Annex II

EVALUATION OF THE QULATIY OF THE DEMOGRAPHIC DATA

A. Introduction

As noted in annex I, the main sources of demographic data in Nepal are the periodic census and the sample surveys. Demographic data collected from censuses as well as sample surveys are usually subject to various kinds and degrees of inaccuracies. The census data may suffer from underenumeration, age misstatement and other reporting errors. Data collected through sample surveys are subject to sampling errors as well as response errors. It is therefore very necessary to evaluate the quality of the data obtained through various sources before they are used for purposes of research, planning and policy decisions.

In Nepal, detailed information on the demographic, social and economic characteristics of the population are available only from the censuses taken in the country since 1952/54. Although a number of *ad hoc* sample surveys have been carried out to collect the required demographic data, by far the most comprehensive survey is the Nepal Fertility Survey (NFS) conducted in 1976 in co-operation with the World Fertility Survey. Hence, the discussion in this annex will be confined to the quality of the data collected in the censuses of 1952/54, 1961 and 1971, and in the 1976 Nepal Fertility Survey.

B. Quality of Census Data

The quality of the data collected in a census is affected by a number of factors which can be classified into two broad groups: those related to the organization of a census and those affecting the response of the people covered by the census.

(a) *Errors resulting from operational difficulties*
The census is a large-scale operation in which a very large number of administrators, supervisors, enumerators, coders and many other persons are employed. Admittedly, therefore, the achievements of this operation are largely dependent upon the efficiency of the organization in preparing the plan and personnel up to the very efficient level needed in data collection. The quality of training received by the personnel and their understanding of the whole procedure is reflected in the data collected in the field. Other factors such as the physical features of the country, the availability of transport and communication facilities, and the timing of the operation are equally important in determining the quality of the data collected.

As noted in annex I, census operations in Nepal have been characterized by a lack of continuity of organizational and administrative experience, since no single permanent organization was entrusted with the responsibility for taking censuses on a continuing basis. Every census was planned, organized and executed by a new organization and a new set of officials who had no previous practical experience of census taking. Thus, the operations could not have been carried out as smoothly as they would have been if the machinery had been already tested and found to be will fitted.

The geographical terrain of the country has also contributed largely to the organizational problems. In the absence of adequate transportation facilities, a large volume of census schedules and publicity materials had to be carried by porters over difficult mountain trails. In the 1952/54 census, the enumerators had to face the difficulties of malaria and torrid heat in the Terai and inner Terai. During this census, the personal questionnaires of 21,546 persons were damaged by rain during their transportation. Detailed data for those areas are therefore not

available. Of the total population of 8,256,625, detailed data were available for only 8,235,079 persons.[1] As the monsoons had already started during the 1961 census, the enumerators had to encounter the difficulties caused by swollen rivers and rivulets. During this census, when it was felt that the definition of housing units in the Terai required modification, fresh instructions were sent to different zones of the Terai, but could not be relayed in time because of poor communications. Similarly, such information could not be communicated to various census units and subunits.[2] Consequently, the number of housing units in the Terai decreased in 1961 compared to 1952/54.

The quality of the data collected in the census is also largely affected by the educational levels of the enumerators employed. As noted earlier, a census is a very large operation requiring the employment of thousands of enumerators with adequate qualifications. But in Nepal, where the literacy level is very low, it has not been possible to recruit sufficient number of enumerators with the requisite educational qualifications. The basic criterion for recruiting an enumerator was his ability to read and write. For instance, in the 1971 census, the enumerators ranged from ordinary literate persons to students and teachers. Owing to the wide variability of the enumerator's educational background, there was the possibility of numerous wrong entries in the schedules. Besides, the ethnic diversity and low literacy rate confounded the problem of recruitment of literate persons from among the various ethnic groups of the country.

The population censuses in Nepal were also characterized by the lack of an appropriate mapping system. Apart from locating the boundary of the villages, it was extremely difficult to locate specific villages. For the 1952/54 census, the Department did not carry information regarding the location of villages nor the names of the *thums progannas*. In the absence of toposheet maps (one inch to a mile) for the whole country, the entire work had to be based on one-fourth inch to a mile maps of the survey of India. Therefore, the task of locating the boundary of the villages was assigned to the field supervisors with the assistance of revenue-collecting agents. The same problem had been faced in the 1961 census. The constitutional amendment of 1962 resulted in the administrative division of the country into 14 zones and 75 districts. The panchayat system made it imperative to have village and town level representation in the country's political system and the result was the creation of village and town panchayats in the districts.[3] Apart from demarcating the boundary of the panchayats, in 1971 there was the serious problem of locating the panchayat centres in the maps, because they are characterized by novel names not mentioned in the maps.[4] The absence of location and boundary of the villages in the maps hindered effective enumeration and exaggerated the possibilities of error of coverage.

(b) *Response errors*

Response errors usually consist of under-reporting or omission of certain groups (age and or sex) at the census, and misstatement or miss-reporting, particularly of the age of a person. The reasons for these errors are illiteracy of the population, superstitions about counting of persons, general apathy and absence of co-operation.

> "The most important factor correlated to biased data is the low educational attainment of the population. Notably, the literate people are more inclined to respond to the census interview more accurately than the illiterates. Internationally, or unintentionally the illiterate people may give false statements or their age, occupation, number of children etc."[5]

In Nepal, where the majority of the people are illiterate and where prevalence of superstitions is high, there is a tendency not to report the newly born babies at the census. The superstitions of the

village folks also account for the underenumeration of male children. Since the male issue is considered to be a support for old age and a symbol of religious security, the women and the orthodox Hindus usually hesitate to disclose the exact number of their male children in order to ward off the evil eye.

In addition to illiteracy and superstition, lack of co-ordination on the part of the respondents also results in underenumeration. At the 1971 census, in the urban areas, the enumerators were unable to procure accurate responses from the local residents and immigrants residing in rented rooms. Further, the household heads and elderly people who were economically active were usually absent at the time of the enumeration. Hence, an undercount in this sector was discerned.

The census data are also usually subject to errors arising from misstatement of age. Age misstatement can arise as a result of ignorance of age and the date of birth, negligence in reckoning the precise age, misunderstanding of the question relating to age, or deliberate false reporting of age. In Nepal, most of the rural people are illiterate and ignorant and do not know their exact ages. Hence the ages are wrongly stated by the respondents. Very often, the enumerators are compelled to guess or estimate the ages of the respondents. Thus errors in tabulated age data:
"May arise from the following types of errors enumeration: coverage errors, failure to record age, and misreporting of age. There is some tendency for the types f errors in age data to offset one another; the extent to which this occurs depends not only on the nature and magnitude of the errors but also on the grouping of the data".[6]

The single-year age distribution for Nepal recorded at the 1961 and 1971 censuses shows heaping at ages ending in certain digits. There are several statistical methods developed for measuring the pattern of digit preference, but the method used here is the one proposed by Myers.[7] Specifically, the method involves determining the proportion which the population ending in a given digit is of the total population 10 times, by varying the particular starting age for any 10 year age group. The results of the application of this method to the data of the 1961 and 1971 censuses of Nepal are shown in table 108. it will be noted from the table that in both censuses, there was a tendency both among males and females to state their ages ending in digits, 0, 5, 9 and 3 with the digits 0 and 5 most commonly preferred. The table also indicates that the preference for these digits was greater in 1971 than in 1961. it is also interesting to note that a greater proportion of females than males tended to state their ages in digits ending in 0 and 5.

The Myers index for comparable years for a few selected countries is shown in table 109. it will be noted that compared with some of the other countries in the region, the digit preference in Nepal is very marked.

In countries where the distribution of the population by single years of age is characterized by peaks and troughs, it is customary to group the data in five-year age intervals because errors in grouped data will be minimal since heaping at certain digits will be offset by deficits at adjacent ages. An age accuracy index has been developed by the united Nations Secretariat to test the accuracy of age distributions grouped in age intervals.[8] The method consists of : (a) determining a sex-ratio score which is the average irrespective of sign of successive differences in the sex-ratios between on age group and the next; (b) calculating an age ratio score for each sex which is obtained by computing age ratios for each sex and averaging their deviations from 100 irrespective of sign; (c) computing the index or joint score which is obtained as three times the sex-ratio score added to the two age-ratio scores.
The sex-ratio scores, age ratio scores and the joint scores computed for the quinquennial age distribution of the Nepal censuses of 1961 and 1971 are compared with the corresponding scores

for a few selected countries of the region in table 110. It will be observed that the degree of misreporting of ages is higher in Nepal than in most countries of the region, and that in Nepal there has been a deterioration in the reporting of ages as indicated by the gradual increase in the joint score from 48.3 in 1952/54 to 52.9 in 1971.

The age ratios for Nepal for the three consecutive censuses are presented in table 111 and figures 8 and 9. Age ratio is the proportion of a given five-year age group to the average of its two adjacent five-year age groups. On not every stringent assumptions, a smooth declining line is expected

Table 108. Myers' index [a] of digital preference for digits 0 to 9, censuses of 1961 and 1971

Digit	1961 census (1 per cent sample)		1971 census (Total population)	
	Males	Females	Males	Females
0	+6.26	+10.65	+10.91	13.97
1	-2.33	-2.22	-3.68	-3.96
2	+2.53	+2.14	+1.25	+0.79
3	-3.81	-4.66	-4.74	-4.96
4	-2.09	-2.88	-3.74	-3.65
5	+6.06	+5.84	+9.89	+9.23
6	-0.69	-1.73	-1.89	-2.70
7	-3.37	-4.29	-4.21	-4.65
8	+1.75	+1.81	+1.27	+1.23
9	-4.31	-5.06	-5.06	-5.30

Source: Computed from data of the 1961 and 1971 censuses of Nepal.

a. See Robert J. Myers, "Errors and bias in the reporting of ages in census data", *Transactions of the Actuarial Society of America,* vol. XII, 1940, pp. 411-415.

Table 109. Myer's indices for selected countries

Country	Year	Males	Females
Hong Kong [a]	1961	3.9	3.8
	1971	6.1	5.2
India [b]	1961	16.4	18.6
	1971	16.7	18.2
Nepal [c]	1961	33.2	40.9
	1971	46.6	50.4
Philippines [d]	1961	19.5	21.1
	1971	15.6	16.4
Sri Lanka [e]	1961	26.0	32.6
	1971	16.6	22.3
Thailand [f]	1961	4.6	4.6
	1971	3.3	2.8

Sources:

a United Nations, *Population of Hong king,* Country Monograph Series No. 1 (Bangkok, ESCAP, 1974), p. 124.

b U.P. Sinha, "Evaluation of quality of demographic data", draft chapter prepared for publication in ESCAP, *Population of India* (Preparation).

c Computed on the basis of the single-year age distributions of 1961 and 1971 censuses.

d United Nations, *Population of the Philippines,* Country Monograph Series No. 5 (Bangkok, ESCAP, 1978), p. 341.

e United Nations, *Population of the Sri Lanka,* Country Monograph Series No. 4 (Bangkok, ESCAP, 1976), p. 382.

f United Nations, *Population of the Thailand,* Country Monograph Series No. 3 (Bangkok, ESCAP, 1976), p. 210.

Table 110. Sex-ratio score, age ratio score and joint score for selected countries.

Country	Year	Sex-ratio score	Age-ratio score		Joint Score
			Males	Females	
Bangladesh [a]	1961	13.8	10.7	14.8	67.0
	1974	16.5	21.4	10.0	67.9
India [b]	1961	5.9	12.7	16.2	46.6
	1971	4.4	11.0	11.5	35.7
Nepal [c]	1952/54	10.4	6.4	10.7	48.3
	1961	9.3	10.6	11.0	49.6
	1971	11.1	9.0	10.6	52.9
Philippines [d]	1960	4.1	11.3	9.5	21.1
	1970	3.8	5.4	4.3	12.9
Republic of Korea [e]	1960	5.4	6.6	6.3	29.1
	1970	5.3	6.5	5.5	27.8
Sri Lanka [f]	1963	4.2	7.3	8.4	28.3
	1971	4.1	5.4	7.9	25.6
Thailand [g]	1960	1.7	4.2	3.5	12.8
	1970	1.9	3.3	3.4	12.5

Sources:
a United Nations, *Population of Bangladesh*, Country Monograph Series (in preparation).
b U. P. Sinha, "Evaluation of the quality of demographic data", draft chapter prepared for publication in ESCAP, *Population of India* (in preparation).
c Computed from the data of the relevant censuses.
d United Nations, *Population of the Philippines*, Country Monograph Series No. 5 (Bangkok, ESCAP, 1978), p. 344.
e United Nations, *Population of the Republic of Korea*, Country Monograph Series No. 2 (Bangkok, ESCAP, 1975), p. 264.
f United Nations, *Population of the Sri Lanka*, Country Monograph Series No. 4 (Bangkok, ESCAP, 1976), p. 383.
g United Nations, *Population of the Thailand*, Country Monograph Series No. 3 (Bangkok, ESCAP, 1976), p. 212.

Table 111. Age ratios [a] 1952/54, 1961 and 1971

Age group	1952/54		1961		1971	
	Males	Females	Males	Females	Males	Females
5-9	111.8	114.2	112.3	113.8	118.6	119.3
10-14	101.4	91.5	102.9	93.0	98.1	87.6
15-19	95.7	95.1	87.8	87.0	93.7	91.1
20-24	92.5	100.6	92.1	102.3	92.9	103.4
25-29	108.1	107.7	110.1	107.6	107.2	102.0
30-34	95.8	100.1	98.2	103.9	91.5	102.3
35-39	102.8	91.8	106.9	92.4	112.4	97.8
40-44	97.6	110.4	90.2	104.4	95.6	107.1
45-49	97.6	86.7	98.8	87.9	97.0	85.6
50-54	109.5	121.0	111.1	121.9	108.0	115.5
55-59	84.6	71.0	82.8	72.3	77.6	70.8
60-64	118.7	151.4	125.2	151.9	90.6	101.6

Source: Computed on the basis of data from the 1952/54, 1961 and 1971 censuses of Nepal.
a Age ratio is the proportion of a given five-year age group to the average of its two adjacent five-year age groups.

in the size of the age groups. However, the age ratio should be equal to utility. When an age group is over enumerated relative to the adjacent groups, its age ratio will be greater than unity. When the age group is under enumerated relative to its adjacent groups, its age ratio is smaller than unity. Figure 9 shows high masculinity ratios at ages 35-39, 45-49 and 55-59. In the censuses of 1952-54 and 1961, the high male age ratio at ages 60-64 is topped by an even higher female age ratio which produced a low masculinity ratio. At 10-14, the male age ratio is unity and the female age ratio is less than one, a feature consistent with the hypothesized male under enumeration at this age group. At 20-24, the relative position of the two age ratios is reversed. Females are almost exactly equal to one, but males have fallen below unity, a feature consistent with the perceived male under enumeration at this age group, and could also be partly due to age heaping at 25-29. The age heaping of males at 25-29 can be a small part of the explanation of the shortage of males at ages 20-24 which is less significant than the heaping of females. At ages 15-19, both sexes seem to have been undercounted, and this phenomenon might be due to heavy out migration of both sexes at these ages, or to a temporary drop in the number of births 15-19 years earlier. The alternating of age heaping at neighbouring ages can be dismissed in view of the low age ratios at the neighbouring age groups. It was felt that migration - total or for any particular age group – was too small to affect the errors and uncertainties to any substantial extent.

C. Quality of Nepal Fertility Survey Data

1. *Response errors*

The Nepal Fertility Survey was conducted in 1976 in co-operation with the World Fertility Survey to obtain reliable estimates of recent levels

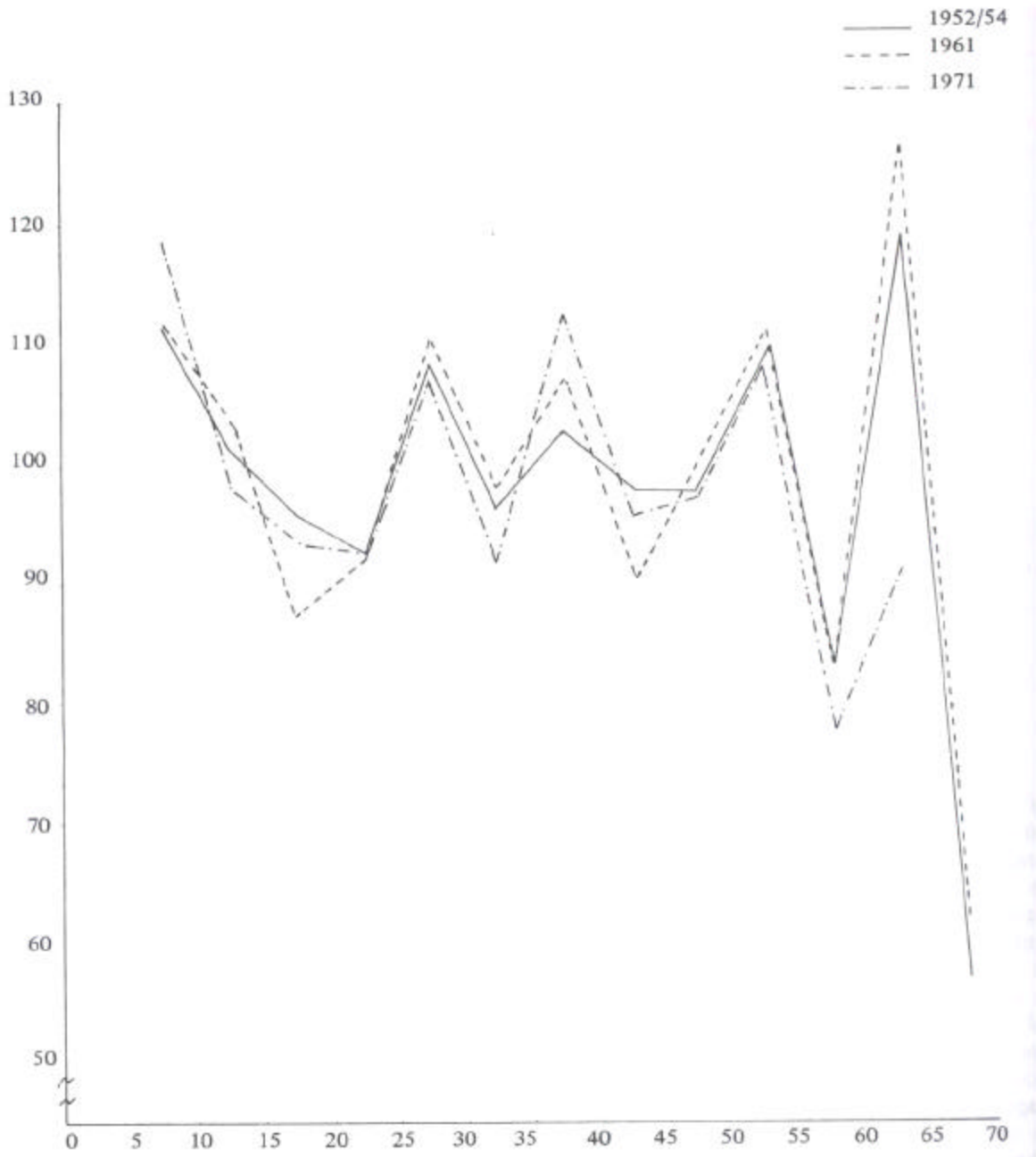


Figure 8. Male age ratio, 1952/54, 1961 and 1971

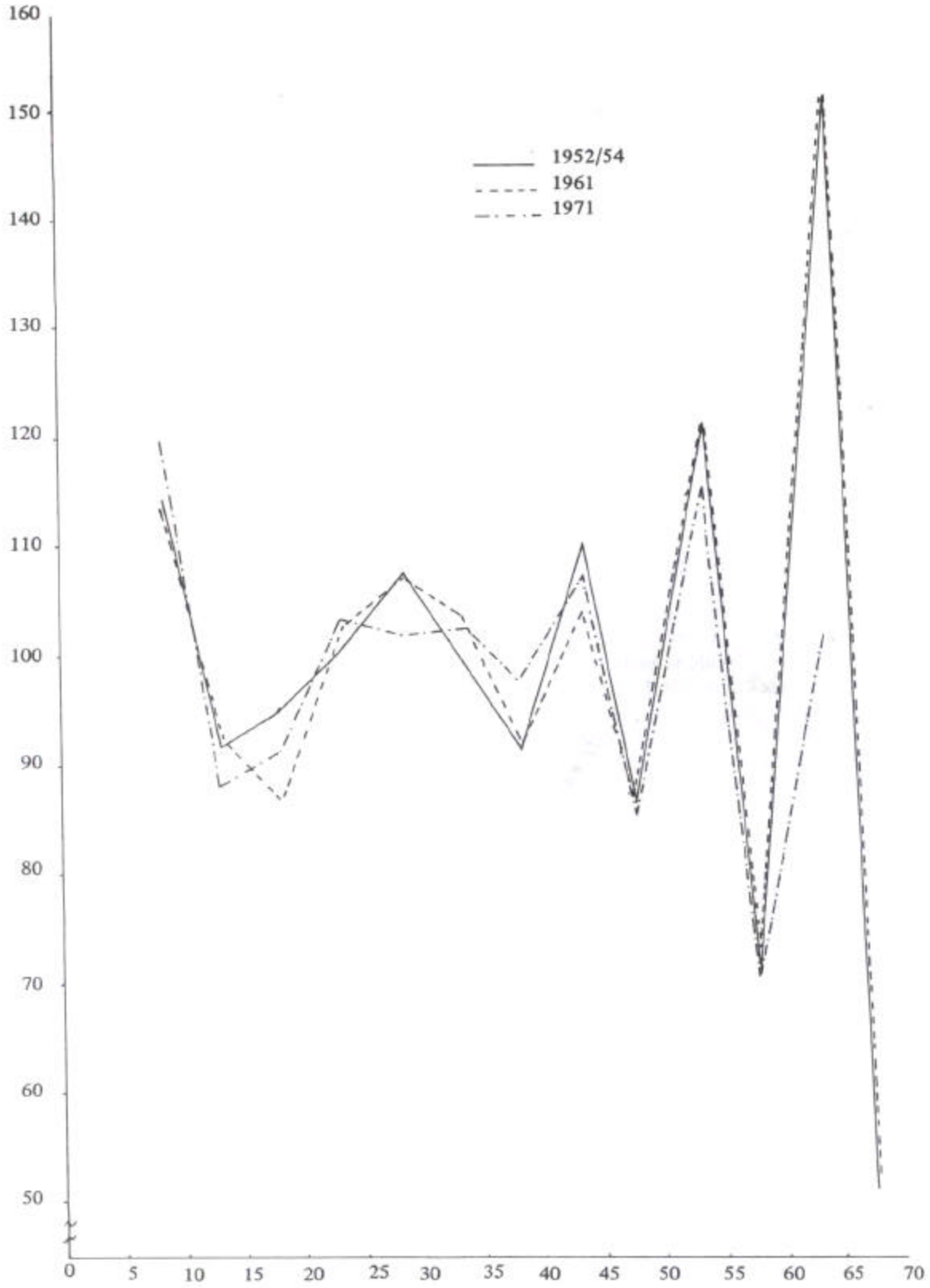


Figure 9. Female age ratio, 1952/54, 1961 and 1971

and trends in fertility. The detailed fertility histories obtained make it possible to estimate age at marriage, age-specific and duration-specific fertility rates, infant and child mortality rates and inter-birth intervals. An analysis of the quality of this survey data was undertaken by Goldman to determine the extent of response error and its effect on different demographic measures.[9] For purposes of her analysis, Goldman classified the types of response errors that distort the demographic measures that one would like to estimate from the Nepal Fertility Survey according to the following trichotomy:

(a) Misreporting of age and durations;
(b) Displacement of vital events;
(c) Omission of vital events.

(a) *Age misreporting*

The percentage distribution by single years of age of females in the Nepal Fertility Survey in comparison with the corresponding female age distribution from the 1971 census of Nepal is shown in figure 10. It is evident in both distributions that reported ages are falsely concentrated at points indicating number preference, i.e., numbers divisible by five and to a lesser degree by two, rather than true chronological age. The similarity of pattern is remarkable, although the extent of misreporting is less in the survey than in the 1971 census.

All women participating in the intensive survey were initially asked their date of birth, and their age was estimated by subtracting the date of birth from the date of the survey. Of the 5,940 ever-married women covered by the survey, only 795 or 13 per cent reported knowing a date of birth. Figure 11 compares the age distribution of those women who reported a date of birth with those women who could only estimate their current age. Although the number of women who knew their date of birth was much smaller and hence the chance fluctuations larger, yet their age distribution is considerably more regular with less heaping on numbers divisible by two and five. The peaks at ages ending in 0 and 5 for those who indicated no knowledge of their dates were notable.

(b) *Misreporting of marriage duration*

Respondents were asked how long they had been married. About 27 per cent of the respondents were able to supply a date of marriage. This was approximately twice as many women who were able to supply a date of birth. Figure 12 compares the percentage distribution of marital duration for those women who supplied a date of marriage with those women who reported the date unknown. Again, the same digit selection was observed for women who did not know their marriage dates.

(c) *Displacement and omission of vital events*

The most significant finding of the Goldman analysis of the Nepal Fertility survey data is the existence of systematic biases in marriage and fertility histories producing erroneous indication of trends in age at marriage, aggregate fertility and age patterns of fertility by cohort. On the other hand, no inconsistencies are found in the estimates of proportions married by age, age-specific fertility rates and infant and child mortality rates for the recent past.

2. *Nuptiality data*

(a) *Reconstruction of marital status as of the census dates*

The household survey provides estimates of the proportion of women who have ever been married by current age; the individual questionnaire provides data on date of marriage (or age at marriage) for all ever-married women between the ages of 15 and 49. On the basis of these two pieces of information, it is possible to construct proportions of women ever married by age for any date up to 20 or 25 years prior to the survey. Since no women older than 49 years were

interviewed in the Nepal Fertility Survey, it is possible to obtain marital status only for women younger than age 49 minus x for a date x years in the past.

The proportion of women ever married by five-year age groups as of the date of the 1971 census, reconstructed from data of the Nepal Fertility Survey and a comparison of this distribution with the corresponding data from the 1971 census is shown in table 112. It will be noted

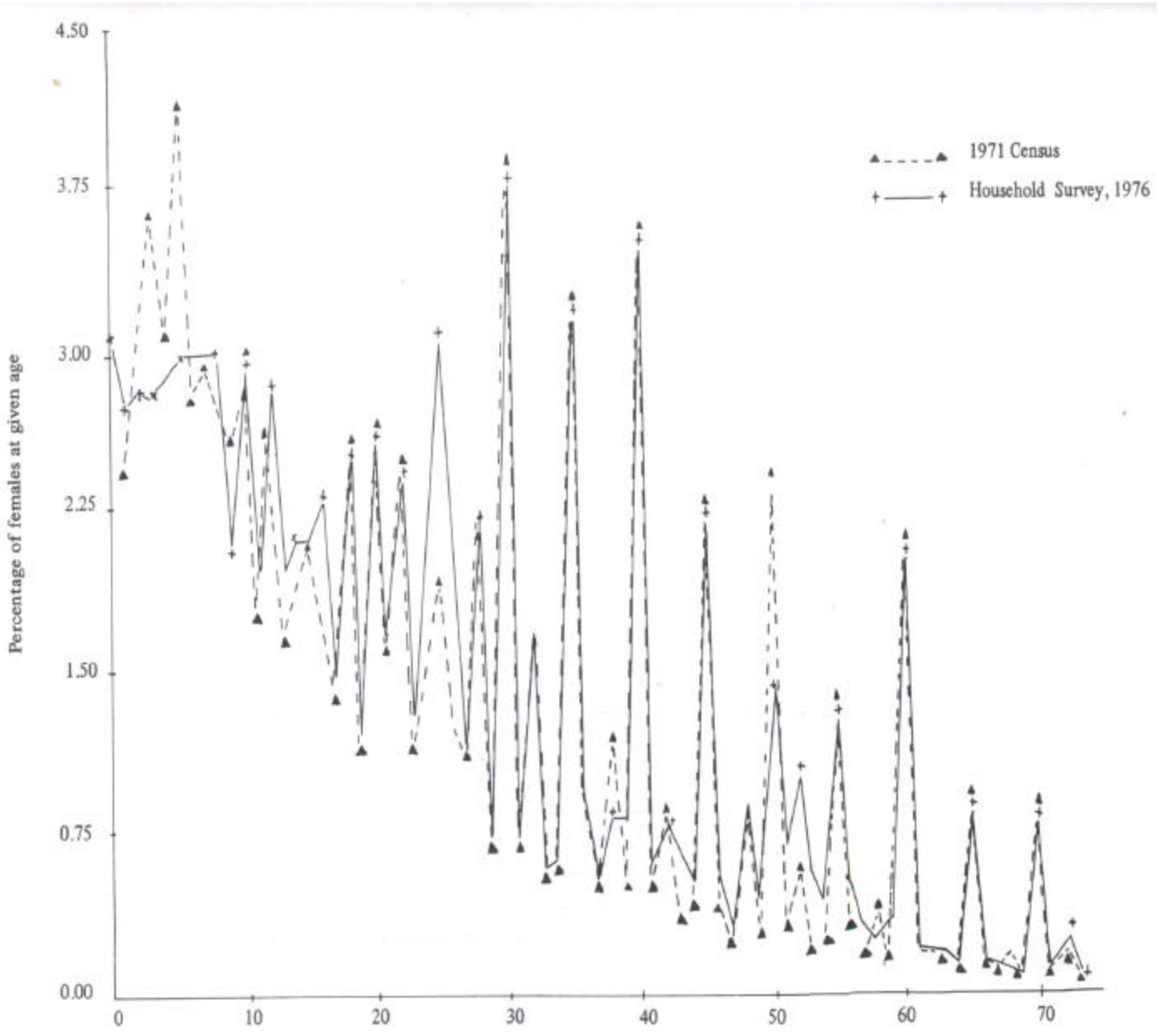


Figure 10. Reported single-year age distributions of females for ages 0-74, Household Survey, 1976 and 1971 Census

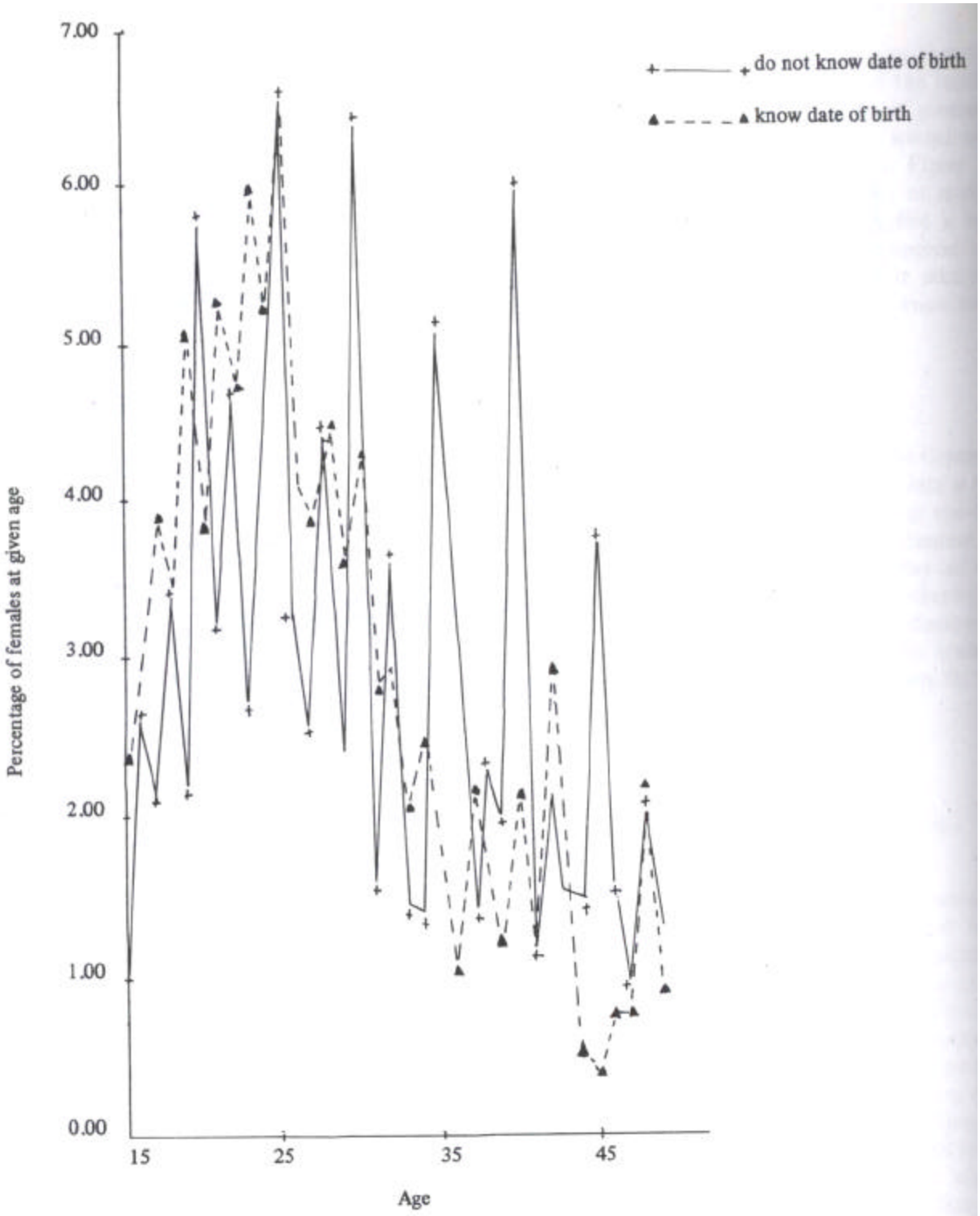


Figure 11. Reported single-year age distributions for women who know and women who do not know their dates of birth for ever-married females aged 15-49, Nepal Fertility Survey, 1976

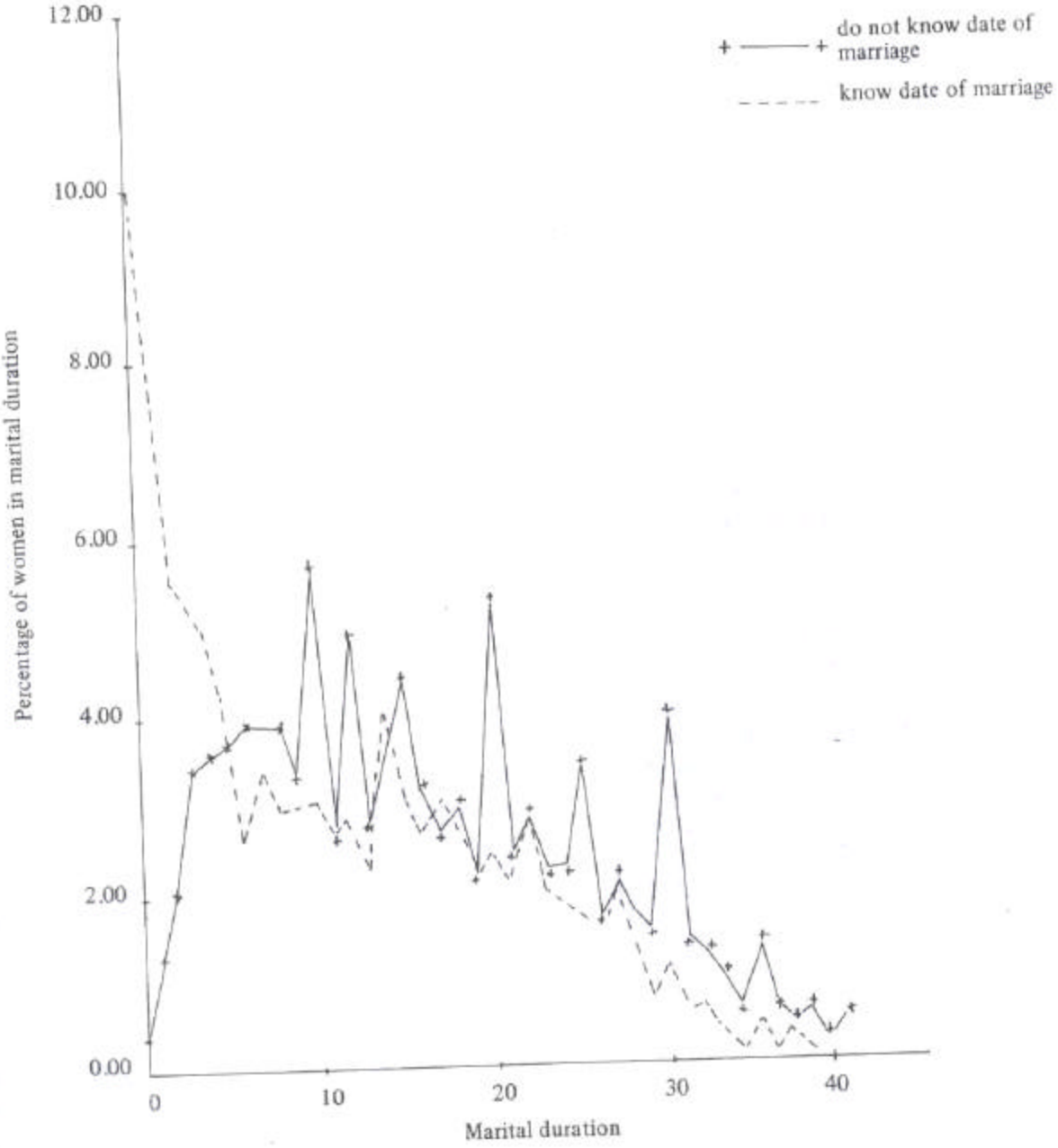


Figure 12. Reported distributions of marital duration for women who know and women who do not know date of marriage for ever-married women aged 15-49, Nepal Fertility Survey, 1976

Table 112. Reconstruction of proportions of females ever married by five-year age groups for the 1961 and 1971 censuses from reported dates of marriage in the Nepal Fertility Survey, 1976

Percentage ever married					
1961			1971		
Age in 1961	NFS	Census	Age in 1971	NFS	Census
10-14	17.9	24.8	10-14	12.0	13.4
15-19	65.7	73.8	15-19	63.5	60.7
20-24	88.4	94.6	20-24	91.6	92.1
25-29	95.9	98.1	25-29	97.5	97.4
30-34	97.3	99.0	30-34	98.7	98.6
			35-39	99.3	98.9
			40-44	98.7	99.1

that there is close, although not perfect agreement between the two, suggesting that reported age of marriage for young women (i.e., under age 25) is fairly accurate.

However, as is evident from table 112, the proportions ever married reconstructed for 1961 are substantially lower than those reported in the 1961 census. It is also evident from the data of the 1961 and 1971 censuses that there has been a considerable decline in the proportions ever married in the age groups 10-14 and 15-19 during this decade: from 25 to 13 per cent for the age group 10-14, and from 74 to 61 per cent for age group 15-19. The estimated singulate mean age at marriage (SMAM) was 15.2 for 1961 and 16.7 for 1971, indicating an increase of 1.5 years over the ten-year period. However, estimates based on the reconstructed proportions ever married (from NFS data) for 1961 and 1971 show that age at marriage changed little over the decade: proportions ever married for the age-group 10-14 years decreased only from 18 to 12 per cent, and for those aged 15-19 years from 66 to 64 per cent, while the proportions for the older age groups increased by several percentage points over the decade.

The distinction between the single and ever-married marital status categories is one of the most robust classifications in a census. The respondent and other present at the interview may not know the exact age, but they are likely to know whether a woman is single or has been married. Thus, the proportion of women recorded in the census as being single for all ages combined is likely to be rather accurate, although extensive age misreporting may result in proportions single by age group being in error. However, van de Walle[10] has proposed a method for estimating SMAM using only the proportion single in the entire population and the robustness of this estimate has been confirmed by Trussell.[11] The estimate based on the van de Walle method also clearly reveals an increase in age at marriage from an estimated SMAM of 14.6 in 1961 to 16.4 in 1971. Thus, there seems to be no reason to doubt the validity of the trend of increasing age at marriage between 1961 and 1971, especially when such a trend is matched by a parallel change in India, particularly in Uttar Pradesh state which borders Nepal (see table 113).

Goldman, therefore, concluded that the discrepancies between the proportions of ever married reconstructed form the Nepal Fertility Survey data and those reported in the 1961 census

Table 113. Singulate mean age of marriage (SMAM) calculated from census of India and Nepal

Census date	SMAM		
	India		Nepal
	Entire Country	State of Uttar Pradesh	
1941	14.7	13.1	
1951	15.2	13.8	
1961	16.1	14.8	15.2
1971	17.2	15.6	16.7

Sources: India, 1941 and 1951: S.N. Agarwala, *Age at Marriage in India* (Allahabad, Kitlab Mahal Publishers, 1962); India, 1961 and 1971: R.P. Goyal, "Shifts in age at marriage in India between 1961 and 1971", *Demography India*, vol. 4, No. 2, pp. 336-344; Nepal, 1961 and 1971: Central Bureau of Statistics, *The Analysis of the Population Statistics of Nepal* (Kathmandu, 1977).

were due to misreporting by the respondents in the survey. Two likely sources of understated proportions ever married are:

(i) Overstatement of age at first marriage in respect of those women aged 10 years and over in 1961, i.e., women older than 25 in 1976;
(ii) False reporting of second marriages as first marriages.

The existence of misreporting of second marriages as first marriages is evident from table 114 which gives the proportion of marriages reported at various ages for women who reported a birth occurring prior to the date of marriage. Although these data could be explained as illegitimate births, it has to be noted that the prevalence of illegitimacy is very low in Nepal. A much more plausible explanation is that the respondent mistakenly reported her most recent higher order marriage as her first one. This interpretation is also supported by the much greater frequency with which a marriage subsequent to a birth occurs for marriages that are themselves at unusually high ages in the Nepalese experience. It will be seen from table 114 that marriages that follow a birth of a child constitute 100 per cent of all marriages over age 40, nearly 45 per cent of all those over age 35, and 33 per cent of all those over age 30. The proportion of such marriages is negligible for ages below 25, especially below age 20. It was not possible to detect the erroneous report of marriage

Percentage of marriages for which women reported date of a birth prior to date of marriage, Nepal Fertility Survey, 1976

Age at marriage	Number of marriages	Percentage with marriage date after date of a birth
10-14	2482	0.1
15-19	2481	0.6
20-24	558	3.6
25-29	106	8.5
30-34	18	33.3
35-39	7	44.3
40-44	3	100.0
45-49	1	100.0

order for those respondents who listed a higher order marriage as their first but who reported only births that followed their more recent marriage. Hence, it is likely that some of the marriages at later ages for which a prior birth is not reported where, in fact, higher order marriages.

In summary, it would appear that the discrepancies between proportions ever married by age as reconstructed from Nepal Fertility Survey date and as reported in the 1961 census 9table 112) can be explained by the following two types of misreporting:

(i) The differences in proportions ever married for the young age groups, 10-14, 15-19, and perhaps to some extent 20-24 in 1961 (or age groups 25-29, 30-34 and 35-39 as of the survey date), seem to be largely due to a displacement of reported age at marriage towards the survey date, and, to an undetermined extent, to a misreporting of higher order marriages as first marriages.

(ii) The differences in proportions ever married for the older age groups 20-24, 25-29 and 30-34 in 1961 (or age groups 35-39, 40-44 and 45-49 as of the survey date) seem to result from a misreporting of second or higher order marriages as first marriages. Although these older cohorts are also likely to have displaced their reported ages of marriage towards the survey date, their marriages occurred considerably before 1961 and so displacement cannot be detected by a comparison with the 1961 census.

(b) *Age at marriage by cohort*

In order to estimate the time trend in age at marriage, one can reconstruct the marriage experience for each cohort in the Nepal Fertility Survey. On the basis of the data on proportions of women who have ever been married as of their current age (from the household survey) and age at marriage for ever-married women (from the individual questionnaire), it is possible to construct cumulative proportions ever married by age for five-year birth cohorts.[12] Cumulative proportions of ever-married women by age for the cohorts age 25-29, 30-34, 35-39, 40-44, and 45-49, as of the survey dte, are given in table 115. since a cohort cannot experience a first marriage at an age greater than its current age, the first marriage experiences are truncated at the lowest age of a five-year age cohort. Beginning with the cohort aged 25-29, it is possible to estimate the mean age at marriage for those marriages occurring before age 25 for each cohort, as an indication of the trend in age at marriage over time. Alternatively, one can fit model first marriage schedules[13] to the actual first marriage experience up to the current age and thereby obtain estimates of first marriage rates for the remaining ages for each cohort. The mean (SMAM) of the fitted first marriage schedule provides an estimate of the mean age at first marriage for the cohort at the end of its lifetime. Both sets of means – SMAM for the fitted schedule and the mean age of marriage for marriages occurring before age 25 – are given in table 116. Since marriages take place at a very young age in Nepal, there is no significant difference in the two sets of means.

It is also evident from the table 116 that over a period of approximately 30 years, age at marriage was not subject to any consistent trend, being lower for intermediate cohorts than for the oldest and the youngest cohorts. The estimates of SMAM from the fitted model schedules are practically identical for the cohorts now aged 20-24 and 45-49.

However, the recorded increases in the mean age of first marriage in neighbouring populations provide indirect evidence that age at marriage has been rising in Nepal during the last thirty years. Table 113 shows the singulate mean age at marriage for India for the State of Uttar Pradesh at the successive censuses since 1941, and for Nepal at the censuses of 1961 and 1971. the increasing age at marriage in India, and especially in Uttar Pradesh, which borders and is culturally similar to Nepal, supports a belief that the data from the two Nepalese censuses reflect a genuine trend.

It could therefore be concluded that the trend in age at first marriage by cohort calculated from the Nepal Fertility Survey is unreliable: the decline in age at marriage to a minimum for the cohort now aged 30-34 and the subsequent increase is not representative of the actual sequence of change. Instead, there was a gradual monotonic increase in the mean age at first marriage concealed by a combination of an overstatement of age at marriage and erroneous reporting of higher order marriages as first marriages.

3. *Fertility data*

(a) *Evidence of omission of births in the detailed fertility history*

The accuracy of the data collected in censuses and surveys on the total number of children ever born (parity) to women at different ages tends to vary inversely with the age of the woman. This may be due to a number of reasons. First, older women in fact do not recall the occurrence of births. Secondly, it is also possible that in some cultures they are reluctant to mention children who have died. Thirdly, they may not be aware that they are supposed to list births of children who have grown up and left home. It is possible that the more remote births are not as susceptible to omission when data are collected in detailed fertility histories as when data are collected from a simple question on the number of children ever born. In the Nepal Fertility Survey there was a

Table 115. Cumulative proportions of women ever married by successive ages, by current age group, Nepal Fertility Survey, 1976[a]

Exact Age	Proportion ever married by age Current age Group						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
9	0.004	0.008	0.004	0.007	0.011	0.000	0.008
10	0.020	0.041	0.048	0.051	0.046	0.056	0.065
11	0.041	0.077	0.099	0.099	0.073	0.089	0.109
12	0.095	0.129	0.157	0.166	0.120	0.170	0.135
13	0.164	0.209	0.251	0.243	0.196	0.243	0.198
14	0.241	0.311	0.351	0.368	0.306	0.326	0.282
15	0.350	0.413	0.479	0.493	0.435	0.423	0.406
16		0.523	0.584	0.603	0.543	0.547	0.517
17		0.637	0.656	0.686	0.632	0.634	0.630
18		0.736	0.756	0.753	0.713	0.708	0.718
19		0.736	0.803	0.808	0.772	0.758	0.755
20		0.796	0.852	0.861	0.822	0.828	0.811
21		0.854	0.892	0.890	0.865	0.864	0.858
22			0.918	0.916	0.896	0.906	0.888
23			0.948	0.942	0.916	0.929	0.912
24			0.957	0.955	0.937	0.939	0.928
25				0.963	0.952	0.946	0.945
26				0.969	0.957	0.954	0.951
27				0.975	0.965	0.963	0.961
28				0.981	0.973	0.967	0.969
29				0.981	0.981	0.975	0.971
30				0.983	0.984	0.982	0.973

a Proportions ever married by successive ages are calculated using data on age at marriage from ever-married women in the intensive survey and data on proportions ever married by age among all women from the household survey.

Table 116. Mean age of first marriage for those women married by age 25 and singulate mean age of married (SMAM) derived from fitting model marriage schedule to cumulative first marriage experience [a] by cohort, Nepal Fertility Survey, 1976

Current age of cohort	Mean age of marriage (for marriages before age 25)	SMAM from model schedule
20-24	-	16.4
25-29	15.7	16.0
30-34	15.6	15.8
35-39	16.1	16.5
40-44	15.8	16.4
45-49	16.1	16.6

a Model first marriage schedules are fitted to the curves of reported proportions ever-married by successive ages (up to the age at survey), for each cohort, by a least-squares optimization programme. Although the marriage experience of each cohort is truncated at the current age of the cohort, the fitted model schedule provides estimates of the remainder of first marriage experience and thus SMAM is based on estimated first marriage frequencies throughout a cohort's lifetime.

reconciliation between the total number of children reported as ever born (based on separate questions on children who were still at home, children who were no longer living at home, and children who had died), and the total of the individual births reported in the intensive fertility history. There are very clear indications that births were omitted from the fertility histories in the survey.

The total number of children ever born to women by single years of age (as reported in the survey) is compared with the cumulation of the age-specific fertility schedule constructed from births in the past year (also by single years of age) in table 117 and figure 13. If fertility had remained constant during the years preceding the survey, and if all births had been reported, the cumulative fertility of each cohort would agree with the cumulation to the same age of fertility rates of the year preceding the survey. It will be noted that the two curves are in good agreement at ages up to the early twenties, suggesting that the reference period of a year seems to have been perceived almost correctly by the respondents. However, the two curves depart increasingly from one another with rising age (with exceptional points such as age 29, 38 and 49).

Age misreporting can disturb the proper sequence of reported parity by age in several ways. If the misreporting of age is independent of the actual parity of the woman, then a shifting of age upward to a heaped age would result in an understatement of fertility at the heaped age, while a shifting downward to a heaped age would result in an overstatement of fertility. On the other hand, if the estimation of a woman's age is linked to her parity, the tendency on the part of the interviewer would be to increase the estimated ages of women with particularly high parity. This might result in overstated parity at the heaped ages (i.e., ages divisible by two or five) and would result in a concomitant understatement at those ages from which the women were displaced (i.e., ages not divisible by two or five). Finally, if there is a tendency for respondents to omit children at older ages, this tendency might be stronger among those women who did not know their ages. These women will be concentrated in the heaped ages.

Among to Goldman's analysis given in table 118, the average values of reported parity at the young heaped ages, especially 20 and 25, are above the average of the values of the neighbouring two ages. It is suspected that these above-average reported parties are due to age misreporting: for

Table 117. Reported number of children ever born per woman [a] compared with number from synthetic births, last year schedule, by single years of age, Nepal Fertility Survey 1976

Age	Reported	Synthetic	Difference [b] (synthetic-reported)
15	0.01	0.05	0.04
16	0.04	0.12	0.08
17	0.17	0.24	0.07
18	0.31	0.39	0.08
19	0.53	0.61	0.07
20	0.91	0.86	-0.05
21	1.12	1.11	-0.01
22	1.45	1.42	-0.03
23	1.66	1.77	0.11
24	1.88	2.07	0.20
25	2.53	2.40	-0.13
26	2.66	2.74	0.09
27	2.87	3.03	0.16
28	3.01	3.32	0.31
29	3.65	3.58	-0.07
30	3.70	3.84	0.15
31	3.91	4.14	0.23
32	4.19	4.41	0.22
33	4.70	4.68	-0.03
34	4.70	4.91	0.21
35	4.65	5.09	0.44
36	4.86	5.29	0.43
37	5.26	5.50	0.24
38	5.38	5.69	0.31
39	5.60	5.86	0.26
40	5.20	5.95	0.75
41	5.86	6.05	0.20
42	5.47	6.15	0.68
43	6.03	6.20	0.17
44	5.80	6.25	0.46
45	5.25	6.29	1.04
46	5.87	6.32	0.45
47	6.00	6.33	0.34
48	5.83	6.35	0.52
49	6.36	6.37	0.01

a In the calculation of children ever born per woman, the numbers of ever-married women are inflated by proportions ever married in order to estimate CEB for all women.

b Numbers may disagree in the last decimal place owing to round-off error.

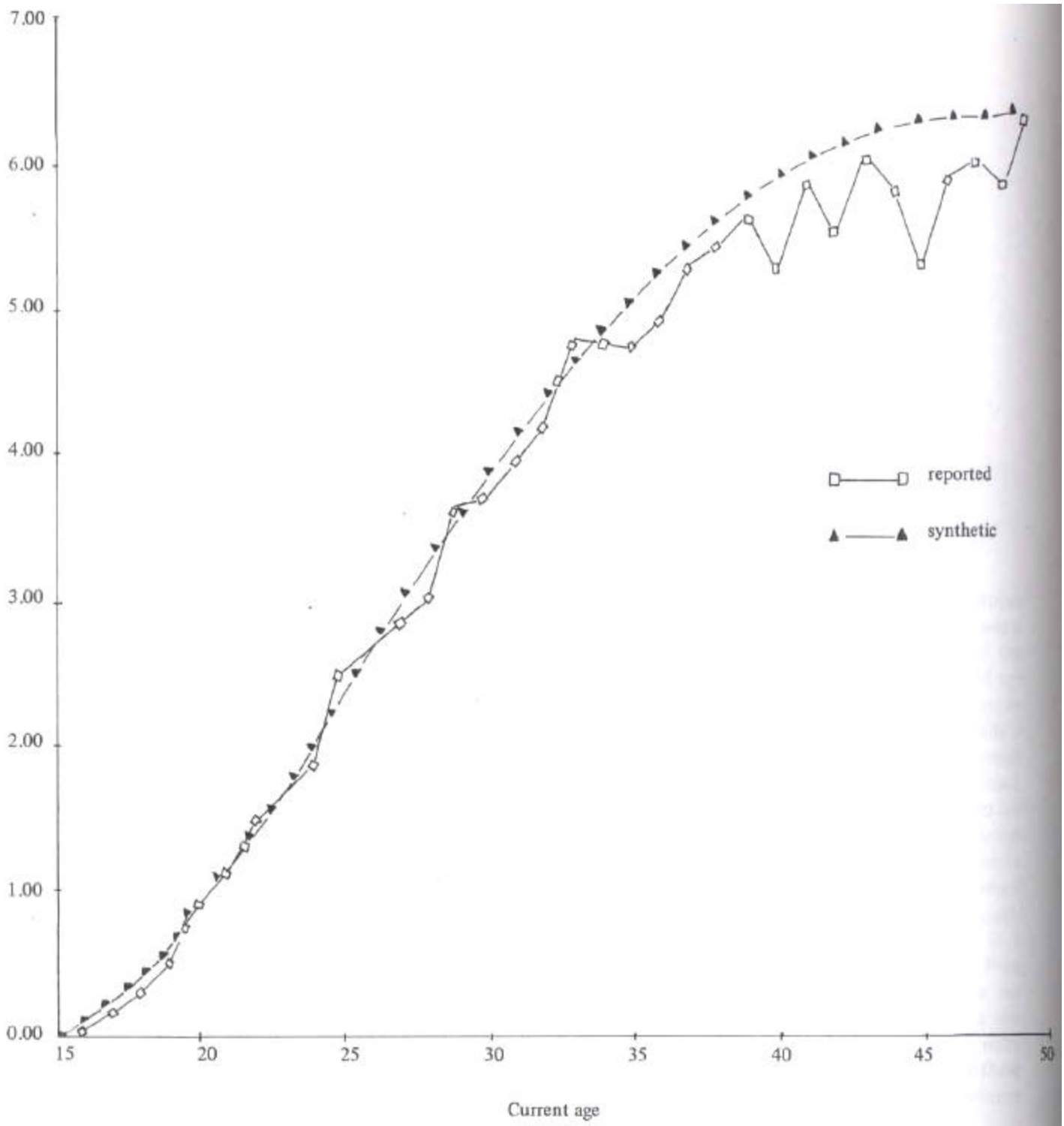


Figure 13. Reported number of children ever born per woman and number from synthetic births, last year schedule, by single year of age, Nepal Fertility Survey, 1976

Table 118. Reported number of children ever born (CEB) per ever-married woman, by five-year age group, for women who know and women who do not know their dates of birth, Nepal Fertility Survey, 1976

Current age group	Date of Birth unknown		Date of birth known	
	CEB	Number of women	CEB	Number of women
15-19	0.31	603	0.38	141
20-24	1.41	1028	1.61	199
25-29	2.90	965	2.93	177
30-34	4.11	740	4.06	115
35-39	5.02	677	5.59	59
40-44	5.52	651	5.65	69
45-49	5.70	481	6.29	35

example, some women above age 20 (who would normally have higher parity than 20-year-olds) are wrongly transferred down to age 20 and some younger women are falsely moved up to 20 partly because they already had one or more children.

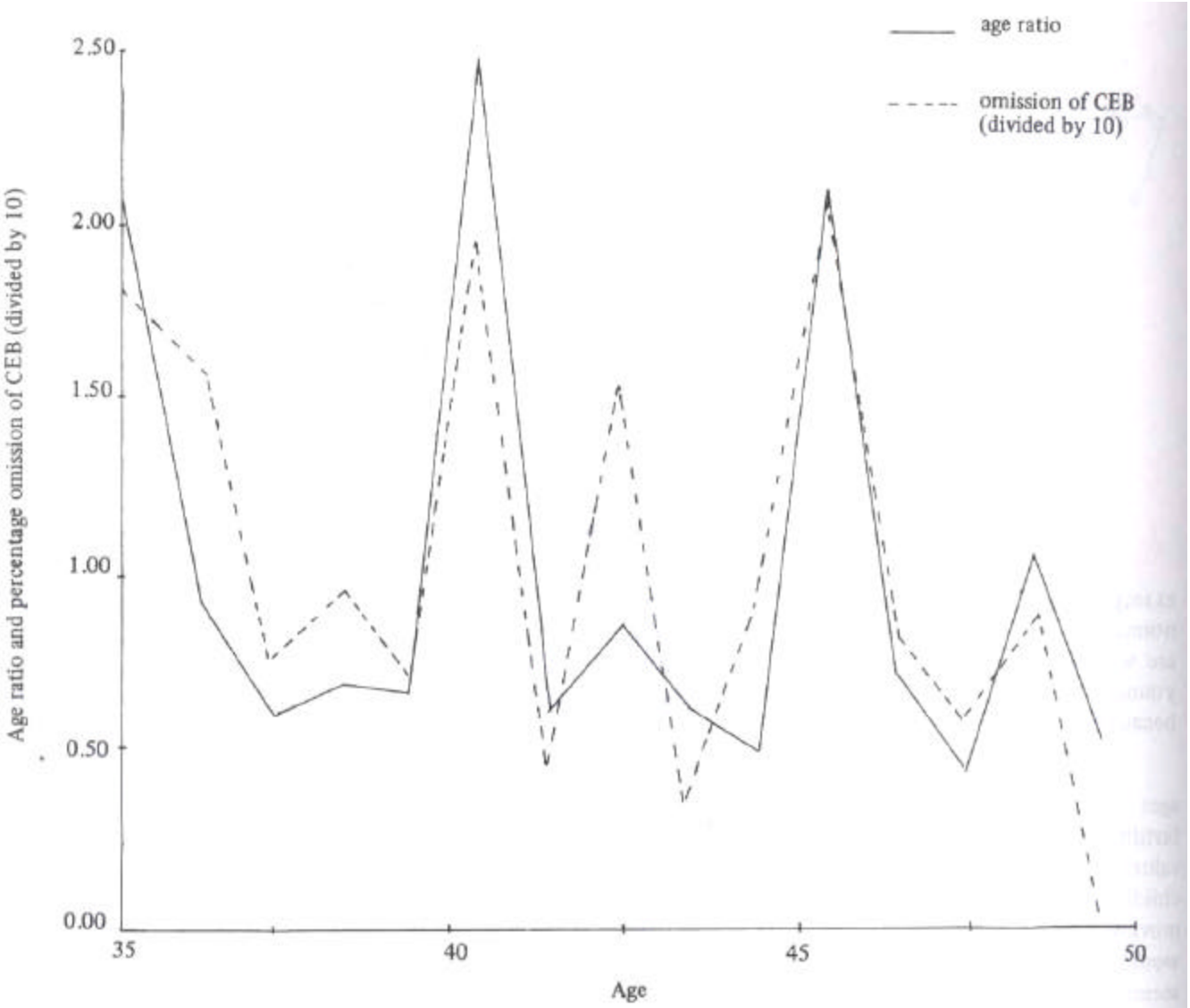
Above age 30, on the other hand, the heaped ages of 35, 40 and 45 have cumulative cohort fertilities that fall below the cumulated period values by an especially large margin. The annual childbearing rates at these ages are so modest that moving women from nearby ages to a heaped age would have only a moderate distorting effect. It seems likely that the increasing deficiency in reported parity is the result of an especially large omission by women whose age is reported at a heaped number, or more generally, by women who do not know their ages.

The reported cumulative fertility, by five-year age intervals, for women who reported their date of birth is compared with that for women who could only estimate their current age in table 118. for each age interval, cumulative fertility for those women who report their date of birth is either approximately equal to or greater than the corresponding value of reported fertility for women who do not know their date of birth. These data support the proposition that women who could not supply a date of birth were more likely to omit births from their fertility histories than were women who reported a date of birth.

The hypothesis that women who did not know their ages were more apt to omit births was tested by comparing the amount of age heaping, for each age over 30, with the extent of omission in the reported numbers of children ever born for the corresponding ages. it was assumed that fertility had been unchanging, so that the true cumulative fertility for each cohort could be approximated by the cumulated fertility rates derived from births in the past year. The amount of omission for each cohort by the difference between the two curves in figure 13 has been measured.

Figure 14 shows the age ratio for each age between 30 and 49 (i.e., the reported number at a given age divided by a seven-year moving average for that age, obtained from numbers of females in the household survey) plotted against an estimate of the proportion of births omitted by women of the same ages. the latter quantity was calculated as the ratio of the number of births omitted to the cumulative fertility at an age ten years less(derived from births in the last year). It was assumed that no births occurring in the most recent ten-year period had been omitted.

The correlation between the age ratio and the proportion of births omitted is striking, yielding a Pearson correlation coefficient of 0.83. This agreement confirms the hypothesis that the source



Notes: 1. Age ratios are calculated as the number in specified single year age group related to the seven-year moving average for that age group.

2. The percentage of omission for each cohort is calculated as the number of children omitted divided by the number of children the cohort was expected to have had 10 years earlier, according to the synthetic births, last year schedule.

Figure 14. Age ratios for female population in the Household Survey and percentage of omission of children ever born (CEB), Nepal Fertility Survey, 1976

of the varying difference between cumulated cohort fertility and cumulated period fertility is the omission of births, especially by older women who report ages at heaped numbers, i.e., those women who, in general, misreport their ages.

The reported cohort fertility was corrected for omissions by assuming that the difference between period and reported fertility for cohorts above age 30 is the result of omission of the more remote births. Specifically, it was assumed that omissions were a fixed proportion of all births occurring more than ten years prior to the survey date, and that there was a linear increase from a zero omission rate five years back to the estimated omission rate ten and more years back. The estimated omission rates ten and more years back, by age, are given in table 119, the omission rates by age for the period five to ten years prior to the survey were estimated as half of these numbers. This adjustment in the reported fertility histories results in the reported number of children ever born for each cohort being equal to the period cumulative fertility (derived from births in the past year). The adjusted fertility histories were used to investigate the extent of displacement in the reporting of dates of births.

(b) *Evidence for event displacement in the detailed fertility history*

Not all of the peculiar features of data reconstructed from the birth histories can be readily explained in terms of omission of remote events. For example, it will be seen from table 120, which shows reported cumulative fertility by successive ages for five-year cohorts, that the cohort aged 25-29 had 0.77 births by exact age 20 whereas the cohort aged 45-49 had only 0.52 births as of the same age. The omission of early births could account for some of this difference of 0.25 births; however, an omission rate as large as 32 per cent would be required to bring the reported parity by age 20 of the cohort now aged 45-49 into line with that for the cohort now aged 25-29. Since there is reason for supposing that the older cohort was married at younger ages, differences in proportions married between the two cohorts would operate in the opposite direction. It will be noted from figure 15, which presents these data graphically, that except for the youngest ages, the cumulative fertility curves for successive cohorts do not even

Table 119. Estimated omission of children ever born as a percentage of number of children reported in fertility history by ten years prior to survey date, for women aged 30-49, Nepal Fertility Survey, 1976

Current age	Omission rate of births more than then years prior to survey
30	10.1
31	13.7
32	11.0
33	0.0
34	7.9
35	16.2
36	14.4
37	7.0
38	8.6
39	6.4
40	20.0
41	4.4
42	15.8
43	3.4
44	9.3
45	23.3
46	8.6
47	6.1
48	9.6
49	0.1

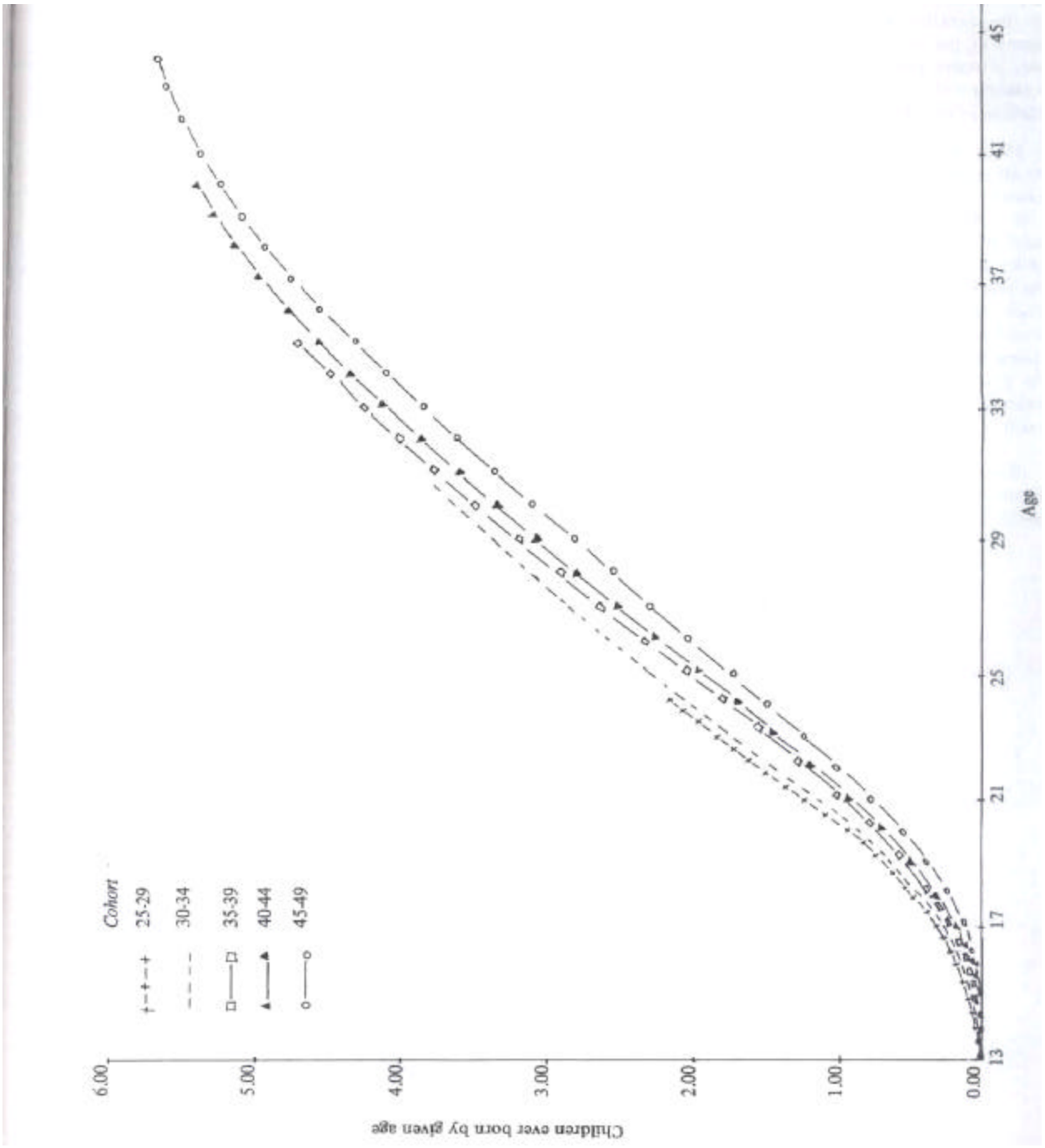
overlap: the older the cohort at the time of the survey, the lower their parity as of a specified age in the past. The simplest explanation of these data is that the older women not only omitted early births but also overstated the ages at which their earlier births occurred; in other words, respondents displaced dates of birth in the direction of the survey date.

Under the assumption of no change in fertility, the mean age of childbearing should be invariant by cohort, and equal to the mean age of

Table 120. Reported number of children ever born per woman by successive age, by current age group, derived from fertility histories of ever-married women [a], Nepal Fertility Survey, 1976.

Exact age	Current age group					
	20-24	25-29	30-34	35-39	40-44	45-49
13	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.01	0.01	0.01	0.01	0.00
15	0.03	0.03	0.03	0.03	0.04	0.02
16	0.07	0.09	0.09	0.07	0.08	0.03
17	0.17	0.18	0.19	0.17	0.15	0.09
18	0.30	0.35	0.33	0.30	0.26	0.20
19	0.48	0.54	0.52	0.47	0.43	0.34
20	0.72	0.77	0.74	0.67	0.62	0.52
21		1.04	1.00	0.88	0.85	0.72
22		1.31	1.25	1.14	1.11	0.96
23		1.62	1.54	1.39	1.36	1.18
24		1.92	1.82	1.68	1.62	1.44
25		2.19	2.11	1.95	1.88	1.67
26			2.44	2.26	2.18	1.98
27			2.74	2.57	2.45	2.24
28			3.03	2.84	2.72	2.48
29			3.31	3.11	2.99	2.76
30			3.57	3.43	3.26	3.03
31				3.70	3.51	3.29
32				3.94	3.78	3.56
33				4.18	4.03	3.79
34				4.41	4.25	4.04
35				4.64	4.48	4.24
36					4.67	4.49
37					4.88	4.68
38					5.04	4.87
39					5.19	5.02
40					5.32	5.17
41						5.32
42						5.43
43						5.53
44						5.59
45						5.65
Number of births	1761	3328	3506	3727	3981	2962
Number of ever-married women	1226	1146	855	736	720	516

a When estimating numbers of children per woman, the number of ever-married women in each age group is divided by the proportion of women in that age group who have ever been married (estimated from the Household Survey) in order to obtain an estimate of the total number of women in each age group.



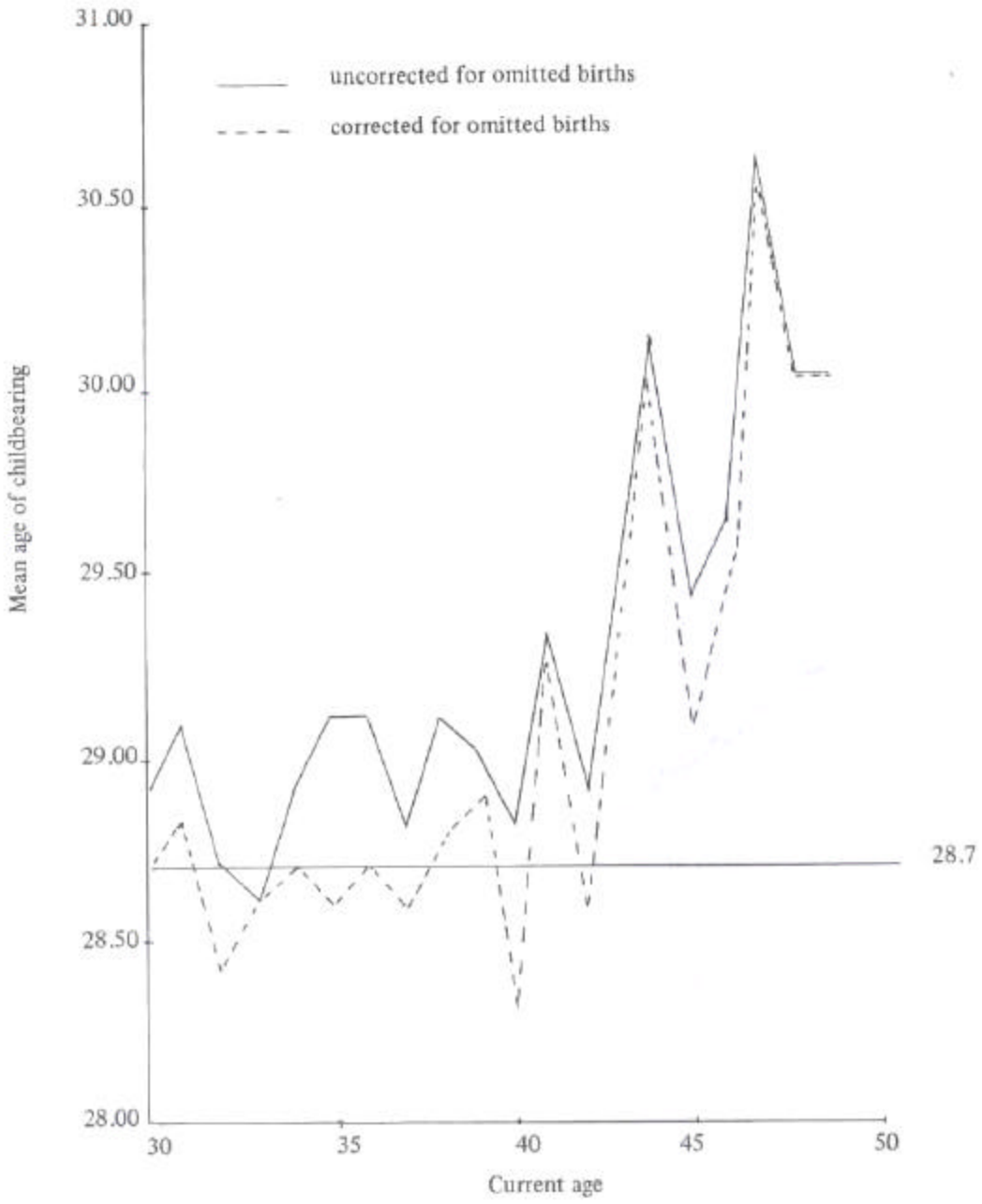
childbearing of 28.7 years of the synthetic fertility schedule constructed from births in the past year. Since the fertility experience of each cohort is truncated at the current age of the cohort, in each cohort, current period age-specific fertility rates were assigned at ages above their current age in the calculation of the mean age of childbearing.

Mean ages of childbearing are shown in figure 16, with and without inflation of births five and more years age for estimated omissions. It will be noted that even after corrections for omitted births, themean ages of childbearing of the older cohorts are substantially higher than those of the younger cohorts and of the period fertility schedule. Whereas the fertility histories (after corrections for omissions) for women in their

thirties at survey date yield a mean age very close to that of the period schedule (28.7 years), the histories for women in their forties yield mean ages considerably higher than 28.7 years.

Reported cumulative fertility schedules (corrected for omissions) are compared with the synthetic period cumulative fertility schedule for the cohorts aged 38 in figure 17 and for cohorts aged 48 in figure 18. (These two cohorts had approximately the same omission rates). These figures further illustrate the displacement of births by women in their forties, contrasted with the approximately correct timing of births (once births have been corrected for omissions) by women in their thirties.

The 49-year-olds in the survey reported a cumulated cohort fertility nearly as high as that constructed from the synthetic period schedule (i.e., they have an omission rate of only 0.1 per cent; see table 115). The age-specific fertility rates reconstructed from the fertility history of the 49-year-olds are compared with the schedule derived from births in the past year in figure 19. (Each schedule has been smoothed by taking a five-year moving average.) A clear indication of a time shift of fertility towards the later ages can be noted. A fertility schedule representing the effect of age displacement (towards older ages) in reported fertility is reproduced in figure 20. The similarity between the two sets of curves is striking.



Note: Completed fertility schedules consist of reported age-specific fertility rates up to current age of cohort together with rates from the synthetic schedule for remaining ages through age 49.

Figure 16. Mean age of childbearing for completed fertility schedules, with and without corrections for omitted births, by single-year cohorts aged 30-49, Nepal Fertility Survey, 1976

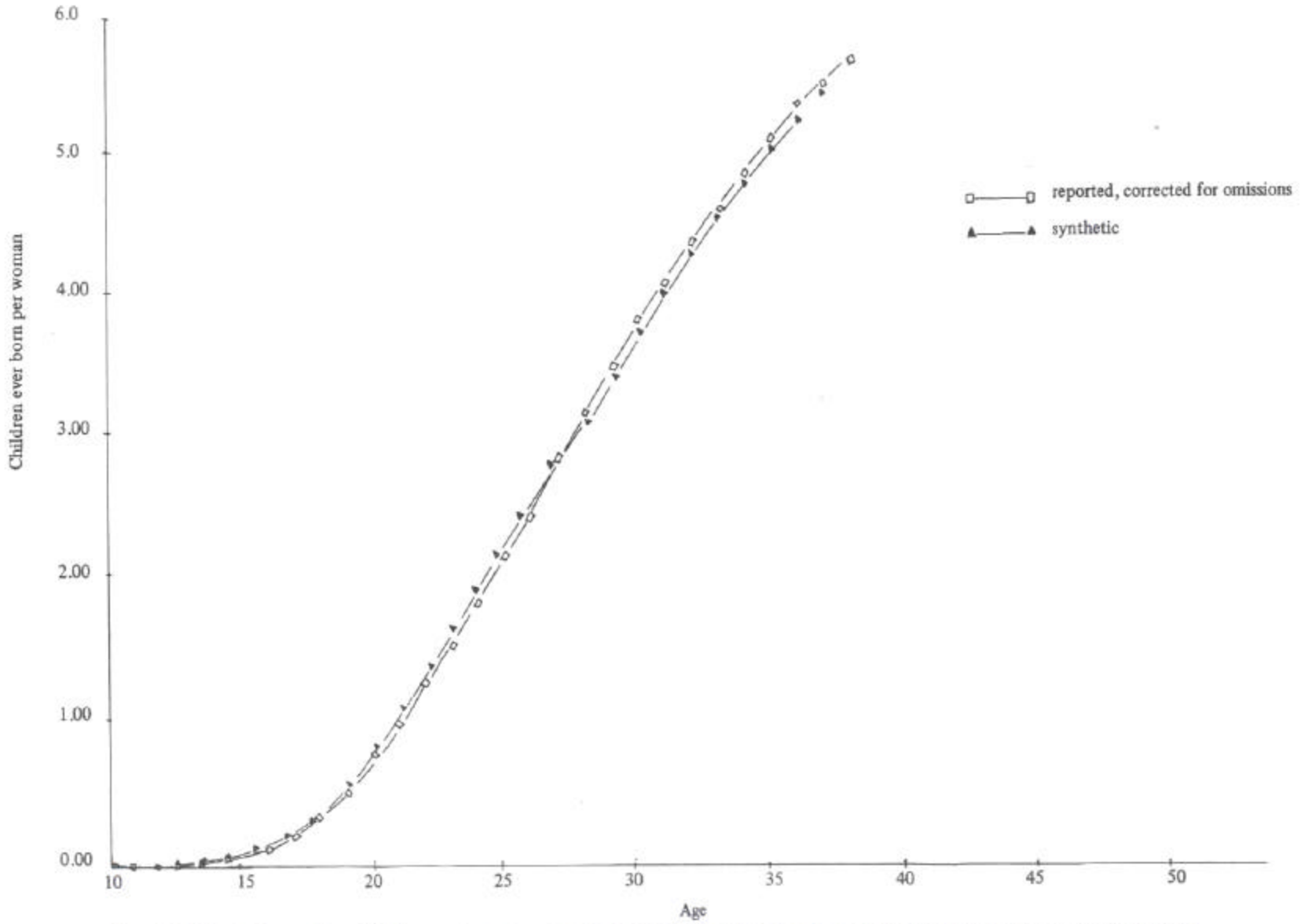


Figure 17. Cumulative number of children ever born per woman in the reported fertility history corrected for omissions and in the synthetic births, last year schedule, 38-year-old women, Nepal Fertility Survey, 1976

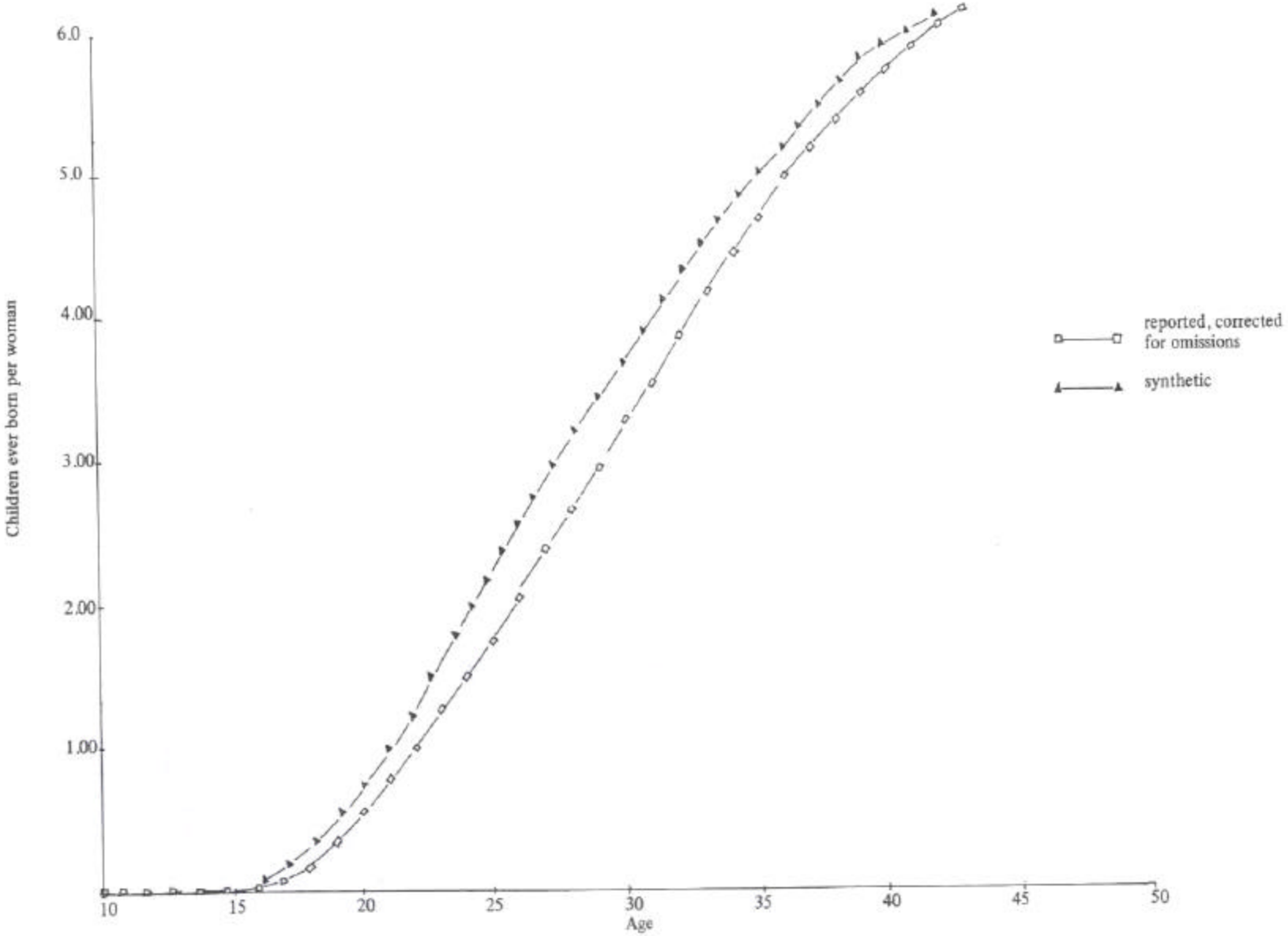
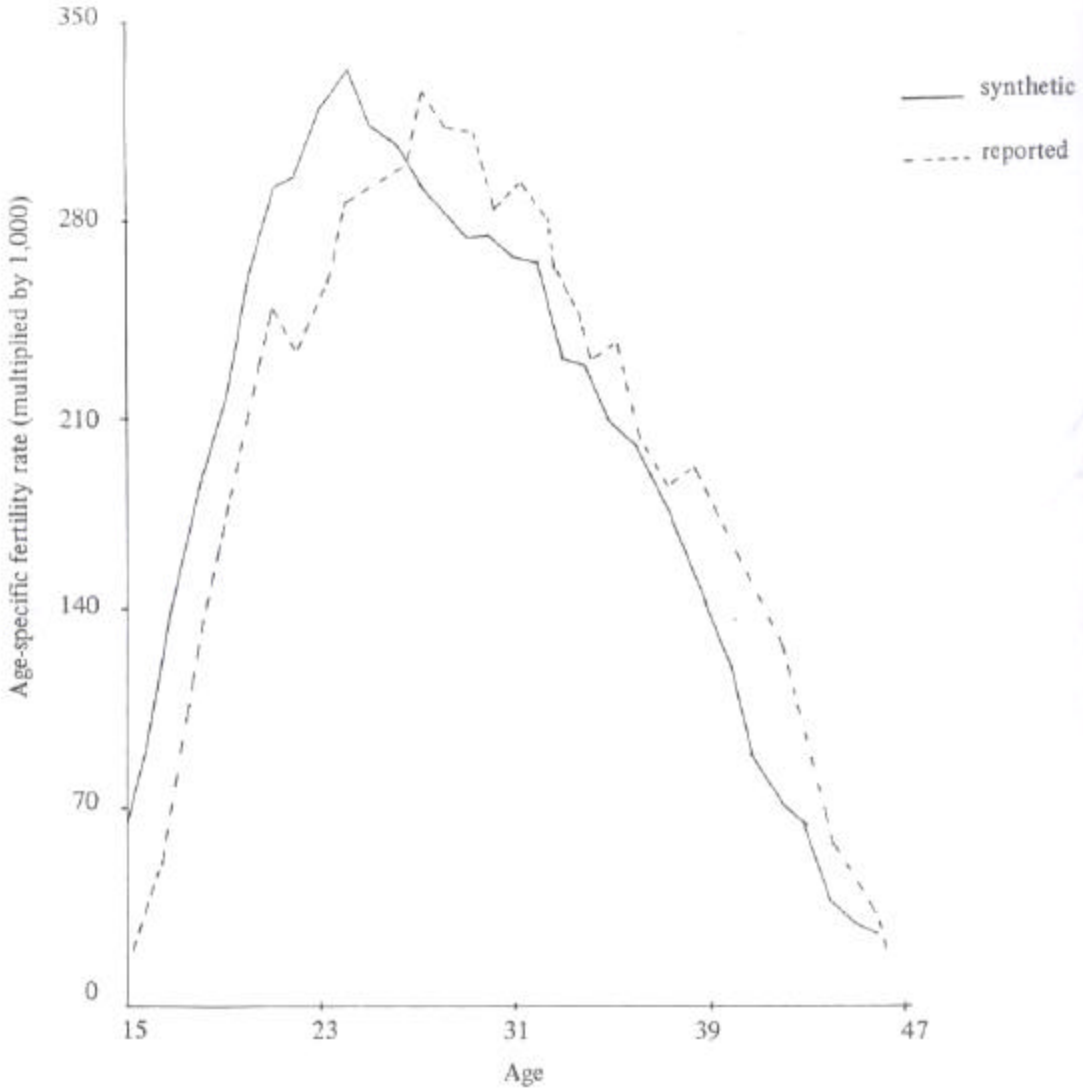
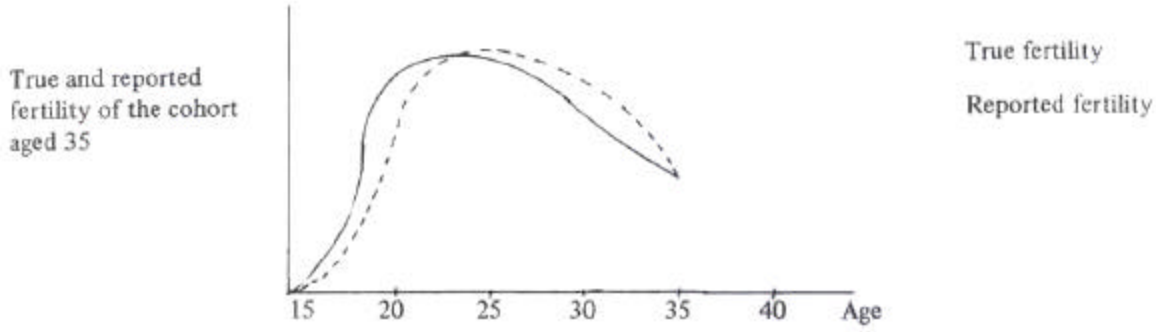


Figure 18. Cumulative number of children ever born per woman in the reported fertility history corrected for omissions and in the synthetic births, last year schedule, for 48-year-old women, Nepal Fertility Survey, 1976



Note: Age-specific fertility rates for both schedules are calculated as five-year moving averages.

Figure 19. Age-specific fertility rates from synthetic schedule and as derived from fertility histories of 49-year-old women, Nepal Fertility Survey, 1976



Source: J.E. Potter, "Problems in using birth-history analysis to estimate trends in fertility", *Population Studies*, vol. 31, No. 2, p. 339.

Figure 20. True and reported age-specific fertility rates for a cohort of older women who displace dates of births towards the present