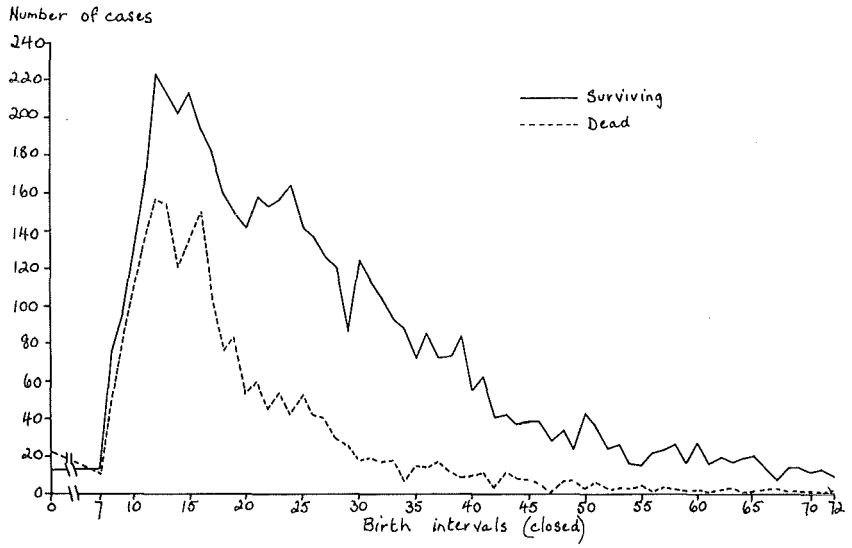

Figure 18 Distribution of children according to birth intervals (closed) and by whether the child is dead or surviving

between exact ages one and five years ($_4q_1$) declined in the same period from 214 deaths per 1000 born alive to 54.6 deaths per 1000 live births.

In normal circumstances, when infant mortality rates are considered according to age of mother at birth and by period prior to interview a general U shape is observed with a depression between ages 20 and 30. Table 33 presents infant mortality rates based on real five-year cohorts. Table 34 compresses table 33 into 10-year age groups. A U shape is very clear for the period 5–9 years before the survey. At periods 0–4 and 10–14, those for which rates for older women are available, such a shape is not apparent. The penultimate column gives the infant mortality rates by age of mother irrespective of placement in time. This suggests that the rate falls steadily with age up to 35–39. The values for age groups 40–44 and 45–49 do not conform to the expected U shape of infant mortality, although the sample size is very small for 45–49 year olds in particular. In addition, these women may have omitted dead children.

If only age groups in the range 15–39 are considered, because there is only an adequate sample for these, mortality can be seen to decline very regularly and consistently, suggesting fairly good reporting of infant deaths.

The irregularities which do occur can be best explained through the omission of dead children and the misreporting of dates. In the most recent period it is perhaps surprising that the rate is so low for women at central age 35. This may be due to a combination of

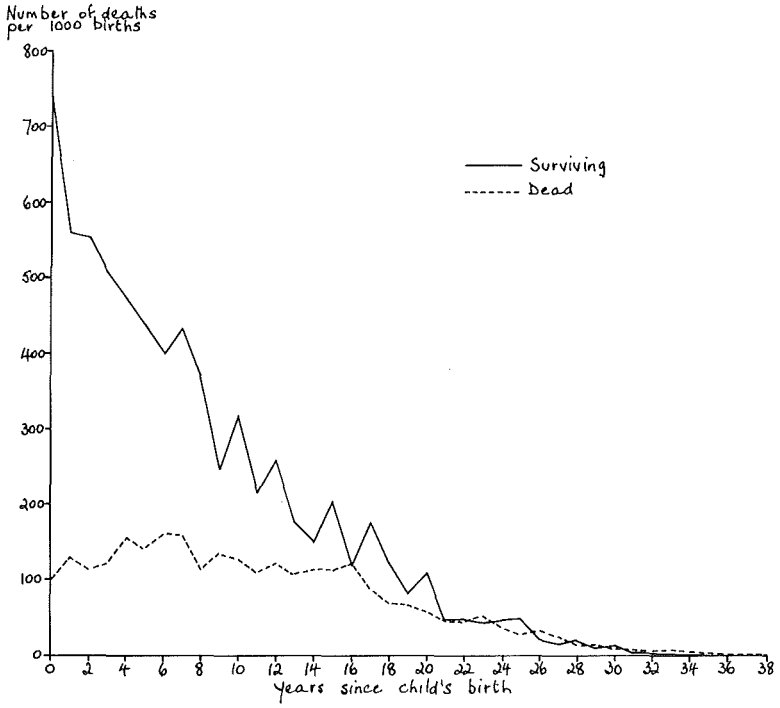

Figure 19 Distribution of children according to years since child's birth and survival status

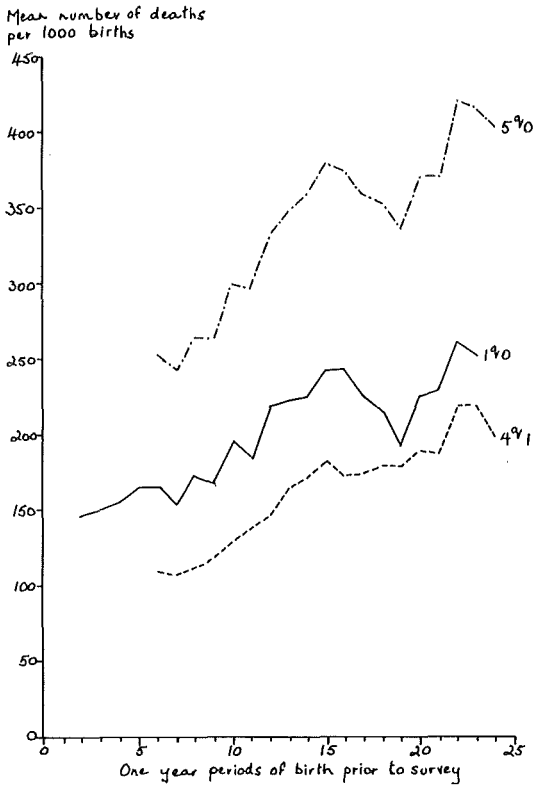

Figure 20 Direct estimate of the probabilities of dying before completing one year of age ($_1q_0$), before completing five years ($_5q_0$) and between exact ages one and five years ($_4q_1$) (three-year moving averages)

sampling error, omission of recent deaths and selective overstatement of age among those who have suffered recent bereavement.

Mortality by sex of child

In order to detect for differential omissions by sex, the data from direct estimates are presented in table 35 for probabilities of dying before age one ($_1q_0$), before age five ($_5q_0$) and between exact ages 1 and 5 ($_4q_1$). It is generally accepted in mortality analysis that the probabilities of dying among male children are higher than among female children. That being the case, our estimates of infant and child mortality from the YARFS individual schedule presented in table 35 seem to be consistent, with the exception of a few cases. The rates for exact ages 1–4 ($_4q_1$) years in the periods 0–4, 5–9, 10–14 and 20–24 seem to be higher for females than males. This may be due to omission of girls as evidenced in the high sex ratios (see previous chapter).

Mortality by order of birth

It is also generally believed that infant and child mortality shows marked differences according to order of birth. First-born children are likely to be by very young women with less or no experience in child care and probably with little or no education, as in the case of Yemen – and so mortality among children of first-order births is likely to be higher than among second- to sixth-order births. Also, seventh- or high-order births are likely to be by

Table 32 Mortality rates by calendar year (three-year moving averages), individual survey

Year of birth	No dying under one year	No dying between one and five years	Survivors	$_4q_1$	No dying before age five	$_1q_0$	$_5q_0$	Children ever born
1946	25	6	28	214.3	31	581.4	720.9	43
1951	56	36	125	288.0	92	309.4	508.3	181
1956	112	66	327	201.8	178	255.1	405.5	439
1961	231	138	800	172.5	369	224.1	357.9	1031
1966	348	197	1245	158.2	545	218.5	342.1	1593
1971	403	242	2098	115.3	645	161.1	257.9	2501
1976	505	152	2786	54.6	657	153.4	199.6	3291

Table 33 Proportion of deaths in first year by age of mother at birth (five-year age group) and years prior to survey

Age of mother at birth	Years prior to survey						Average	No of cases
	0–4	5–9	10–14	15–19	20–24	25–29		
10–14	136.4	255.3	307.7	278.5	193.5	346.2	281.2	288
15–19	179.7	205.8	251.7	239.5	247.3	277.3	229.7	2042
20–24	149.4	167.8	189.7	239.3	255.3	325.3	187.2	2532
25–29	160.6	147.4	162.6	228.5	171.4		167.2	1968
30–34	136.8	141.8	166.0	166.7			147.3	1188
35–39	96.0	157.9	153.3				137.8	588
40–44	141.8	170.9					158.9	258
45–49	108.7						122.4	49

NOTE: These rates are based on real cohorts.

Table 34 Probabilities of death in first year ($_1q_0$) of life by age of mother at birth of child (ten-year age group) and years prior to survey

Age of mother at birth	Years prior to survey						
	0–4	5–9	10–14	15–19	20–24	25–29	30–34
10–19	(192.4)	(217.2)	(271.8)	(235.5)	(236.6)	(291.5)	(602.2)
20–29	162.8	154.2	(186.4)	(236.8)	(218.5)	(385.5)	
30–39	134.0	155.3	(162.9)	(184.1)			
40–50	(167.8)	(156.3)					

NOTE: Parentheses indicate number of exposed children less than 500.

older women probably close to the end of their childbearing period. Since it is normally the less educated, the poor and those residing in rural areas who are likely to produce several children, it is also true that such children receive less care or often live with relatives. For these reasons children of seventh or higher order are likely to have higher probabilities of dying. The data presented in table 35, section B, seem to be consistent with those stated facts in regard of infant mortality, but the reverse seems to be the case for childhood mortality as measured by $_4q_1$, which is an interesting finding.

5.2 ESTIMATES BASED ON INDIRECT METHODS

Both the household and the individual questionnaires collected data on the total number of children ever born

Table 35 Probabilities of death in the first year ($_1q_0$), first five years ($_5q_0$) and between the first and fifth birthdays ($_4q_0$) by period before the survey and sex of child (A) and birth order (B)

	Period before the survey (years)						
	0–4	5–9	10–14	15–19	20–24	25–29	30–34
A By sex of child							
Male							
$_1q_0$	166.3	182.0	216.6	(248.1)	(270.4)	(372.8)	(546.1)
$_5q_0$	238.4	281.2	(344.4)	(407.3)	(419.2)	(534.3)	(742.3)
$_4q_1$	86.5	121.3	(163.2)	(211.7)	(204.0)	(257.5)	(432.4)
Female							
$_1q_0$	156.4	152.4	194.3	(209.8)	(178.3)	(264.7)	(662.5)
$_5q_0$	234.5	269.5	(332.9)	(336.3)	(381.4)	(429.2)	(724.4)
$_4q_1$	92.6	138.1	(172.0)	(160.0)	(247.2)	(223.6)	(183.5)
Both sexes							
$_1q_0$	161.5	167.9	206.6	229.5	(224.3)	(323.2)	(591.9)
$_5q_0$	236.5	275.4	339.3	(372.8)	(400.5)	(486.6)	(732.1)
$_4q_1$	89.4	129.2	167.2	(186.0)	(227.1)	(241.5)	(343.6)
B By birth order							
First birth							
$_1q_0$	195.3	(173.2)	(212.2)	(221.4)	(178.4)	(272.4)	(626.6)
$_5q_0$	(259.8)	(278.3)	(301.5)	(312.8)	(297.2)	(454.5)	(677.9)
$_4q_1$	(80.2)	(127.1)	(113.4)	(117.4)	(144.7)	(250.2)	(137.3)
Second or third							
$_1q_0$	150.2	154.4	203.5	(201.3)	(245.4)	(286.6)	(568.5)
$_5q_0$	223.1	(260.9)	(360.1)	(361.7)	(463.2)	(445.9)	(780.5)
$_4q_1$	85.8	(126.0)	(196.6)	(200.8)	(288.6)	(223.2)	(491.4)
Fourth to sixth							
$_1q_0$	144.5	153.7	(189.5)	(229.1)	(254.4)	(537.8)	(333.3)
$_5q_0$	227.2	(270.5)	(344.0)	(445.9)	(429.0)	(661.6)	
$_4q_1$	96.7	(138.0)	(190.6)	(281.2)	(234.2)	(267.9)	
Seventh or higher							
$_1q_0$	172.0	(216.5)	(264.9)	(427.3)	(216.9)		
$_5q_0$	(246.9)	(315.8)	(350.0)	(472.6)	(458.8)		
$_4q_1$	(90.6)	(126.8)	(115.8)	(79.0)	(308.9)		

NOTE: Parentheses indicate number of exposed children in the denominator less than 500.

Table 36 Calculation of $_1q_0$, $_2q_0$, $_3q_0$, $_5q_0$, $_{10}q_0$, $_{15}q_0$ and $_{20}q_0$ for Yemen AR based on children ever born and children surviving recorded in the YARFS 1979 (Trussel model)

Interval (i)	Age of women	Average no of children ever born	Proportion still surviving (Si)	Proportion dead	Multipliers for column 5 from P1/P2 and P2/P3				Age	Proportion dead by age (x_0^q)			
					South model	North model	West model	East model		South model	North model	West model	East model
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	15–19	0.428	0.794	0.206	0.871	0.902	0.941	0.960	1	0.179	0.186	0.194	0.198
2	20–24	1.669	0.793	0.207	0.992	0.942	1.000	1.104	2	0.205	0.195	0.204	0.228
3	25–29	3.224	0.763	0.237	0.997	0.929	0.982	0.991	3	0.236	0.220	0.223	0.235
4	30–34	4.954	0.718	0.283	1.009	0.971	0.996	0.999	5	0.286	0.275	0.282	0.283
5	35–39	6.013	0.710	0.290	1.027	1.031	1.100	1.019	10	0.298	0.299	0.319	0.296
6	40–44	6.452	0.672	0.328	1.006	1.173	0.999	1.068	15	0.330	0.385	0.328	0.350
7	45–49	7.193	0.637	0.363	0.995	1.001	0.992	0.995	20	0.361	0.363	0.360	0.361

NOTE: P1/P2 = 0.256; P2/P3 = 0.514.

and those still surviving or dead. The individual schedule, however, collected more detailed information on maternity histories as outlined in the introduction of this chapter. This information on children ever born by women aged 15–49 and the estimation of infant and child mortality are presented in table 36. Column 3 gives the total number of children ever born while columns 4 and 5 give the proportions of all children still surviving and dead respectively. Using P1/P2, which is 0.428/1.669 = 0.256, and P2/P3, which is 1.669/3.244 = 0.514, and the Brass–Trussell formula Ki = A(P1/P2) + B(P2/P3) + C loge(P1/P2) + D loge(P2/P3) + E (for details see Moveh, *Population Statistics*, 1975, vol 29, no 1, p 105), the multipliers given in columns 6, 7, 8 and 9 based on all the four families of the model mortality tables of Coale–Demeny (1966) were derived. Each set of multipliers is multiplied by column 5, the proportion of all children dead, to yield life-table estimates of probabilities of dying before age one ($_1q_0$), before age 5 ($_5q_0$) and before ages 2 and 3 ($_2q_0$ and $_3q_0$) (see the last four columns). In the absence of detailed knowledge about the pattern of mortality, West model life tables are best used, as they represent a more average pattern. The probability of dying before reaching one year of life ($_1q_0$) is 0.194 and before reaching five years ($_5q_0$) 0.282. Comparing these estimates with those derived directly from the birth histories during the period 0–4 years prior to the survey where $_1q_0$ is 0.162 and $_5q_0$ is 0.237, the two sets of estimates seem to be quite different. These rates though are subject to errors due to the misplacement of deaths and births in time. A comparison of the rates based on the Brass method with those from the maternity history analysis for the period 5–9 years before the survey shows far closer agreement. $_5q_0$ is estimated as 0.282 and 0.275 respectively.

In conclusion, it can be said that there appears to be some consistency in the derived mortality estimates, suggesting that the data are perhaps of better quality than those on other demographic aspects. The relative smoothness of change in $_1q_0$ and $_5q_0$ by age of mother supports this view.

6 Summary and Conclusions

Changes in fertility levels often occur as a result of the process of modernization through the influence of such factors as education, urbanization and women's participation in the modern sector of the economy, to mention but a few. These affect fertility indirectly through the intermediate variables. Rapid development in education, for instance, results in the postponement of marriage, thereby reducing the period of exposure to the risk of pregnancy with the result of lowering fertility. Development in education, urbanization and other modernizing factors often leads to the shortening of breastfeeding periods, which in the absence of contraception leads to shorter birth intervals with the result of raising fertility. Socio-economic changes in the Yemen AR are taking place only very slowly. For instance, according to the 1975 census the illiteracy rate for the population over ten years of age was 65 per cent for men and 97 per cent for women with an overall average rate of 83 per cent. This was because formal education was not introduced until after the revolution in 1963 and did not become effective until after 1970. Just over 5 per cent of the total population are urban and by tradition women in Yemen play a very minor or no role in the modern sector of the economy. Thus, to say the least, the modernizing factors of education, urbanization and women's status have changed little and have therefore had a negligible effect on the intermediate fertility variables.

Evidence from the YARFS shows no substantial changes in marriage patterns over the last thirty years. There have been no major changes in breastfeeding (see *First Country Report*, Vol 1), and contraception is virtually absent. Although first birth intervals appear to have fallen dramatically, we have attributed this to reporting error. Undoubtedly, data from the YARFS suffered from irregularities of various types including heaping, shifting of ages, omission and misdating of births and deaths and first marriages as well as errors due to sampling problems. Any observed rise in fertility is probably not real, but more the result of various kinds of error. It is unfortunate that data from external sources such as vital statistics and the 1975 census were not available for comparison. Nevertheless at present, and probably for a long time to come, the estimates from the YARFS will remain the best and most reliable source of information on the nuptiality, fertility and mortality situation in this country.

6.1 AGE REPORTING

The analysis of data on age reporting showed typical irregularities associated with age misstatement in most developing countries. There was marked preference for digits ending in 0 and 5 in both household and individual surveys as measured by the Myers index. To a lesser extent heaping occurred on digits 2 and 8 as well.

Heaping was particularly exaggerated at calendar years of birth. The fact that the survey date was 1979 had some bearing on the preference for dates ending in digits 4 and 9. The dates in the historical calendar 1948, 1955 and 1959 have historical significance as *coups d'état* were witnessed during these years. Also the period 1942–48 witnessed one of the worst economic crises followed by a series of famines.

The results of the UN age accuracy index, which takes into account sex ratios and age ratios in both sexes in its calculations, indicated that age data in the YARFS are rather inaccurate. Comparison of the female age structure reported in the household survey with a stable population age structure suggested an overcount of young children under the age of ten. The proportion under age 25 was almost identical, and this may imply the understatement of age of young people. Comparison of the age structures revealed in the 1975 census and the 1979 household survey indicated a shifting of ages to groups 24–28, 59–63, and 69–74 in the survey. This was also apparent from a study of the survey alone.

Lastly, a comparison between household and individual surveys showed inconsistency in age reporting (82.9 per cent of the ever-married women reported the same age group in both cases). Contrary to expectations, however, consistency was less among young women in the age groups less than 20, 20–24 and 25–29, being 77.1, 81.7 and 82.5 per cent respectively, probably showing that someone else gave the ages to the interviewers on behalf of those young women. The high figures for older age groups, on the other hand, show that those older women were able and less restricted to report their own ages in the household survey.

6.2 NUPTIALITY

Data on year of first marriage showed heaping at dates 1941, 44, 46, 49, 52, 54, 59, 62, 64, 67, 69, 72, 74 and 77. Heaping was influenced by the usual preference for even numbers, digits ending in 9, the year in which the survey was conducted and the important dates in the historical calendar as mentioned above in the age data. The reporting of age at first marriage was concentrated at age 15, with lesser concentrations at 13 and 14.

Analysis of the nuptiality changes by looking at the cumulative proportions ever married by specified ages for each five-year cohort showed appreciable fluctuations across cohorts – thus complicating any analysis of the trend. The inconsistencies indicated that dates of first

marriages were misreported especially among the older women, where such marriages occurred many years in the past. Another possibility was errors resulting from sampling problems.

When the data were examined at percentages of a cohort ever in a union by years before the date of the interview, there was evidence of shifting of dates of first marriages closer to the date of interview and/or omission of unions. This was further confirmed by the data on mean number of unions for each five-year cohort. The number of unions rose from 1.0 to only 1.3 with no or very little change for cohorts 25–29 to 45–50, suggesting some possible omission of some unions that occurred among older age groups above age 35. Consistency of reporting marital status in both household and individual schedules was very high. About 99.4 per cent of ever-married women reported the same marital status.

6.3 FERTILITY

The recorded number of children ever born from the YARFS (reconstructed) could not be compared with those derived from the 1975 census as the data were not available. The mean number of children ever born seems to be increasing with age as expected.

Analysis of recent trends and levels in fertility (period 1948–78) showed irregularities with no consistent pattern towards an increase or decrease in fertility. Many rates were, however, higher than for adjacent years, showing a possibility of heaping when birth rates were calculated.

Examination of P/F (cohort period fertility analysis) reveals values of less than 1.0 – a reflection of either increasing current fertility or misreporting of births (ie reported births actually belong to the period before that under observation or else past births have been omitted, especially those which occurred long ago in the past). P/F ratios for the period 0–4 years before the survey for births of specific orders showed some evidence of displacement and omission of births. Proportions dead of children ever born showed evidence of omission largely attributable to girls. Cohort–period fertility analysis also suggested that past births have been brought forward in time towards the date of the survey.

6.4 INFANT AND CHILD MORTALITY

The data confirm that infant and child mortality are very high in the Yemen AR. A high proportion of the deaths occur in the first year of life. Birth history analyses yield estimates of about 162 out of every 1000 live births dying in infancy and about 237 out of every 1000 live births dying between birth and five years.

Birth history data in mortality were affected by various types of errors due to:

1 reporting;
2 the selectivity resulting from the fact that living mothers (interviewed) may have children with different mortality from dead mothers (not interviewed);
3 the relatively small sample size.

Errors due to reporting which distorted the estimates on infant mortality rates are the omission of live births and subsequent deaths as well as the misreporting of age at death. In particular, live births which are followed by early neonatal deaths are the most susceptible to omission from birth histories, especially if they occurred a long time in the past from the date of the interview. There is evidence from the reporting of date of death to suggest that the estimates of infant mortality seem to be underestimated probably due to omission of children who died.

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