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The Quality of Data in the Nepal Fertility Survey

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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.
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Acknowledgements

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1 Introduction

The Nepal Fertility Survey (NFS) was conducted in 1976 in cooperation with the World Fertility Survey primarily to obtain reliable estimates of recent levels and trends in fertility. The Household Survey and the Individual Questionnaires collected in the Nepal Fertility Survey contain extensive detailed demographic data, much of which had never before been obtained in Nepal. The Household Survey collected information on the age and marital status of the male and female population; the detailed individual questionnaire, administered to 5,940 ever-married women between age 15 and 49, obtained information on the date of marriage, the date of birth of each child born to the respondent, and the dates of death for children who died, in addition to demographic data on family planning and breastfeeding practices.

Accurate data in the detailed fertility histories would make it possible to estimate age at marriage, age specific and duration specific fertility rates infant and child mortality rates, and the distribution of interbirth intervals, not only for the year prior to the survey, but for a period of fifteen or twenty years prior to the survey. Owing to a real scarcity of reliable demographic data in Nepal, it would be particularly desirable to obtain such demographic measures. However, it is first necessary to examine the extent of response error in the survey so as to determine the usefulness of these measures. Data collected in Nepal prior to the NFS – data in the 1961 and 1971 Censuses and in the 1974-75 and 1976 Demographic Sample Surveys – contain clear evidence of misreporting of various kinds by the Nepalese population. Respondents have little knowledge of their age and marital duration, or of the dates of vital events (e.g. births and deaths of their children). In addition, respondents tend to omit and displace vital events. As a result, each of the previous demographic sources has produced an obviously low estimate of the fertility rate (His Majesty's Government Health Ministry, 1977).

An investigation of the quality of data in the Nepal Fertility Survey has been carried out during the past year at the Office of Population Research at Princeton University by Noreen Goldman, Ansley Coale, and Maxine Weinstein. The purpose of this analysis has been to examine the accuracy of the individual responses in the NFS in order to determine the extent of response error and its effect on different demographic measures. The analysis has demonstrated the existence of biases in the NFS and, in some instances, has provided estimates of demographic measures that are substantial improvements over those derived from reported data. The investigation has also shown that, in spite of the physical difficulties in operating a survey in Nepal, the limited number of trained researchers, and respondents' lack of knowledge of the dates of their vital events, the quality of data in the NFS is a remarkable improvement over that previously obtained from the censuses and from the recent Demographic Sample Surveys.

We initially hoped that this report would serve as a guideline for quality-of-data analyses in other World Fertility Surveys, but it soon became evident that many methods used here are not generalizable. For example, the detection of bias in the birth histories depends on the assumption of an absence of a substantial trend in fertility, and the detection of bias in the marriage histories depends on the existence of census data on marital status. More generally, many demographic estimates derived from the NFS could not be substantiated due to the absence of vital registration data and the scarcity of reliable survey and census data in Nepal. In countries in which conventional demographic data are extensive, the analysis would be very different from that presented here.

Although we now realize that this analysis cannot serve as a model for other countries, it has demonstrated the importance of a critical scrutiny of the data. We suggest that the quality of data in each of the World Fertility Surveys be analyzed in a way appropriate to the particular country and hope that with further experience in these types of analyses a set of models for testing data quality will be developed.

1.1 TYPES OF RESPONSE ERROR

There are various types of response error that can distort the demographic measures one would like to estimate from the NFS. For the purposes of this analysis, the errors can be classified according to the trichotomy below:

1) Misreporting of Age and Durations (most prominently heaping on preferred numbers)
2) Displacement of Vital Events
3) Omission of Vital Events

A common form of error in the Nepal Fertility Survey is misreporting of current age and current duration of marriage. The Nepalese population presents a severe challenge to any effort to determine exact ages and dates, since it is clear that the majority of Nepalese do not keep a calendar and often do not know age, even approximately. In general, the respondents in the NFS were not able to recall their own date of birth or date of first marriage, and instead the respondents, or the interviewers, estimated ages and marital durations, often with numbers divisible by two or five. Such 'heaping' on preferred digits is also prevalent in the reporting of age of death for infants and duration of breastfeeding.

A second type of error is inaccurate reporting of the date of a past event – event displacement. Event displacement may arise from misreporting of the duration of an interval: e.g. the lifetime of a child who died or the interval between successive births. Displacement of vital events can cause an apparent concentration or attenuation in the frequency of events allocated to particular periods in the past. For example, event displacement can cause too many births or deaths to be reported in a particular period in the past at the expense of events that should have been reported at other times. As a result, displacement of births and of infant deaths can cause a false impression of the time pattern of fertility and of the age pattern of infant mortality.

The third common form of error in surveys is the omission of past events in the detailed histories provided by each respondent. Older women may fail to report births that occurred in the more remote past, possibly because of a lapse of memory, or more likely because of a misunderstanding of the intent of the questionnaire (e.g. in failing to report a child who died or left home). As with event displacement, omissions can create a false impression, not only of the level of fertility or child mortality, but also of trends, since typically the omissions are more frequent in the more remote past. Omissions distort the reconstructed

pattern of births by age and by birth order: the omission of births in the distant past creates an understatement of fertility at early ages in the older cohorts, and, for example, omission of first births leads to the recording of second births as first births, etc. Similarly, the omission of first marriages leads to the recording of second marriages as first ones, thereby distorting data on age at first marriage.

These different forms of response error are interrelated. For example, misreporting of age in the form of heaping on preferred digits is indistinguishable from the displacement of a vital event – the respondent's birth date. Similarly, as described in the paragraph above, omissions of early births and of early marriages cause event displacement of birth dates by parity and of date of first marriage, respectively. These different errors are further related by the fact that the same respondents tend to exhibit more than one form of misreporting. For example, it will be shown in the next section that respondents who report ages with preferred numbers (most of whom do not know their ages) are also more likely to report heaped durations of marriage. Moreover, these same respondents are more apt, at least at older ages, to omit children from the birth histories.

The remaining two sections of the paper will be concerned with the extent to which these three types of response error appear in the Nepal Fertility Survey and their influence on various demographic estimates. Section II provides a discussion of the degree of misreporting of age and marital duration, in particular the extent of heaping on preferred numbers. In addition, heaping on the reported duration of breastfeeding and on the month of death for infant and child deaths is analyzed. Section III offers an analysis of the extent of event displacement and omission of vital events in the Individual Questionnaires. Since these two types of error often occur together and interact to distort the fertility and nuptiality histories, they are discussed simultaneously. The discussion in Section III is divided into three parts – (1) Nuptiality, (2) Fertility, and (3) Infant and Child Mortality. In each part, the prevalence of event displacement and omission and the effects on the relevant demographic estimates are analyzed for both the recent past and for periods dating as far back as 20 or 25 years.

The basic methodology used to derive demographic estimates from data contained in the detailed fertility and marriage histories is presented in Appendix I. A brief analysis of interbirth intervals is given in Appendix II. An assessment of the extent of misreporting in the fertility histories, undertaken by Rod Little of the World Fertility Survey staff, is described in Appendix III.

2 Misreporting of Age and Durations

2.1 AGE MISREPORTING

Because the most important demographic analyses derived from the survey are based on information from female respondents, only the female age distribution is analyzed below. In Figure 1,the per cent distribution by single years of age of females in the Household Survey is shown, and in Figure 2 this distribution is compared with the corresponding female age distribution from the 1971 Census of Nepal. It is evident that in both distributions, 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. However, the degree of misreporting (measured by heaping on preferred numbers) is lower in the NFS than in the 1971 Census.

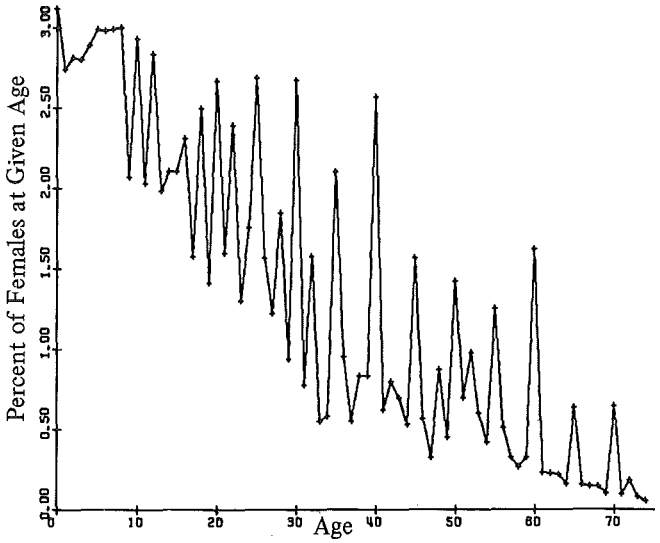

Figure 1 Reported Single-year Age Distribution of Females for Ages 0-74 (in percents), Household Survey (Nepal Fertility Survey, 1976).

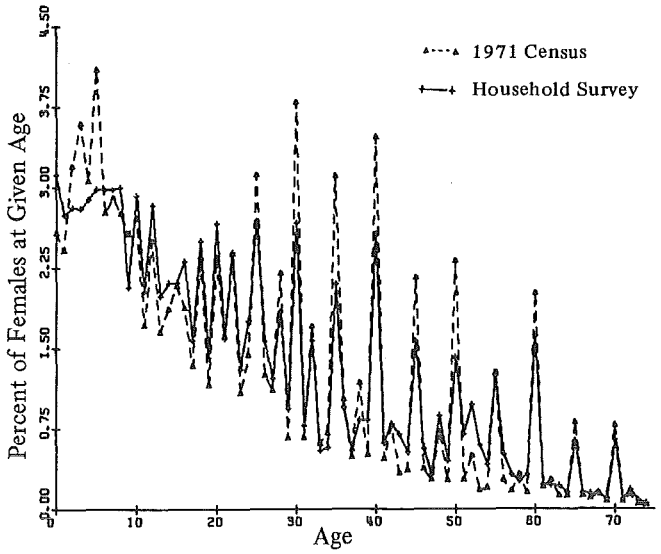

Figure 2 Reported Single-year Age Distributions of Females for Ages 0-74 (in percents), Household Survey (Nepal Fertility Survey, 1976) and 1971 Census of Nepal.

When the age distribution is expressed in five-year age intervals, rather than in single-year intervals, the degree of misreporting appears to be considerably lower. In Figure 3, the distribution of females in the Household Survey is compared with a stable population (a West model stable population with an expectation of life of 40 years and the same proportion of the population under 35 years as in the reported distribution; Coale and Demeny, 1966). The usual features of South Asian and Tropical African reported age distributions are much less prominent in the Nepal Fertility Survey than in the Nepalese or Indian Censuses. That is, the large deficits at ages 10-14 and 15-19 and surpluses at 25-34, noted frequently in these populations (United Nations, 1967), are either absent or of relatively small magnitude. It appears that the use of better-trained enumerators, longer interview time, and greater supervision considerably reduced the degree of age misreporting.

It has been conjectured that the similarities in reported age distribution among countries in South Asia and Tropical Africa result from estimation of age by the interviewer or persons other than the respondent. It has been further suggested that the biases in reported age distributions may result from external clues such as appearance, sexual maturation, marital status and parity. For example, there is

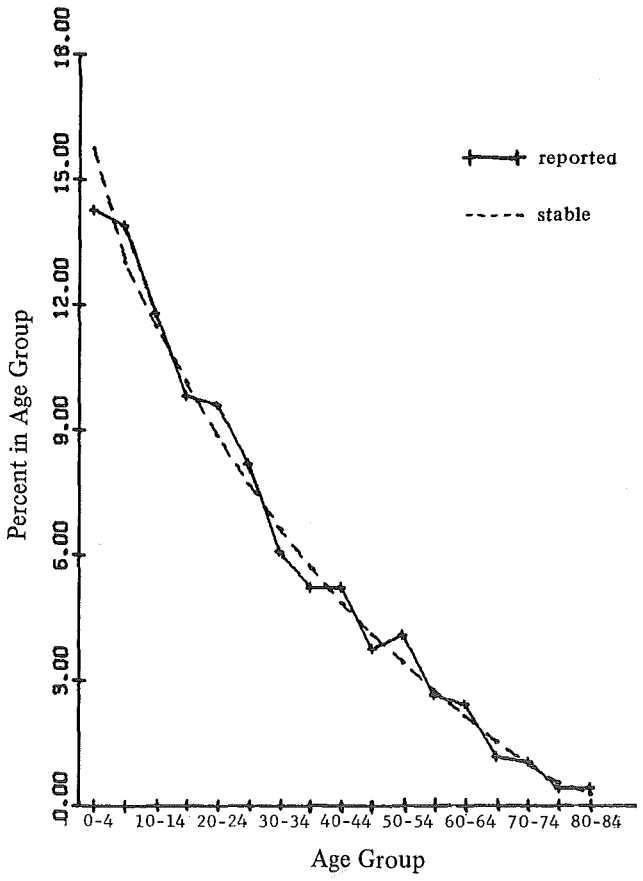

Figure 3 Percent Distribution of Female Population by Five-year Age Groups as Reported (Household Survey) and as Fitted by a Stable Population (West Mortality level 9, r = 0.0187; Coale and Demeny, 1966).

a tendency to overestimate age for younger women who are married, particularly for women with several children.
The table that follows shows proportions of females ever married (from the Household Survey) and average parity per women (estimated for all women, by including never-married women in the denominator), by single years of age between ages 18 and 22, from the Nepal Fertility Survey:

Age	Per cent Ever Married	Number of Children Ever Born
18	77.7	0.31
19	81.1	0.53
20	92.8	0.91
21	89.2	1.12
22	94.4	1.45

Note that the proportion of women ever married at age 20 is above even the reported value at age 21. Similarly, average parity of 20-year old women is considerably greater than the average value for 19- and 21-year olds. It is very likely that the ages of married women in their late teens are over-estimated by being 'pushed up' to age 20; as a result, there is an understatement of proportions ever married at younger ages and an excess at age 20. Similarly, it appears probable that younger ages are differentially misstated according to a women's parity: e.g. some women in their late teens who have already attained a parity of two may have their age overstated to age 20 because of their parity. The relation between age misreporting and parity is discussed further on p. 22.
Figure 4 shows the age distribution of ever-married women in the age range of 15-59 – i.e. women interviewed in the individual survey. All women participating in the individual survey were initially asked their date of birth (and their age was then estimated by subtraction from the date of survey); respondents who could not supply a date were subsequently asked to estimate their current age. Of the 5,940 ever-married women in the individual survey, only 795 or 13 per cent reported a date of birth. Figure 4 compares the age distribution of those women who supplied a date of birth with women who could only estimate their current age. Despite the much smaller number of women who reported their date of birth, leading to larger chance fluctuations, their age distribution is considerably more regular, with less heaping on numbers divisible by two and five. Nevertheless, even for these women, the age distribution peaks at certain preferred ages, such as 20 and 25.
Figure 5 compares the single-year age distribution of the female population in the Hill and Mountain areas with the population in the Terai. Although the respondents in both areas exhibit a considerable degree of age misreporting, the greater extent of age heaping in the Terai region is clearly visible, especially at ages below 30.

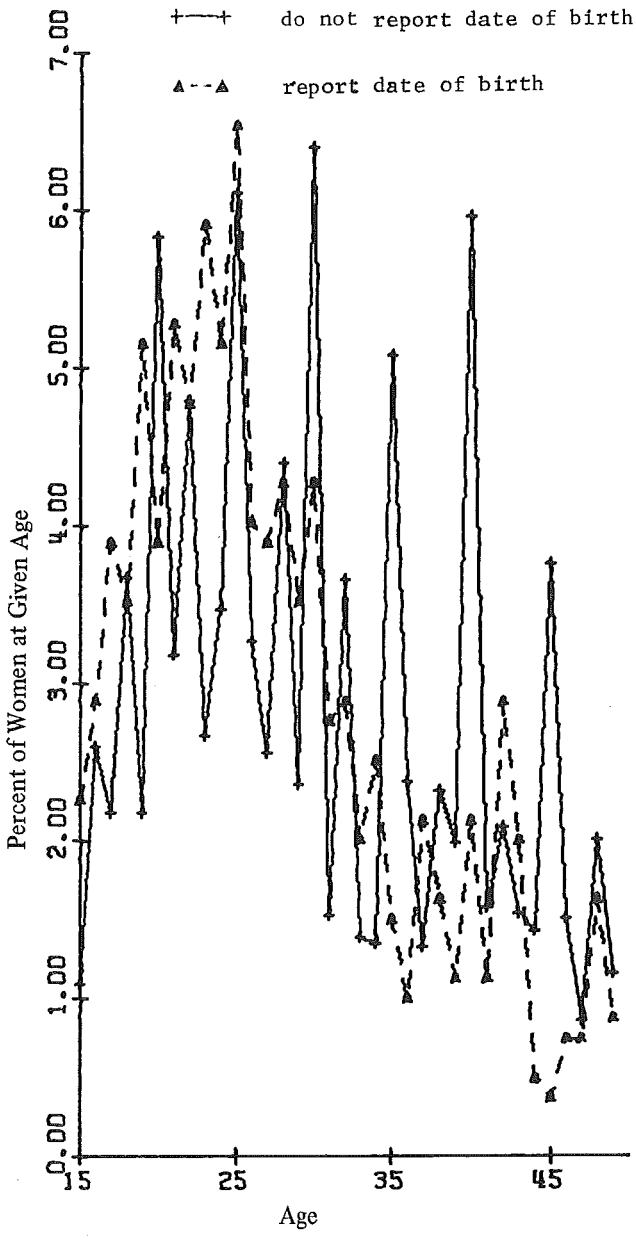

Figure 4 Reported Single-year Age Distributions (in percents) for Women Who Report vs. Women Who Do Not Report Their Dates of Birth, for Ever-married Women Aged 15-49, Nepal Fertility Survey (1976).

2.2 MISREPORTING OF DURATION OF MARRIAGE

Child marriage is still commonly practiced in Nepal, but a women does not move into her husband's household until the onset of puberty (Central Bureau of Statistics, 1977, p 102). In the Nepal Fertility Survey, an attempt was made to obtain an 'effective' rather than a ceremonial age at marriage (His Majesty's Government Ministry of Health, 1977, p. 35). Specifically, respondents were asked if they began living together with their husbands immediately after marriage. If they reported a delay, they were asked how long after marriage they began living with their husbands. About 22 per cent of the respondents reported such a delay. Table 1 presents the number of women reporting a

Table 1 Mean Delay between Date of Formal Marriage and Onset of Cohabitation, by Age at Survey

Age at Survey	Number of Women	Number of Women with Delay	Per Cent with Delay	Mean Delay (in months)
15-19	741	175	23.6	33.4
20-24	1226	276	22.5	36.7
25-29	1146	240	20.9	37.5
30-34	855	200	23.4	37.3
35-39	736	160	21.7	42.6
40-44	720	155	21.5	43.0
45-49	516	117	22.7	46.0

Source: *Nepal Fertility Survey, 1976.*

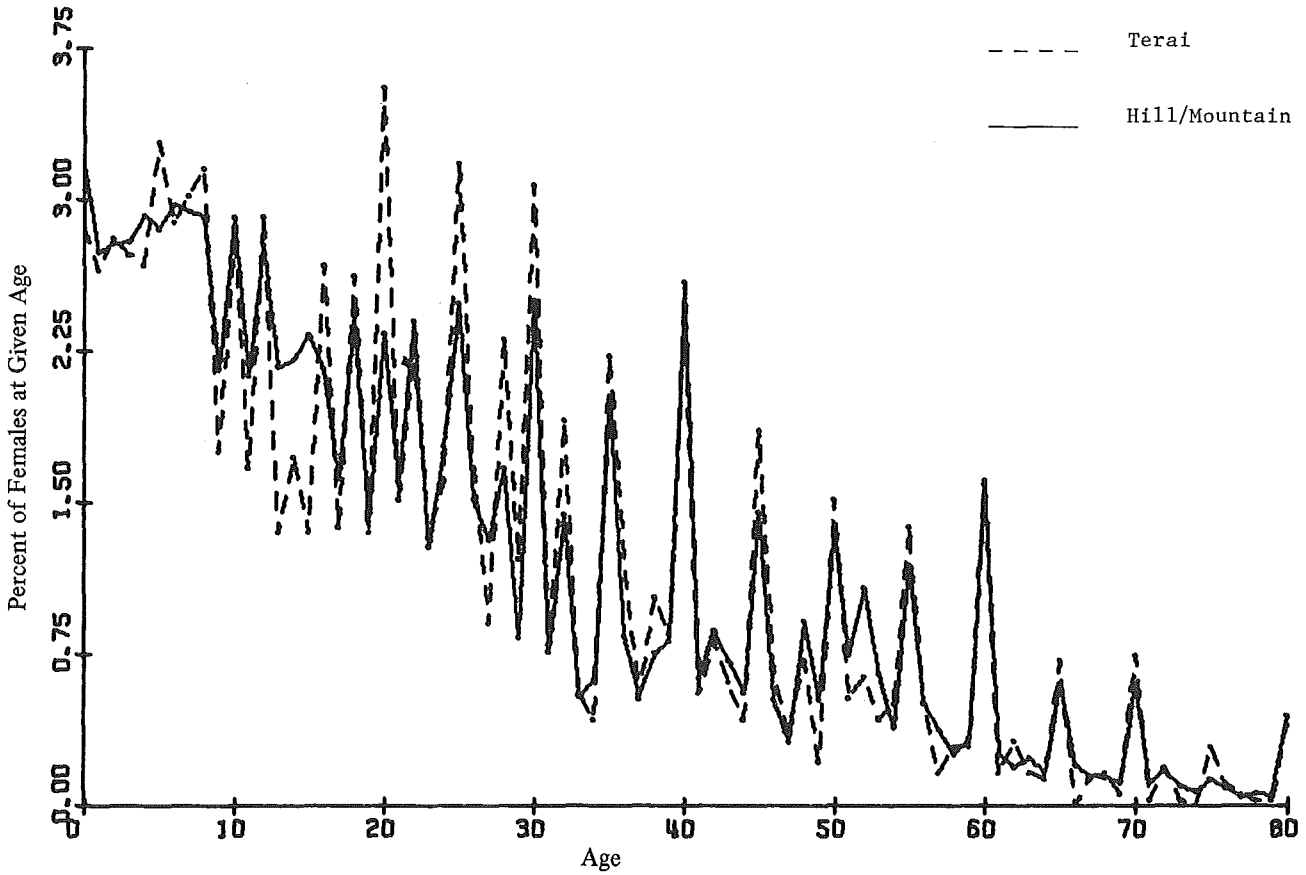

Figure 5 Reported Single-year Age Distributions of Females for Ages 0-79 (in percents), by Region, Household Survey (Nepal Fertility Survey, 1976).

delay between marriage and cohabitation, as well as the mean delay for these women. For women who reported an age at menarche greater than the age at onset of cohabitation, the latter was increased to be equal to age at menarche. (A total of 15 per cent of respondents could not supply an age at menarche). This composite variable denoting age at onset of cohabitation was used in place of age at marriage (and labelled age at marriage) throughout the *First Report* and in the recoded data tape of the survey.[1]

An additional complication was introduced by the wording of the question on date of marriage. According to Hindu tradition, widows should not remarry, but legal restrictions on remarriage no longer exist.[2] In order to avoid the embarrassment of questioning respondents about remarriage, interviewers asked respondents 'In what month and year did you get married?' or 'How many years ago did you get married?' Interviewers did not question women about *first* marriage, not did they attempt to elicit a marriage history. In fact, in the next section we present evidence that some women married more than once supplied the date of their most recent marriage.

Unless otherwise stated, we will use the composite variable, age at onset of cohabitation, for age at marriage. (In cases, where we use reported age at marriage from the raw data tape, we will label this variable age at *formal* marriage). Hence, throughout this report, duration of marriage actually refers to years since the recorded date of onset of cohabitation, for those women currently widowed or divorced as well as for those currently married.

Figure 6 shows the per cent distribution of marital duration in single years for ever-married females interviewed in the individual survey. Again, heaping on preferred digits is evident. An exponential curve was fitted to the data in Figure 6 for marital durations up to 34 years.[3] The deviations from this fitted exponential distribution, plotted in Figure 7, more clearly reveal the heaping on particular durations of marriage. These deviations are compared with the deviations of the single-year age distribution for females up to age 34 from a fitted age distribution (i.e. a stable age distribution fitted to the age distribution reported in the Household Survey).

A priori, there is no reason for the year of birth of large (or small) birth cohorts to coincide with the year of marriage of large (or small) marriage cohorts. Yet, the similarities in number preference – i.e. the heaping on even numbers and numbers divisible by five, as well as the deficits in the zero to four range are striking. Evidently, respondents or

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1 The effort on the part of the NFS to obtain age at onset of cohabitation rather than age at ceremonial marriage was not completely successful since many child marriages (i.e. marriages under age 12 and even under age 10) still appear in the recorded data.

2 Restrictions on the remarriage of widows were eliminated by the Naya Mulki Ain (New Law of the Land) in 1962 (Central Bureau of Statistics, 1977, p. 102). Although the extent of remarriage is not known, widow remarriage is believed to be more common in various Hills and Mountains regions, particularly among tribal populations, than in Kathmandu or the Terai. Levirate systems of widow remarriage prevail among several tribal populations (Bista, 1967).

3 Residuals are calculated through 34 years of marriage rather than through 39 because the distribution of marital duration is truncated. Specifically, since women older than 49 years are not interviewed in the individual survey, an exponential distribution yields a poor fit in higher marital durations.

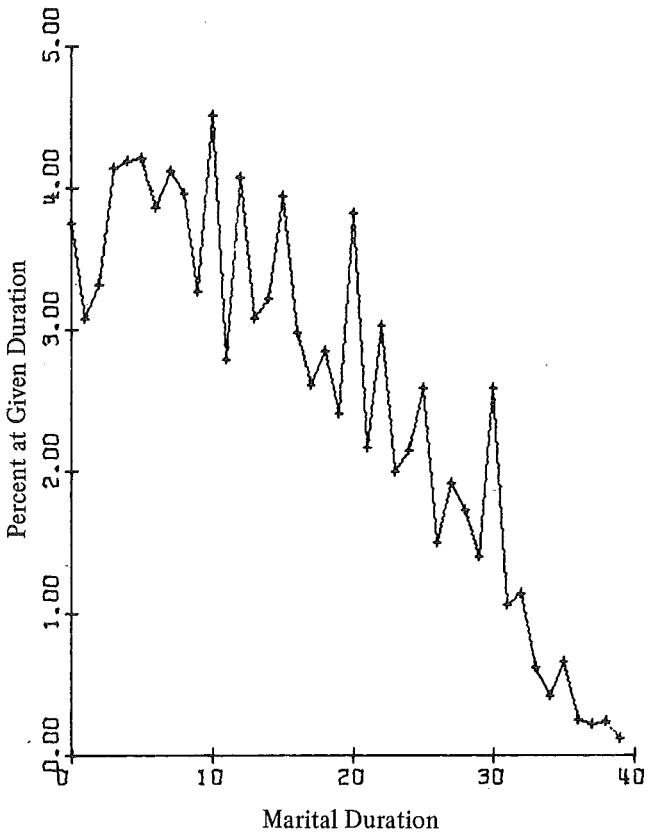

Figure 6 Reported Single-year Distribution of Marital Duration (in percents) for Ever-married Women (Nepal Fertility Survey, 1976).

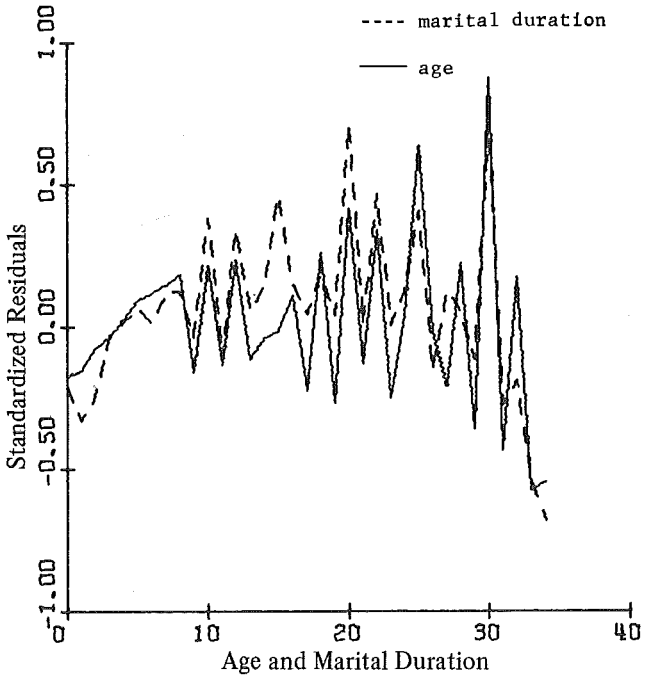

Figure 7 Standardized Residuals* of Single-year Distributions of Age (Women Aged 0 to 34 in the Household Survey) and Marital Duration (Women aged 15 to 49 in the Individual Survey), (Nepal Fertility Survey, 1976).

* Residuals are [(Observed – Expected) ÷ Expected] values. We obtained 'expected' values by fitting a stable age distribution (see Figure 3) to the reported age distribution and an exponential curve to the reported distribution of marital durations.

enumerators showed the same preference for particular numbers in reporting (or recording) both duration of marriage and age.

As was the case with date of birth, respondents in the individual survey were asked their date of marriage (and marital duration was estimated by subtraction from the survey date); those respondents who did not know the date were subsequently asked to estimate their duration of marriage. If that too failed, respondents were asked to estimate their age at marriage. Approximately twice as many women were able to supply a date of marriage as a date of birth: 27 per cent and 13 per cent, respectively. Figure 8 compares the per cent distribution of marital duration for women who supplied a date of marriage with the distribution for women who reported the date unknown. Note that a very high proportion of those women with recent marriages – within the few years prior to the survey – can supply a date. Women reporting a date of marriage, even those women who were married many years ago, show only a slight tendency to heap on preferred numbers.

Figure 9 compares the distributions of marital duration for women in the Hill and Mountain areas and for women in the Terai. Women in the Terai region exhibit a greater

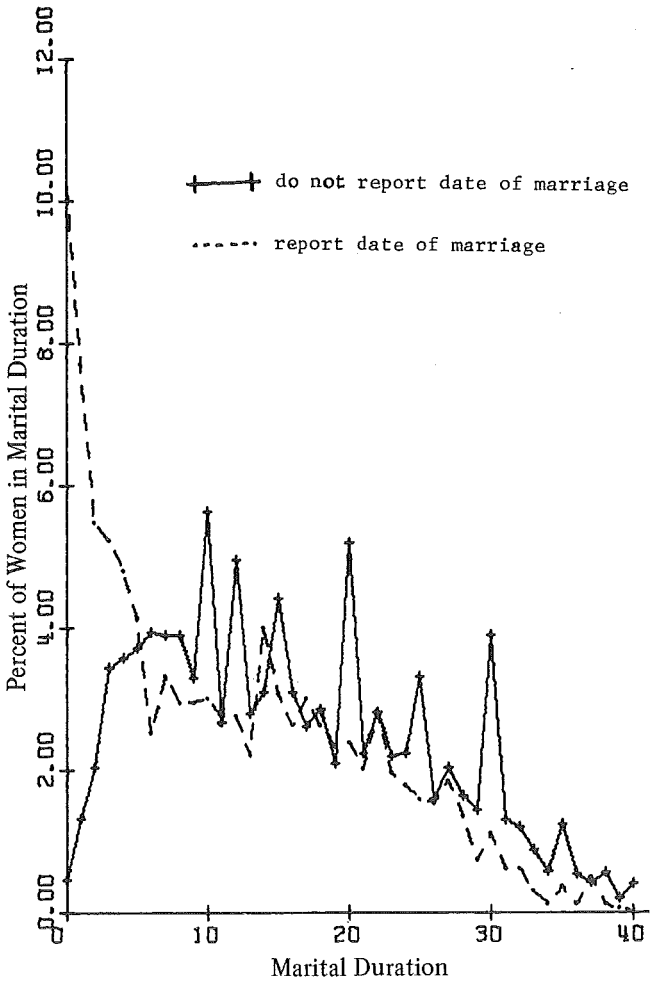

Figure 8 Reported Distributions of Marital Duration* (in percents) for Women Who Report vs. Women Who Do Not Report Date of Marriage, for Ever-married Women Aged 15 to 49, (Nepal Fertility Survey, 1976).

* These data were taken from the unedited data tape and are based on reported age at formal marriage rather than on age at onset of cohabitation (see pp. 12-13).

degree of misreporting, as evidenced by their reporting with preferred numbers, although regional differences are less extensive here than in misreporting of age (Figure 5).

The extent of heaping in the reports of marital duration can be measured by indices of preference for terminal digits. These indices – e.g. Whipple's index, the Carrier index, Myers' blended index – measure the preference for, or avoidance of, each of the ten possible terminal digits in the reporting of a single-year distribution. Myers' blended per cent distribution of terminal digits (Myers, 1940) has been used here to determine the extent to which women who report their ages with preferred numbers also report their marital durations with these numbers. In the hypothetical situation of random reporting of durations, each of the digits between 0 and 9 would appear 10 per cent of the time as terminal digits in the distribution of reported durations. The more frequent the use of a preferred number, the higher the per cent of durations ending with that number,

Figure 10 compares the per cent distribution of terminal digits in the reports of marital duration for those women whose ages end in '0' or '5' with the corresponding distribution for women in neighboring single-year age groups; and the distribution of digits for women in the age group 20-29 with that for women in the older age group 40-49. Under the hypothesis that women who misreport their age, also misreport their duration of marriage, we expect a greater degree of heaping in the distribution of marital duration for women who report their ages with preferred numbers and for the older women. The distributions of terminal digits in Figure 10 confirm this hypothesis. The tendency to report marital durations ending in the digits '0' and '5', and similarly the tendency to avoid the less preferred digits '1' and '9', is greater for those women who we believe are prone to age misreporting.

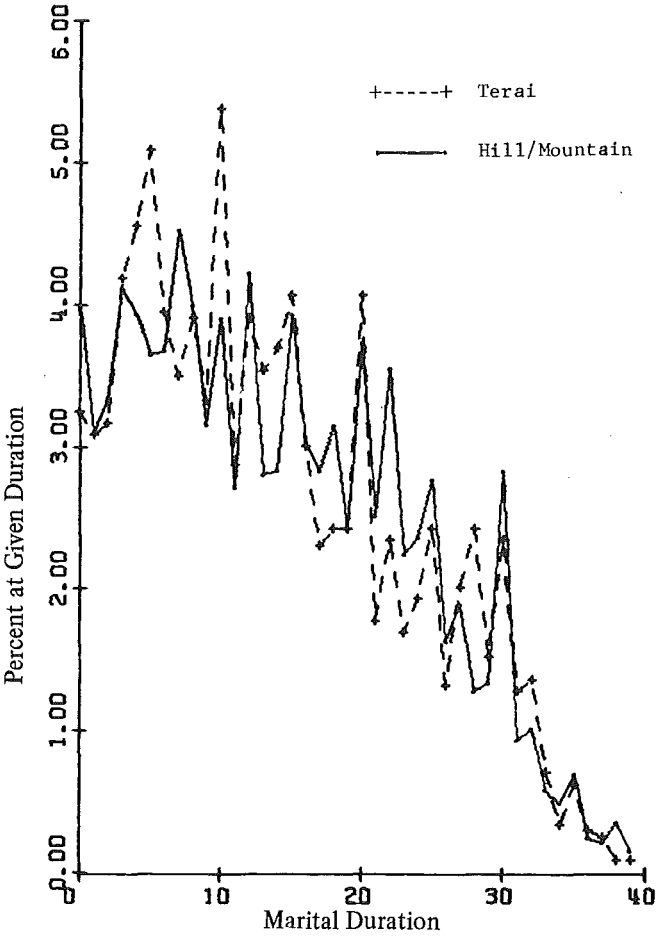

Figure 9 Reported Single-year Distribution of Marital Duration (in percents) for Ever-married Women by Region, Nepal Fertility Survey (1976).

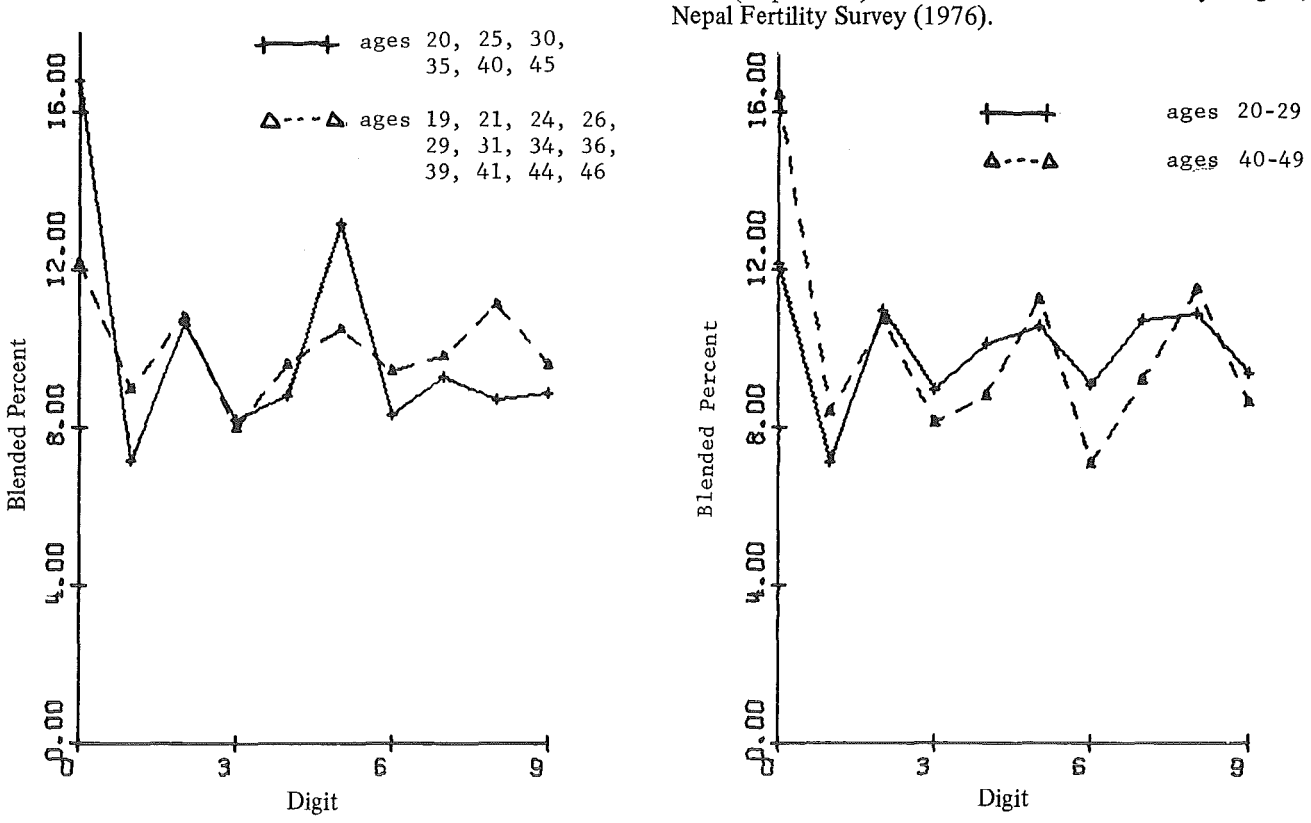

Figure 10 Myers' Blended Percent Distribution of Terminal Digits for Reported Marital Durations, For 'Heaped' vs. Neighboring Ages; and for Younger vs. Older Age Groups, Nepal Fertility Survey (1976).

2.3 MISREPORTING OF AGE OF INFANT DEATHS AND OF DURATION OF BREASTFEEDING

Figure 11 shows the distribution of month of death for infants dying within the first five years (excluding deaths at 0 months). The distribution reflects a strong tendency for reporting infant and child deaths with a whole number of years (i.e. 12, 24, 36, 48, and 60 months), and to a lesser extent with half-years (i.e. 6 and 18 months). The high degree of heaping can affect the estimation of infant mortality rates (see p. 32).

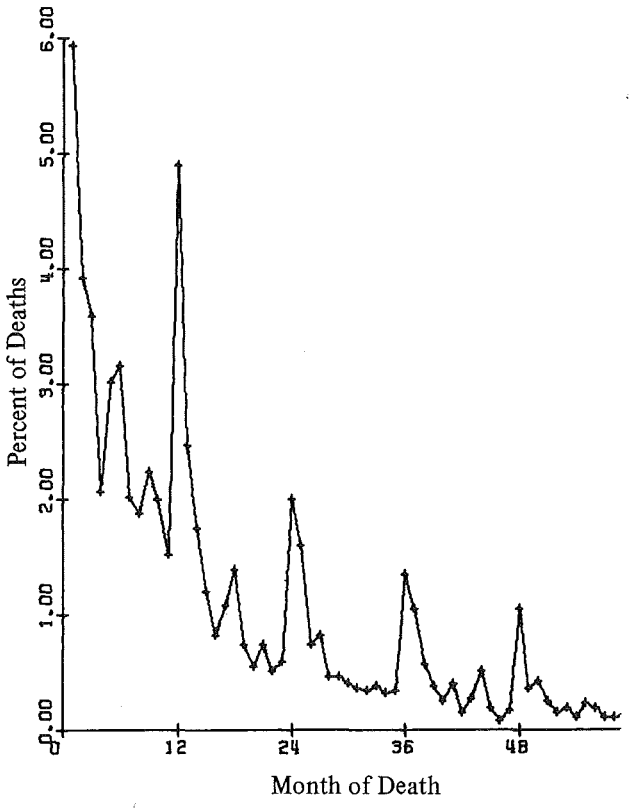

Figure 11 Per cent Distribution of Month of Death, for All Deaths Within Five Years of Age (Excluding 0 Months), Nepal Fertility Survey (1976).

The per cent distribution of duration of breastfeeding, in months, is shown in Figure 12. As with the ages of infant deaths, there is extensive heaping on half and whole numbers of years. The heaping on 24 months for the duration of breastfeeding is conspicuous. Although, it first appeared that heaping on 12, 24, and 36 months may reflect actual breastfeeding practices, the data for women still breastfeeding by survey date do not support this explanation of the heaping. Figure 13 shows first differences of proportions of women still breastfeeding by time since birth, for births which occurred during the 60 months prior to survey. These values have been calculated by subtracting the proportion of women who are still breastfeeding among women who had a birth x+1 months ago from the corresponding value for women who had a birth x months ago, x = 1,2, . . .60. Note that the calculation includes *all* births which occurred x months ago, x = 1,2 . . .60, not only the last birth for each women. It can be safely assumed that births preceding the last birth are no longer being breastfeed at survey date.

Since events are estimated to the nearest month, a true peak at z months of breastfeeding in Figure 12 could be

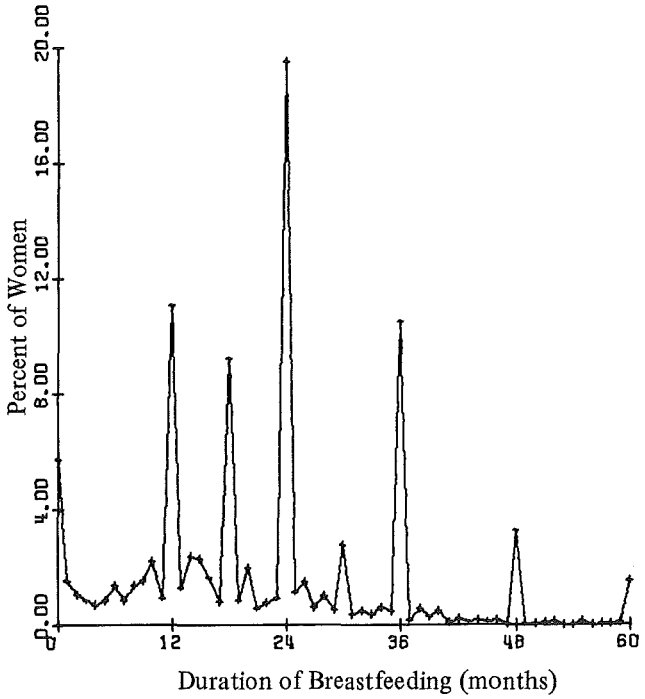

Figure 12 Percent Distribution of Duration of Breastfeeding in the Last Closed Birth Interval, in Months, for Durations Within Five Years, Nepal Fertility Survey (1976).

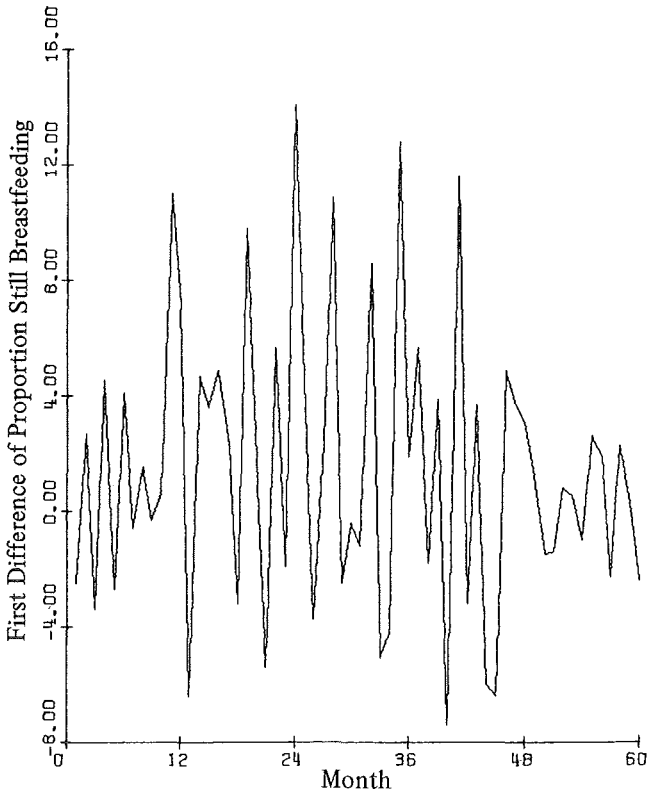

Figure 13 First Differences* of Proportions of Women Still Breastfeeding at Survey Date, by Time (month) Since Birth, Nepal Fertility Survey (1976).

* The first difference for month x is calculated as the difference between the proportion of women still breastfeeding among women who had a birth x months ago and the corresponding proportion among women who had a birth x+1 months ago.

reflected by a peak in first differences for either month z-1 or z in Figure 13. We note that first differences are highest for months 11, 24, 36, as we might have expected. However, the almost as large values for some intervening months (e.g. 19, 28, 32) suggest that much of the heaping in Figure 12 is due to misreporting.

The cumulative distribution of proportions breastfeeding by time since birth, derived from reported durations of breastfeeding in the last closed interval, was compared with the distribution of proportions still breastfeeding in the last open interval to determine whether the heaping in Figure 12 introduced bias. The former proportions are always lower than the latter, suggesting that heaping on reports of breastfeeding length in the last closed interval has produced a downward bias in reported duration of breastfeeding.

3 Displacement and Omission of Vital Events

This section presents estimates of the extent of displacement and omission of events in the reporting of births, first marriages, and infant deaths. The analysis is based upon both internal checks of consistency in the reporting of vital events and, whenever possible, validation of the data in the Nepal Fertility Survey by the scarce reliable data available from other sources – the 1961 and 1971 Censuses and the 1974-75 and 1976 Demographic Sample Surveys.

The following analysis provides evidence for the existence of systematic biases in the histories of marriage and fertility that produce erroneous indications of trends in age at marriage, aggregate fertility, and age patterns of fertility, by cohort, or by time period. On the other hand, no inconsistencies are found in estimates of age specific fertility rates and infant and childhood mortality rates for the recent past, or in proportions ever-married by age as of the 1971 census date.

Specifically, the data as reported in the individual histories indicate that

1) fertility has been rising for the past 20 or 25 years, and
2) age at marriage has been subject to no consistent trend over this period.

We suggest that when errors in the reporting of vital events have been corrected, the demographic picture is more likely to show

1) no trend in fertility and
2) rising age at marriage.

3.1 NUPTIALITY

3.1.1 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. Using both pieces of information, one can construct proportions of women ever married by age for any date up to 20 or 25 years before the survey. Since no women older than 49 are interviewed in the NFS, one can only obtain marital status for women younger than age 49-x for a date x years in the past. (See Appendix I for methodological details).

Table 2 shows the per cent of women ever married by five-year age groups as of the census dates, reconstructed from data in the NFS, and compares these distributions with the corresponding data from the censuses. Percentages shown for the NFS are based on both reported dates of formal marriage from the raw data tape and on dates of onset of cohabitation from the recorded data file. As noted previously all marital status data in the *First Report* as well as in the recorded data file are based on a composite variable which attempts to establish date of onset of cohabitation by adding the delay between formal marriage and cohabitation to the reported date of formal marriage (see pp. 12-13).

A comparison of percentages ever married for 1971 from NFS data and from the 1971 Census reveals that, with the exception of women aged 15-19, agreement between the two distributions is fairly close. However, as shown in Table 2, percentages ever married as reconstructed for 1961 are substantially lower than those reported in the 1961 Census (with the exception of the age group 10-14 for data based on date of formal marriage). Indeed, for women between ages 20 and 34, percentages ever married reconstructed from the individual survey for 1961 are lower than the corresponding estimates from either the 1961 or 1971 Census or from the Household Survey. For example, whereas census and Household Survey data indicate that approximately 94 per cent of women aged 20-24 and 98 per cent of women aged 25-29 have been married, NFS data reconstructed for 1961 yield the corresponding estimates of 89 and 96 per cent, respectively. By age 35, when according to data from the censuses and Household Survey, all but 1 per cent of females have been married, NFS data reconstructed for 1961 indicate that approximately 3 per

Table 2 Percentage of Females Ever-Married, by Five-year Age Groups, for the Household Survey and Reconstructed for the 1961 and 1971 Census Dates, from Reported Dates of Formal Marriage and Onset of Cohabitation.[1]

	Percentage Ever Married						
	1961			1971			1976
							Household Survey (NFS)
Age at Census or Survey Date	Formal Marriage	Onset of Cohabitation	NFS Census	Formal Marriage	Onset of Cohabitation	NFS Census	
10-14	24.9	17.9	24.8	15.6	12.0	13.4	–
15-19	68.0	65.7	73.8	65.6	63.5	60.7	62.7
20-24	88.8	88.4	94.6	92.3	91.6	92.1	94.0
25-29	96.0	95.9	98.1	97.6	97.5	97.4	98.2
30-34	97.3	97.3	99.0	98.6	98.7	98.6	98.8
35-39	–	–	–	99.2	99.3	98.9	99.4
40-44	–	–	–	98.7	98.7	99.1	99.5

[1] See Appendix I for details of procedure.
Source: *Nepal Fertility Survey, 1976.*

cent of females are still single.

According to the 1961 and 1971 Censuses, the percentages ever married for the younger age groups decreased considerably over the decade. Estimates of the singulate mean age at marriage (SMAM; Hajnal, 1953) for the two censuses are 15.2 and 16.7, respectively, an increase in SMAM of 1.5 years over the ten year period. Proportions ever married reconstructed from data in the individual survey (date of formal marriage) indicate little change in age at marriage over the decade: estimates of SMAM are 16.1 and 16.4 for 1961 and 1971, respectively.[4]

The distinction between the categories of single and ever-married is one of the most robust classifications in a census. The respondent and others present at the interview may have no idea of age, but they are likely to know whether a women 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 if age misreporting is extensive, the proportions single by age group may be in error. However, van de Walle (1968) has proposed a method for estimating SMAM using only the proportion single in the entire population, and Trussell (1976) has confirmed the robustness of this estimate. The van de Walle estimates also clearly reveal an increase in age at marriage during the intercensal decade, from an estimated SMAM of 14.6 in 1961 to 16.4 in 1971.[5]

We surmise that the discrepancies between the proportions ever married reconstructed from the NFS and those reported in the 1961 Census are the result of two types of errors in the Nepal Fertility Survey:

1) The reporting of second (or higher) order marriages in place of first marriages as a result of an ambiguous question on date of marriage (see p. 13).
2) An overstatement of age at marriage for the older women.

Evidence supporting the claim that women reported dates of second (or higher order) marriages is presented in Table 3 which gives the per cent of marriages for which women reported a birth as occurring prior to the date of marriage (i.e. date of onset of cohabitation).[6] One might explain these data as illegitimate births, but illegitimacy appears to be uncommon in Nepal. A more likely explanation is that the respondent reported the date of her most recent higher order marriage. As noted previously, interviewers did not question respondents specifically about their first marriage. Thus, one would expect women married more than once to report their most recent date of marriage. This interpretation is buttressed 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. Marriages that follow a birth of a child constitute 100 per cent of all marriages over age 40, 45 per cent of all those over age 35 and 38 per cent of all those over age 30. The prevalence of marriages reported after a birth becomes negligible below age 25, especially below age 20.

The extent of remarriage in Nepal cannot be ascertained from data in the NFS. The data in Table 3 provide only a lower bound for an estimate of the prevalence of remarriage. It is quite possible that women who reported dates of second marriages also reported only those births which followed the second marriage, or that their first marriage was childless. Moreover, editing procedure may have resulted in the alteration of histories which contained dates of birth preceding dates of marriage.

It is also possible that older women have displaced the date of marriage towards the present or have overstated age at marriage. This type of displacement would account for some of the discrepancies in Table 2 and would be consistent with the displacement of dates of birth towards the survey date, shown later in Figure 18, 20, and 21. It is possible that reported ages at marriage have been affected by the passage of two laws imposing minimum ages at marriage. The first legislation of this type went into effect in 1961 and set minimum ages at marriage of 14 for girls and 16 for boys (with parental consent). A second law in 1966 raised the minimum ages to 16 and 18 (with parental consent), respectively. Although neither law was retroactive and hence would not have affected marriages contracted before 1961, women who were unaware of the details of the legislation and who feared possible fines or imprisonment for violation of the laws, might have overstated ages at marriage.

Both types of misreporting of first marriages – reporting of a higher order marriage and displacement of the date of marriage towards the survey date – result in too low proportions ever married for dates in the past and consequently too high ages at marriage. Hence, without knowing the extent of remarriage, one cannot determine the extent of displacement in the reporting of dates of marriages. It may be the case that the discrepancies between the 1961 Census and NFS are mostly due to the reporting of higher order marriages.

Table 3 Percentage of Marriage for Which Women Reported Date of a Birth Prior to Date of Marriage

Age at Marriage	Number of Marriages	Percentage with Marriage Date after Date of a Birth
10-14	2,482	0.1
15-19	2,481	0.6
20-24	558	3.6
25-29	106	8.5
30-34	18	33.3
35-39	7	14.3
40-44	3	100.0
45-49	1	100.0

Source: *Nepal Fertility Survey, 1976.*

3.1.2 AGE AT MARRIAGE BY COHORT

In order to estimate the time trend in age at marriage, one

[4] In computing SMAM for 1961 from NFS data, proportions ever married for the age groups 35-39 and 40-44 were taken from the 1961 Census.

[5] The procedure for calculating the van de Walle estimate of SMAM for a stable population is based on finding a single age a so that the proportion of the stable female population below age a equals the overall proportion of females in the population who are single. The van de Walle estimates of SMAM for the 1961 and 1971 Censuses of Nepal are based on

1) reported proportions single among all females (0.389 and 0.430, as obtained from the two Censuses, respectively) and
2) stable populations which have been fitted to the reported age distributions by matching proportions of women below age 35 and by choosing an approximate schedule of mortality (a West model in life table with e_0 equal to 40 years; Coale and Demeny, 1966). Details of the procedure are described in Trussell (1976).

[6] Exclusion of dates of birth which occur prior to date of onset of cohabitation but subsequent to reported date of formal marriage reduces premarital births by one-third for marriages which occur below age 25 and has no effect on pre-marital births for marriages which occur after age 25.

can reconstruct the marriage experience for each cohort in the NFS. Based on the same data that were used to reconstruct proportions ever married for dates in the past – namely, proportions of women who have been ever married as of their current age (from the Household Survey) and age at marriage for ever-married women (from the Individual Questionnaire) – one can construct cumulative proportions ever married by age for five-year birth cohorts (five-year rather than single-year to reduce the effect of sampling error). Cumulative proportions ever married by age, for the cohorts aged 25-29, 30-34, 35-39, 40-44, and 45-49 as of the survey date, are given in Table 4. Because a cohort cannot have experienced 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, one can 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 to the actual first marriage experience up to current age (the data in Table 4) using a least-squares optimization routine (Coale and Trussell, 1974) 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 5. Since marriages occur at such younger ages in Nepal, the two sets of means do not differ by very much.

The data in Table 5 indicate that over a period of approximately 30 years age at marriage was subject to no 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.

A fairly constant age at marriage as indicated by the NFS data is inconsistent with the rising age at marriage indicated by the 1961 and 1971 Censuses of Nepal. Figure 14 indicates that an increase in proportions single at ages 15-19 and 20-24 and hence an increase in age at marriage occurred

Table 5 Mean Age at Marriage[1] for Those Women Married by Age 25 and Singulate Mean Age at Marriage (SMAM) Derived from Fitting Model Marriage Schedule to Cumulative First Marriage Experience, by Age at Survey

Age at Survey	Mean Age at Marriage (for Marriages before age 25)	SMAM from Model Schedule[2]
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

[1] Mean ages at marriage are based on dates of onset of cohabitation from the recoded data.
[2] Coale and Trussell (1974) for a complete description of model first marriage schedules.
Source: *Nepal Fertility Survey, 1976.*

Table 4 Cumulative Proportions of Women Ever Married, by Successive Ages and by Age at Survey[1]

	Age at Survey						
Exact Age	15-19	20-24	25-29	30-34	35-39	40-44	45-49
9	.004	.008	.004	.007	.011	.006	.008
10	.020	.041	.048	.051	.046	.056	.065
11	.041	.077	.099	.099	.073	.089	.109
12	.095	.129	.157	.166	.120	.170	.135
13	.164	.209	.251	.243	.196	.243	.198
14	.241	.311	.351	.368	.306	.326	.282
15	.350	.413	.479	.493	.435	.423	.406
16		.523	.584	.603	.543	.547	.517
17		.637	.656	.686	.632	.634	.630
18		.736	.756	.753	.713	.708	.718
19		.796	.803	.808	.772	.758	.755
20		.854	.852	.861	.822	.828	.811
21			.892	.890	.865	.864	.858
22			.918	.916	.896	.906	.888
23			.938	.942	.916	.929	.912
24			.948	.955	.937	.939	.928
25			.957	.963	.952	.946	.945
26				.969	.957	.954	.951
27				.975	.965	.963	.961
28				.981	.973	.967	.969
29				.981	.981	.975	.971
30				.983	.984	.982	.973

[1] Proportions ever married by successive ages are calculated using data on age at marriage from ever-married women in the individual survey and data on proportions ever married by age among all women from the Household Survey. Numbers of ever-married women in each age group are divided by the proportion of women in the corresponding age group who have ever been married in order to obtain denominators for the proportions given above. Numerators are obtained by using data (on date of marriage) from ever-married women only.
Source: *Nepal Fertility Survey, 1976.*

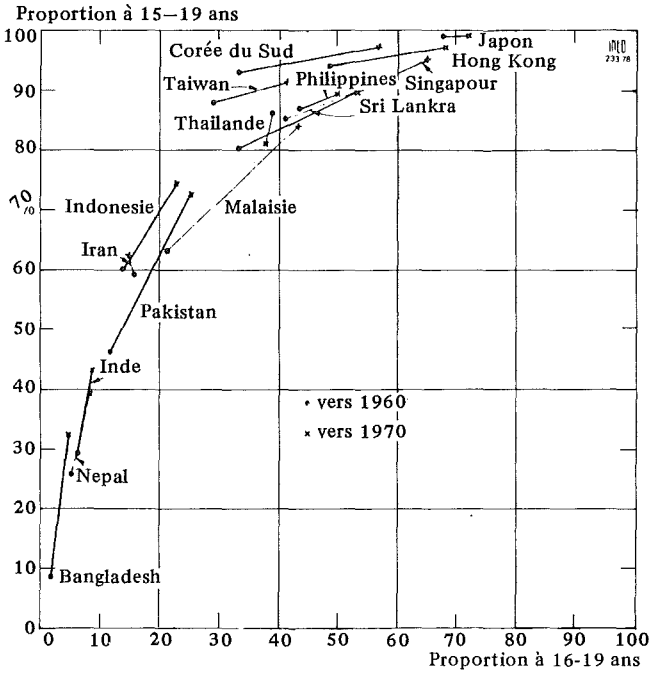

Figure 14 Changes in Proportions of Females Single at Ages 15-19 and 20-24 Between 1960 and 1970, in Various Asian Countries.

Source: Blayo, Y. 1978. Les premiers mariages féminins en Asie. *Population. No. 4-5.* p. 959.

in Bangladesh and in India, as well in Nepal, between the approximate dates of 1960 and 1970. Although Bangladesh, India, and Nepal are culturally distinct, the three countries were the only Asian countries to show a mean age at marriage in 1960 as low as 16 years (Blayo, 1978). Thus, the rising age at marriage indicated by the Nepal censuses appears to be a real phenomenon.

We conclude 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, we believe that there was a gradual monotonic increase in the mean age at first marriage concealed by reports of higher order marriages and, possibly, by an overstatement of age at marriage.

3.2 FERTILITY

The detailed fertility data available from the Individual Questionnaire include date of birth of each child ever born to the ever-married women in the sample. In a procedure analogous to that used to estimate proportions ever married by age, data on the dates of each birth (from the Individual Questionnaire) together with the proportions of women ever married by current age (from the Household Survey) can be used to estimate average numbers of children ever born per women at successive ages for each cohort. With additional data on womens' dates of birth and marriage, age specific and duration specific fertility rates for any period in the past, up to 20 or 25 years ago, can be constructed (see Appendix I for details).

Fertility data from the recent Demographic Sample Survey (1974-75, 1976) yield independent verification of estimates of age specific fertility rates for the recent past derived from the NFS. However, data from the 1961 and 1971 censuses are of no use since the levels of omission of births in the censuses are much greater than that in the NFS.[7]

3.2.1 RECENT AGE SPECIFIC FERTILITY RATES

Using data on the number of births to women in the twelve month period prior to the NFS and data on the age of women at that time, one can construct a synthetic age specific fertility schedule for the year prior to the survey (most of 1975 and part of 1976): data on the proportion of women ever married as of a date approximately six months prior to the survey must be used in order to calculate age specific fertility rates for all women, not only for those ever married (see Appendix I).

A common problem with constructing a fertility schedule using births in the past year is that the reports of these births are often understated or overstated because of a mistaken perception of the duration of the reference period (one year in this case). In the classical Brass method for estimating fertility in the absence of a recent trend, the ratio of cohort fertility (reported parity in a census) to cumulated current fertility derived from births in the last year, calculated among women in their early to mid-twenties, is used as a correction factor to adjust for a misperceived reference period (the so-called P/F ratio; see Brass and Coale, 1968). In the case of the Nepal Fertility Survey, cumulated fertility from the births-last-year schedule agrees quite closely with reported parity for women in their early twenties (see Figure 15), and so there seems to be no need for an adjustment factor. Age specific fertility rates by five-year age intervals, constructed from births in the past year, are shown in the first column of Table 6.

These rates can be compared with age specific fertility rates

Table 6 Age Specific Fertility Rates (per Thousand Women) Derived from Births in the Past Year and Current Pregnancies (Nepal Fertility Survey, 1976), Compared with Rates from 1974-75 and 1976 Demographic Sample Surveys of Nepal

	Nepal Fertility Survey 1976		Demographic Sample Survey	
Age	Births in Past Year	Current Pregnancies	1974-1975	1976
15-19	145	121	114	138
20-24	290	308	270	305
25-29	295	311	297	284
30-34	269	271	260	252
35-39	169	165	169	170
40-44	75	81	89	95
45-49	23	9	50	34
TFR	6.33	6.33[1]	6.25[2]	6.39[2]

[1] TFR based on current pregnancies is adjusted to agree with TFR based on births in the past year. See Appendix I for details.
[2] See footnote 8

Source: Estimates for the 1974-75 and 1976 *Demographic Sample Surveys* are obtained from Bourini (1976, 1977).

[7] For example, ever-married women aged 45 to 49 reported an average of 4.0 children ever born in the 1971 Census and 5.7 children ever born in the NFS (His Majesty's Government Ministry of Health, 1977, p. 41).

similarly constructed from the number of current pregnancies (i.e. current pregnancies can be treated as births that will occur approximately three months into the future; see Appendix I for details). The pattern of age specific fertility rates derived from current pregnancies appears in the second column of Table 6 and agrees quite closely with those derived from births in the past year. (Since current pregnancies reflect future births for a period much shorter than a year, the rates derived from current pregnancies have been adjusted – i.e. multiplied by a constant – to yield the same total fertility rate as that derived from births in the past year; hence, only the pattern of age specific fertility can be examined).

Age specific fertility rates from the 1974-75 and the 1976 Demographic Sample Surveys give independent support for the estimates from the NFS. Data from the Demographic Sample Surveys yield a very similar level of fertility (a Total Fertility Rate of approximately 6.3) and a very similar age pattern of fertility to those derived from the Nepal Fertility Survey (see Table 6). However, in contrast to the Demographic Sample Surveys which obtained counts of births through what were essentially triple round interviewers,[8] the NFS achieved a fairly complete count of births using only one set of interviews.

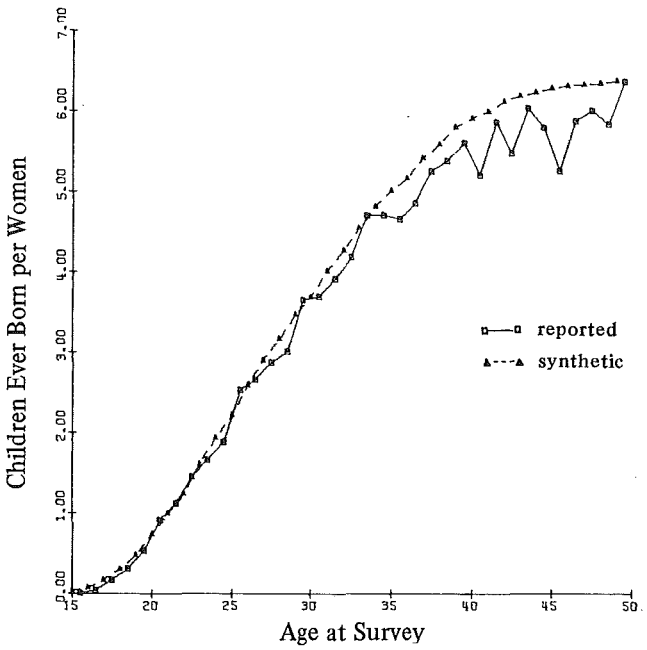

Figure 15 Reported Number of Children Ever Born per Women vs. Number from Synthetic Births-last-year Schedule, by Single Years of Age, Nepal Fertility Survey (1976).

3.2.2 EVIDENCE FOR OMISSION OF BIRTHS IN THE DETAILED FERTILITY HISTORY

A common fault with data collected in censuses and surveys on the total number of children ever born (parity) to women at different ages is a progressive understatement of parity among older women. It may be that older women, in fact, do not recall the occurrence of births, but it is also possible that they are reluctant in some cultures to mention children who have died or that they do not understand that they are supposed to list births of children who have grown up and left home. It is customary in Nepal for a women to join her mother-in-law's household after marriage. In recent years it has become less rare for the son and daughter-in-law to establish their own household several years after marriage. It has been suggested that some omissions of sons by older women may be a result of mothers not wanting to acknowledge the existence of children who have 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 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 individual fertility history. Nevertheless, as will be shown in this section, there are very clear indications that births were omitted from the fertility histories in the NFS.

In Figure 15, 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). If fertility had been constant during the years preceding the survey, and if all births had been reported with a correct reference period, the cumulative fertility of each cohort would agree with the cumulation to the same age of fertility rates of the pre-survey year.

As noted in the previous section, the two curves are in good agreement at ages in the early twenties, suggesting that the reference period of a year seems to have been perceived approximately correctly by the respondents. However, the two curves depart increasingly from one another with rising age (with exceptional points, such as ages 29, 33, and 49). Do these discrepancies result from increasing fertility, so that cumulated current fertility is greater than the fertility of the older cohorts, or are the discrepancies the result of a combination of omission of children ever born and age misreporting?

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 women, a shifting of age upward to a heaped age would result in an understatement of fertility at the heaped age, whereas a shifting downward to a heaped age would result in an overstatement of fertility. On the other hand, if the estimation of a women'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, the tendency might be stronger among those women who did not know their ages. These women will be concentrated in the heaped ages.

We find, in fact, that the average values of reported parity at the young heaped ages – most notably ages 20 and 25 and to a lesser extent 18 and 22 – are above the average of the values of the neighboring two ages (see Table 7). We

[8] In each of the Demographic Sample Surveys, fertility data were obtained through a two-round follow-up survey covering a period of one year. Following the second round of each survey, a quality control sample of ten per cent of the initial sample was carried out in order to check for omission of births and deaths. Each of the surveys indicated an omission rate of approximately 16 per cent, so that the Total Fertility Rates shown in Table 6 had been derived by applying an inflation factor of 16 per cent to the number of births registered during the appropriate twelve-month period (Bourini; 1976, 1977).

Table 7 Reported Number of Children Ever Born per Women v. Number from Synthetic Births-Last-Year Schedule, by Single Years of Age

Age at Survey	Children Ever Born: Reported[1]	Synthetic	Difference[2] (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

[1] In the calculation of children ever born per women, the number of ever-married women at each age is divided by the proportion of women at that age who have ever been married (estimated from the Household Survey) in order to obtain an estimate of the total number of women at each age.
[2] Numbers may disagree in last decimal place due to round-off error.
Source: *Nepal Fertility Survey, 1976.*

suspect that these above-average reported parities are the result of age misreporting: for 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 have 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 especially large omission by women whose age is reported at a heaped number, or, more generally, by women who do not know their ages. We examine this hypothesis in the following pages.

Table 8 compares the reported cumulative fertility, by five-year age intervals, for women who reported their date of birth with that for women who could only estimate their current age. 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 the remaining women.[9] Although one could argue that women who report a date of birth are likely to be of higher socio-economic status and consequently to have higher fertility than the remaining women, this appears not to be the case. Table 9 shows the reported number of children ever born, by age group, according to the literacy of respondents' husbands. (Husbands' literacy was used in place of women's literacy since 46 per cent of husbands as compared with only 6 per cent of respondents are literate). There are no consistent differences in the number of children ever born between women whose husbands are literate and those whose husbands are illiterate. In addition, the KAP and fertility survey found no consistent relationship between fertility and husband's or wife's education level (His Majesty's Government Ministry of Health, Differentials in Fertility and Mortality [Four District Baseline Survey Report No. II]). Thus, the data in Table 9 lend some support to the proportion that

Table 8 Reported Number of Children Ever Born per Ever-married Women, by Age at Survey, for Women Who Report v. Women Who Do Not Report Dates of Birth

Age at Survey	Date of Birth Not Reported: Children Ever Born	Number of Women	Date of Birth Reported: Children Ever Born	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

Source: *Nepal Fertility Survey, 1976.*

Table 9 Mean Number of Children Ever Born to Ever-Married Women, by Age at Survey and by Literacy of Husband

Age at Survey	Husband Literate: Children Ever Born	Number of women	Husband Illiterate: Children Ever Born	Number of women
15-19	0.3	417	0.4	324
20-24	1.5	647	1.4	579
25-29	3.0	578	2.9	567
30-34	4.0	367	4.2	487
35-39	4.9	283	5.2	449
40-44	5.5	268	5.5	452
45-49	6.0	189	5.6	327

Source: *Nepal Fertility Survey, 1976*

[9] The differences in cumulative fertility for the younger women are probably not due to omission of births. A more likely explanation is that age misreporting (an overstatement of age) of young women with high parities has resulted in too low parities for young women who do not report dates of birth.

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.

Figure 15 suggests that the amount of age heaping, in age intervals over 30, is correlated with the extent of omission in the reported number of children ever born. In order to test this numerically, we assume here, and in the remainder of this section, that fertility has been unchanging by cohort. This assumption of constant fertility appears to be a reasonable one.[10] An overall decline in fertility is neither supported by the birth history data (Table 10) nor consistent with the still low age at marriage (SMAM of 16.7 in the Household Survey) and low level of current use of contraception (2.2 per cent). On the other hand, the pattern of increasing fertility, as indicated by the birth history data, shows a peculiar and implausible sequence by age and time period. Table 10 shows age specific fertility rates for five-year periods in the past, calculated from reported dates of all births in the fertility histories. The time pattern of fertility suggested by these data is one of increasing fertility at the youngest ages, particularly notable during the period 20 to 34 years ago. The data also suggest a much smaller increase in age specific fertility rates during the period 10 to 19 years ago, and relatively constant or decreasing (for the older ages) fertility over the past 10 years. Such a pattern of changing age specific fertility over the past 30 years appears implausible if accepted as reported.

Table 10 Age Specific Fertility Rates (per Thousand Women) for Five-year Periods in the Past, by Current Age, Derived from Fertility Histories

Age at Survey	Numbers of Years Ago						
	0-4	5-9	10-14	15-19	20-24	25-29	30-34
15-19	40						
20-24	225	44					
25-29	297	225	49				
30-34	273	285	208	44			
35-39	211	277	279	194	45		
40-44	130	222	266	269	182	32	
45-49	52	149	220	257	264	168	29

Source: *Nepal Fertility Survey, 1976.*

On the basis of the assumption of constant fertility, true cumulative fertility for each cohort can be approximated by the cumulative fertility rate derived from births in the past year. That is, we measure the amount of omission for each cohort over age 30 by the difference between the two curves in Figure 15 (see the last column in Table 7).

Figure 16 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 is calculated as the ratio of the number of births omitted (the last column of Table 7) to the cumulative fertility at an age ten years earlier (derived from births in the past year). We assume for the moment that no births occurring in the most recent ten-year period have been omitted.

The correlation between the age ratio and the proportion of births omitted is striking, yielding a Pearson correlation coefficient of 0.83 for the data in Figure 16. This agreement supports the hypothesis that the source of the varying difference between cumulative cohort fertility and cumulative period fertility is the omission of births, especially by

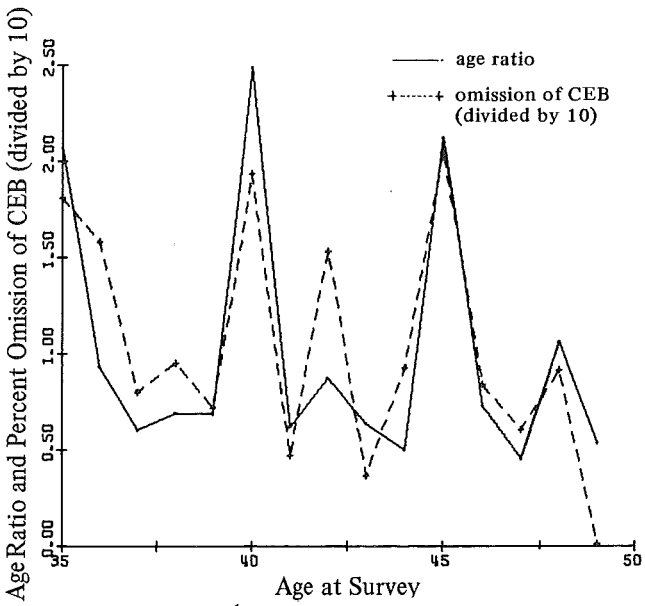

Figure 16 Age Ratios[1] for Female Population in Household Survey vs. Percent Omission of Children Ever Born[2] (CEB), Nepal Fertility Survey (1976).

[1] Age ratios are calculated as the number in the specified single-year age group relative to the seven-year moving average for that age group.

[2] The percent omission for each cohort is calculated as the number of children omitted (see Table 7) divided by the number of children the cohort was expected to have had 10 years earlier, according to the synthetic births-last-year schedule.

older women who report ages at heaped numbers – i.e. those women who, in general, misreport their ages.[11]

We have adjusted the reported cohort fertility 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, we have 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 11; the omission rates by age for the period five to ten years prior to the survey are estimated as half of these numbers. The omission rates given in Table 11 differ from those plotted in Figure 16 since in Table 11 (and in all subsequent work) we assume that omissions occur in the period five to ten years prior to the survey as well as in the period more than ten years prior. Adjusting the reported fertility histories in this manner forces the reported number of children ever born for each cohort to equal period cumulative fertility (derived from births in the past year).

[10] The assumption of constant fertility throughout the past 20 or 25 years implicitly assumes that higher rates of widowhood in the past (as a result of higher mortality) did not significantly reduce fertility. A sample calculation shows that is in fact the case. Based on the differences in proportions widowed between 1961 (1961 Census) and 1976 (Household Survey), our calculation shows that the cohort now aged 45-49 would have had 6.27 children by the end of its reproductive career; this is a difference of only 0.06 children from the synthetic calculation of 6.33 children, based on current proportions widowed.

[11] On the other hand, data on proportions dead of children ever born and on sex ratios at birth, for single-year cohorts, reveal that women who report ages at heaped numbers are not more likely to omit dead children as compared with children still alive, or female births as compared with male births.

Table 11 Estimated Omission of Children Ever Born as Percentage of Number of Children Reported in Fertility History, by Ten Years Prior to Survey Date, for Women Aged 30-49

Age at Survey	Omission Rate of Births More than Ten 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

Source: *Nepal Fertility Survey, 1976.*

We do not propose that the estimates given in Table 11 be used as corrections to the fertility histories. Any set of estimates of the extent of omission by age depends upon a somewhat arbitrary assumption as to when (i.e. how many years ago) the omitted births occurred. Rather, we use the estimates to suggest a general pattern of omission by age and to provide adjusted fertility histories which are no longer characterized by omissions of large numbers of births. In the following section, we use the adjusted fertility histories to investigate the extent of displacement in the reporting of dates of birth. An alternative procedure for evaluating the degree of omission and displacement of births in the maternity histories has been proposed by Rod Little and is presented in Appendix III.

3.2.3 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 by omission of remote events. Table 12 shows reported cumulative fertility by successive ages for five-year cohorts. Note, for example, that the cohort now aged 25-29 had 0.77 births by exact age 20 whereas the cohort aged 45-49 had only 0.52 births by 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

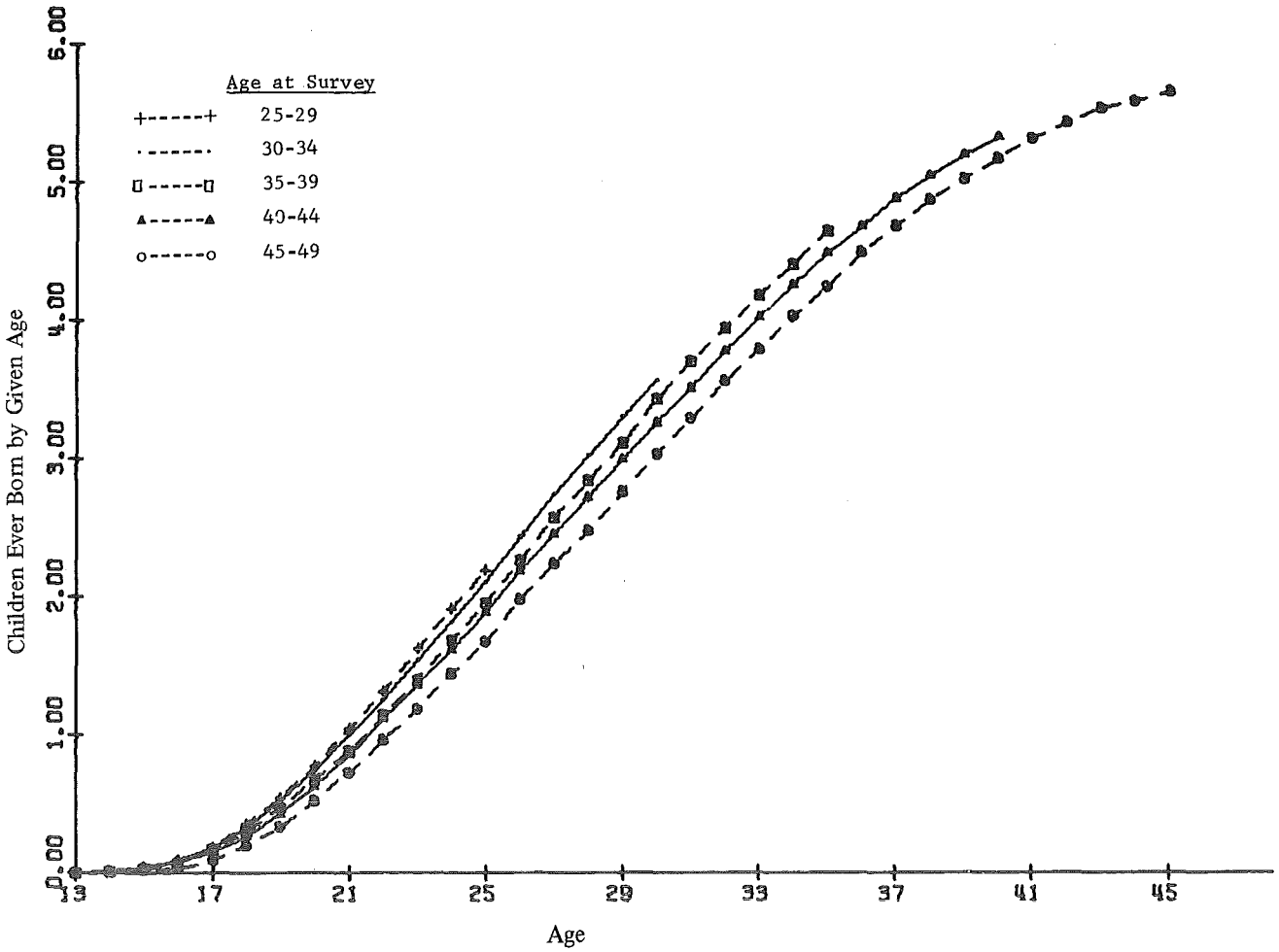

Figure 17 Cumulative Number of Children Ever Born per Women by Five-year Cohorts, Derived from the Fertility History, Nepal Fertility Survey (1976).

Table 12 Reported Number of Children Ever Born per Women, by Successive Ages and by Age at Survey, Derived from Fertility Histories of Ever-married Women[1]

Exact Age	Age at Survey					
	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	1,761	3,328	3,506	3,727	3,981	2,962
Number of Ever-married Women	1,226	1,146	855	736	720	516

[1] In the estimation of numbers of children per women, 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.
Source: *Nepal Fertility Survey, 1976.*

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. Figure 17 presents these data graphically. Note that except for the youngest ages the cumulative fertility curves for successive cohorts do not even 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; i.e. respondents displaced dates of birth in the direction of the survey date.

Under the assumption of unchanging fertility, the mean age of childbearing should be invariant by cohort, and equal to the mean age of 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, we have assigned to each cohort current period age specific fertility rates at ages above their current age in the calculation of the mean age of childbearing.

Mean ages of childbearing are shown in Figure 18, computed with and without inflation of births five and more years ago for estimated omissions (see Table 11 for estimated omission rates). Even after adjustments for omitted births, the mean 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 adjustments 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. In Figures 19 and 20, reported cumulative fertility schedules (adjusted for omissions) are compared with the synthetic period cumulative fertility schedule for the cohorts aged 38 and 48, respectively. (These two cohorts had approximately the same omission rates). These figures further illustrate the displacement of births by women in

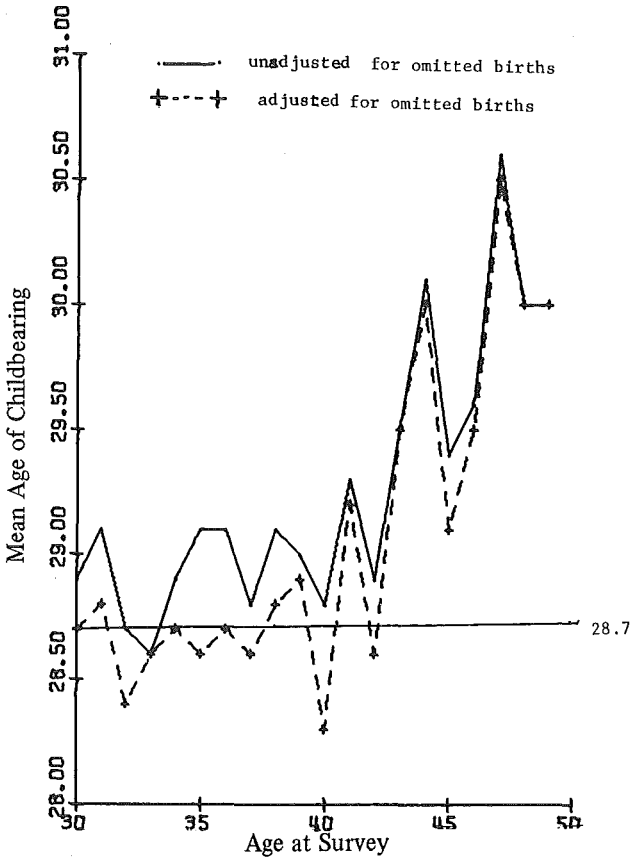

Figure 18 Mean Ages of Childbearing for Completed Fertility Schedules[1], with and without Adjustments for Omitted Births, by Single-year Cohorts Aged 30-49, Nepal Fertility Survey (1976).

[1] 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.

their forties, contrasted with the approximately correct timing of births (once births have been adjusted for omissions) by women in their thirties.

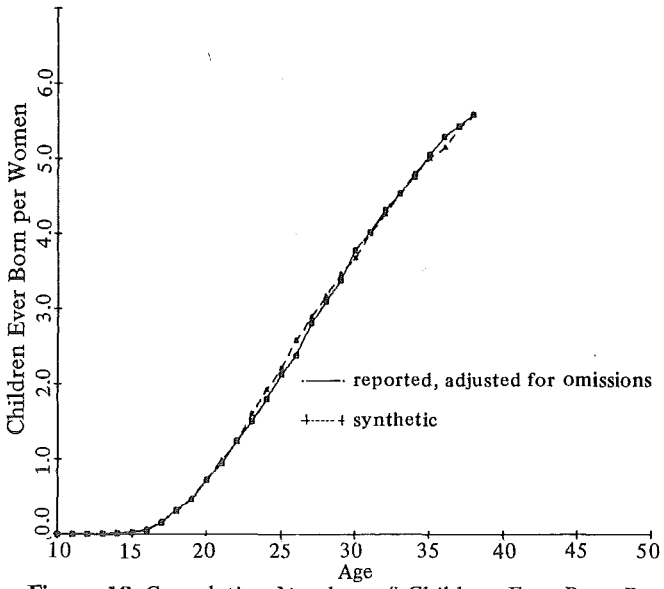

Figure 19 Cumulative Number of Children Ever Born Per Women in the Reported Fertility History Adjusted for Omissions and in the Synthetic Births-last-year Schedule, for Thirty-eight Year-old Women, Nepal Fertility Survey (1976).

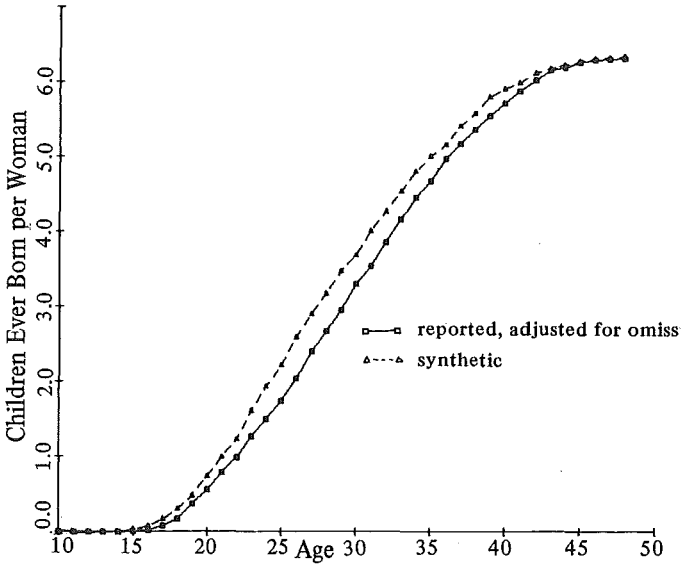

Figure 20 Cumulative Number of Children Ever Born per Women in the Reported Fertility History Adjusted for Omissions and in the Synthetic Births-last-year Schedule, for Forty-eight Year-old Women, Nepal Fertility Survey (1976).

The 49 year-olds in the survey reported a cumulative 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 11). In Figure 21 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. (Each schedule has been smoothed by taking a five-year moving average). Note

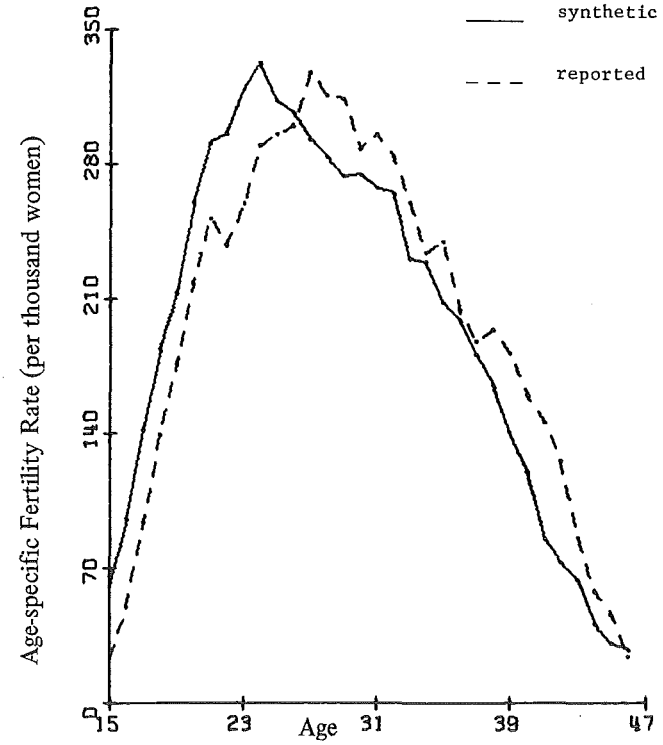

Figure 21 Age-specific Fertility Rates[1] (Per Thousand Women) from Synthetic Schedule and As Derived from Fertility Histories of Forty-nine Year-old Women, Nepal Fertility Survey (1976).

[1] Age-specific fertility rates for both schedules are calculated as five-year moving averages.

the clear indication of a time shift of fertility toward the later ages. A fertility schedule representing the effect of age displacement (toward older ages) in reported fertility is reproduced from Potter (1977) in Figure 22. The similarity between the two sets of curves is striking.

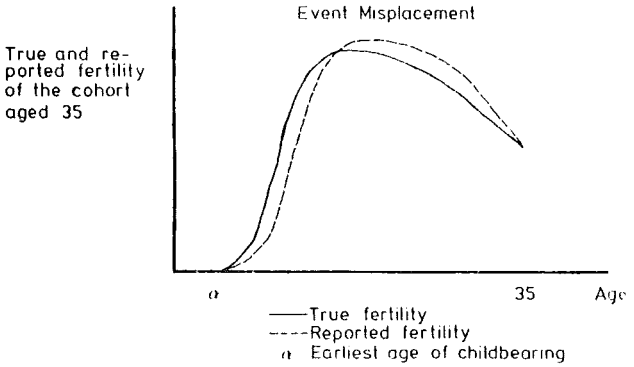

Figure 22 True and Reported Age-specific Fertility Rates for a Cohort of Older Women Who Displace Dates of Births Toward the Present.

Source: Potter, J.E. 1977. Problems in Using Birth History Analysis to Estimate Trends in Fertility, *Population Studies* 31 p. 351.

3.2.4 FURTHER EVIDENCE FOR OMISSION AND DISPLACEMENT IN THE DETAILED FERTILITY HISTORY

The combination of omission of births and displacement in the dating of births (or in the ages of mothers at the time of the births) in the fertility histories distorts the measures of fertility in the early durations of marriage as well as time trends in age specific fertility rates. Measures of fertility in the early durations of marriage and fertility rates for periods in the past, dating as far back as 30 years, have been reconstructed from data in the fertility histories and are presented below. Tables 13 and 14 shows the per cent of women not reporting a birth within the first few years of marriage and the average number of children reported in the first five years of marriage, respectively. The data indicate that, in general, the older the cohort, the fewer children reported in the first few years of marriage. Tables 12, 13, and 14 all reveal, in various ways, the omission of early births and the displacement of the dates of these births toward the present, by the older women.

Cumulative proportions of the cohorts now aged 30-34, 35-39, 40-44, and 45-49 ever having had a birth by successive ages (up to exact age 30) are graphed in Figure 23. Note that the older the cohort, the lower the proportion having had a birth by any given age. As in Figure 17, except for the very young age, the curves for different cohorts do not even overlap. Omission of first births (causing later occurring second births to be treated as first births) and displacement of these births toward the present have reduced the reported early fertility experience of the older women.

Using data on the dates of all births reported in the fertility histories, we have constructed age specific fertility rates for five-year periods in the past (Table 10). Table 10 indicates reduced age specific fertility for the oldest cohorts at early ages. For example, following the first diagonal in Table 10, we note that age specific fertility rates centered on age 15 (i.e. the age group 15-19 for a period on the average 2.5 years ago) increase from a value of 29 (per thousand women) for the period 30 to 34 years ago to a peak value of 49 for the period 10 to 14 years ago; even more striking is the monotonic increase of age specific fertility centered on age 20 from 168 for the period 25 to 29 years ago to 225 for the period 0 to 4 years ago. As noted previously, the data in Table 10 suggest an increase in fertility during the remote past, but relatively constant or decreasing fertility during the past decade.

It is interesting to note that after Table 10 is adjusted for omission of births (according to the adjustment factors described on p. 26 but not for displacement of births, the resulting pattern of fertility shows a decline in fertility over the past ten-year period in addition to an increase during the more remote past. Table 15 shows age specific fertility rates (per thousand women) for five-year periods in the past, adjusted for omission of births. The decline in fertility from the period 5 to 9 years ago to the most recent five-year period, most notable for women 30-34, 35-39, and 40-44 at survey date, appears to be a consequence of the displacement of births by these cohorts toward the survey date. As described in detail by Potter (1975, 1977) the

Table 13 Percentage of Ever-married Women Not Having a Birth within Three, Five, and Eight Years of Marriage, by Age at Marriage and by Age at Survey

Age of Marriage Less than 15	Percentage Not Having Birth Within *n* Years of Marriage		
	n		
Age at Survey	3	5	8
20-24	81	52	24
25-29	79	50	22
30-34	79	55	26
35-39	76	52	22
40-44	83	60	30
45-49	87	64	37
Age of Marriage 15-19	Percentage Not Having Birth Within *n* Years of Marriage		
Age at Survey	3	5	8
20-24	47	25	7
25-29	48	21	6
30-34	51	23	9
35-39	54	28	12
40-44	63	29	12
45-49	58	32	16

[1] The analysis is restricted to ever-married women who have been married for at least three, five, and eight years for the three calculations, respectively.
Source: *Nepal Fertility Survey, 1976.*

Table 14 Mean Number of Children in First Five Years of Marriage for Currently Married Women Who Have Been Married at Least Five Years, by Age at Marriage and by Age at Survey

Age at Survey	Age at Marriage		
	Less than 15	15-19	20-24
20-24	0.65	1.16	–
25-29	0.69	1.20	1.45
30-34	0.63	1.12	1.35
35-39	0.71	1.07	1.25
40-44	0.53	0.97	1.15
45-49	0.46	0.97	1.17

Source: *Nepal Fertility Survey, 1976.*

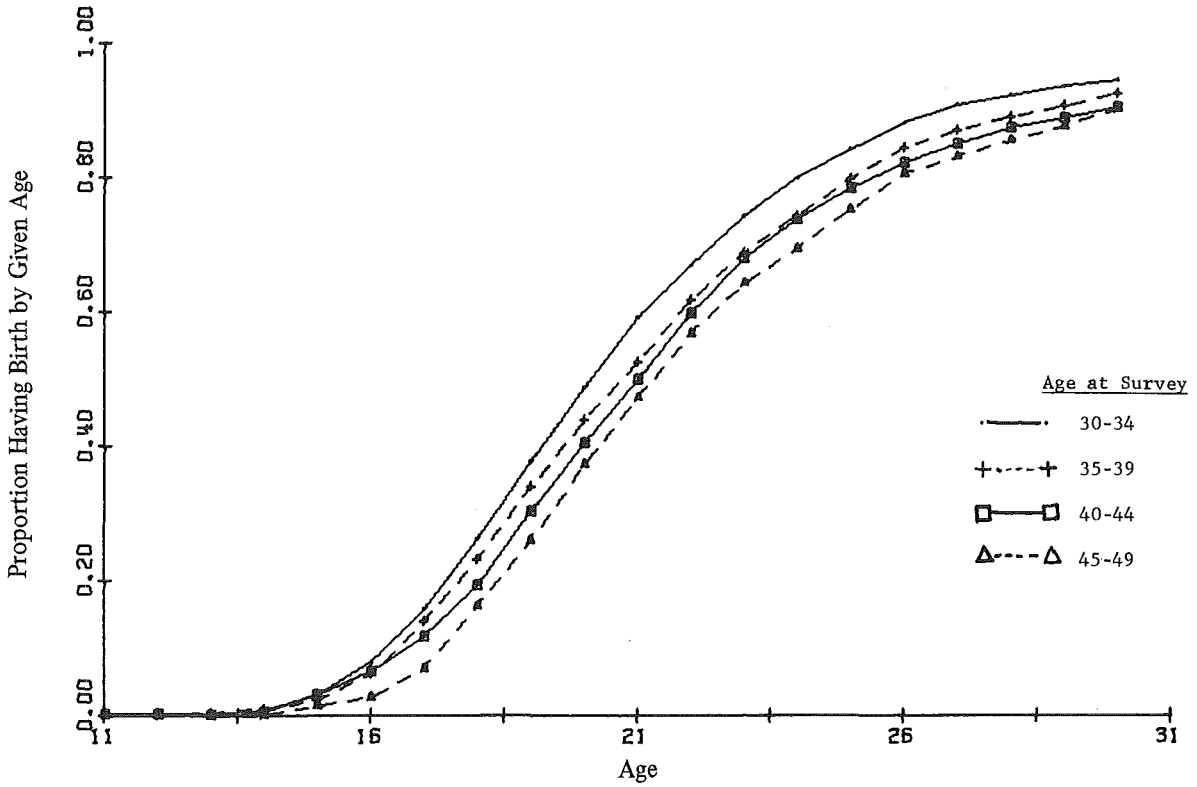

Figure 23 Cumulative Proportions of Cohorts Having Had a Birth by Successive Ages, Nepal Fertility Survey (1976).

Table 15 Age Specific Fertility Rates (per Thousand Women) for Five-year Periods in the Past, by Current Age, Adjusted for Omissions of Births[1]

Age at Survey	Number of Years Ago						
	0-4	5-9	10-14	15-19	20-24	25-29	30-34
15-19	40						
20-24	225	44					
25-29	297	225	49				
30-34	273	298	227	47			
35-39	211	294	358	247	53		
40-44	130	238	301	306	205	36	
45-49	52	160	249	289	297	187	31

[1] Adjustments are based on the hypothesized omission rates given in Table 11.

Source: *Nepal Fertility Survey, 1976*

Table 16 Age Specific Fertility Rates (per Thousand Women) for Five-year Periods in the Past, by Current Age, Derived from Fertility Histories, Terai

Age at Survey	Number of Years Ago						
	0-4	5-9	10-14	15-19	20-24	25-29	30-34
15-19	61						
20-24	236	47					
25-29	313	242	58				
30-34	285	298	222	52			
35-39	217	287	269	202	54		
40-44	121	217	264	284	211	46	
45-49	49	129	192	230	254	163	25

Source: *Nepal Fertility Survey, 1976.*

Table 17 Age Specific Fertility Rates (per Thousand Women) for Five-year Periods in the Past, by Current Age, Derived from Fertility Histories, Hills and Mountains.

Age at Survey	Number of Years Ago						
	0-4	5-9	10-14	15-19	20-24	25-29	30-34
15-19	31						
20-24	219	42					
25-29	287	213	42				
30-34	266	277	200	38			
35-39	206	271	286	190	40		
40-44	135	225	268	261	165	24	
45-49	53	163	238	275	271	171	31

Source: *Nepal Fertility Survey, 1976.*

displacement of births in the more remote past has presumably led to artificially increased fertility in the period 5 to 9 years ago, but has not affected births in the most recent five-year period; hence, the mistaken appearance of a recent decline in fertility.

Tables 16 and 17 show age specific fertility rates for five-year periods for the Terai and Hills/Mountain regions. The birth history data for Terai women seem to indicate a high degree of omission and displacement of births. For example, age specific fertility rates centered about age 15 increase from a rate of only 25 (per thousand women) for the period 30 to 34 years ago to a rate of 61 for the period 0 to 4 years ago. Similarly, the rate centered about age 20 increases from 163 to 236 over the same time span. Increases in fertility appear in all age groups (except 40-44), particularly during the period 20 to 34 years ago, and hence seem to be indicative of misreporting of dates of birth. In contrast, the birth histories for respondents in the Hills and Mountains indicate fairly constant age specific fertility between the period 0 to 4 years ago and periods 20 or more years ago (except for fertility rates centered about age 20 which increase with time). A greater degree of misreporting in the birth histories of Terai women is consistent with the more prominent heaping in reports of age and marriage duration (Figures 5 and 9) for these women.

In summary, we note that the data from the detailed fertility histories of the NFS indicate that younger cohorts have been subject to an earlier start and a higher level of fertility. Although increases in fertility may, in fact, have occurred, the evidence which we have presented in this section – e.g. reduced fertility among women who do not know their ages and a displacement of fertility for women in their forties – suggests that the ostensible trend in fertility rates is actually caused by biases in reporting. Specifically, the fertility histories for the older women appear to be distorted by a combination of omission of remote births and displacement of births toward the present.

4 Infant and Child Mortality

Information for each child recorded in the fertility history, who later died, was obtained in the form of month and year of death and age at death. These data can be converted into estimates of standard measures of infant and child mortality in two ways:

1) The proportion of births surviving to ages 2, 3, and 5 (ℓ_2, ℓ_3, and ℓ_5) can be estimated by indirect estimation techniques (Brass and Coale, 1968; Trussell, 1975) from data on proportions dead among children ever born as reported by women in different age groups (and estimates of parity for women in age groups 15-19, 20-24, and 25-29).
2) The proportions of births surviving to ages 1, 2, 3, and 5, (or the proportions of births dying in these ages $-$ $_1q_0$, $_2q_0$, $_3q_0$, and $_5q_0$) can be obtained directly for periods in the past (dating back as far as 25 years) by determining the number of births in each period and cumulating the number of these births that die before their first, second, third and fifth birthdays, respectively.

Estimates from these two procedures for the recent past are forced to have some degree of consistency since both are based on the same reports of births and deaths.

4.1 RECENT INFANT MORTALITY RATES

Table 18 shows estimates of ℓ_2 derived from data on proportions dead of children ever born (Trussell, 1975), according to the four regional patterns of mortality (Coale and Demeny, 1966). Among the parameters ℓ_1, ℓ_2, ℓ_3, and ℓ_5, the estimates of ℓ_2 from this procedure are the most robust when the underlying pattern of mortality is not known (Trussell, 1975). Values of ℓ_2 in Table 18 show very little variation by regional pattern of mortality, ranging only from 0.777 to 0.787. These estimates of ℓ_2 pertain to a period approximately 2.3 years ago (see discussion below). For a given regional pattern of mortality, an estimate of ℓ_2 implies a particular level of mortality (or a value of e_0); a value of ℓ_1 can be determined from the estimated level of mortality. As shown in the last column of Table 18B the values of ℓ_1 range considerably more than those of ℓ_2, lying between 0.813 and 0.839.

Estimates of the probability of dying in the first year of life ($_1q_0$) can be obtained from the values of ℓ_1 in Table 18 (i.e., $_1q_0 = 1 - \ell_1$). These estimates, ranging from 0.161 to 0.187 for the four regional patterns of mortality, are shown in Table 19. A direct estimate of the infant mortality rate for the recent past can be obtained by tabulating from dates of birth and death in the fertility history the proportion of infants dying before their first birthday. This estimate of $_1q_0$, obtained for the period approximately one to five years before the survey, equals 0.154, somewhat less than the first set of estimates.

Estimates of $_2q_0$, $_3q_0$, and $_5q_0$ derived indirectly from data on proportions dead of children ever born and the corresponding estimates derived directly from the fertility histories can also be compared. Estimates of $_2q_0$, $_3q_0$, and $_5q_0$ derived from the data in Table 18A, according to the procedure described in Trussell (1975), are shown in Table 20, along with estimates of the number of years in

Table 18A Proportions Dead of Children Ever Born, by Age at Survey

Age at Survey	Proportion Dead of Children Ever Born
15-19	0.174
20-24	0.219
25-29	0.223
30-34	0.249
35-39	0.273
40-44	0.305
45-49	0.311

Table 18B Estimates of ℓ_2, Level of Model Life Table, and Corresponding Estimate of ℓ_1, by Regional Pattern of Mortality, Based on Proportions Dead of Children Ever Born.[1]

Region	ℓ_2	Mortality Level	ℓ_1
North	0.787	9.25	0.834
South	0.778	10.76	0.839
East	0.777	11.54	0.813
West	0.777	9.88	0.822

[1] Estimates of ℓ_2 are based upon a regression equation involving the proportion dead of children ever born to 20-24 year old women and the average parities for women in the age groups 15-19, 20-24 and 25-29 (equal to 0.200, 1.350 and 2.853, respectively). The technique is an extension of the Brass procedure (Brass et al, 1968) and is described in detail in Trussell (1975). Each value of ℓ_2 implies a mortality level for each region of the model series of life tables (Coale and Demeny, 1966); once a mortality level is estimated, a corresponding value of ℓ_1 can be determined.

Source: *Nepal Fertility Survey, 1976.*

Table 19 Estimates of Infant Mortality Rate ($_1q_0$) from Nepal Fertility Survey (1976) and from Demographic Sample Surveys (1974-75 and 1976)

Source of Estimate	$_1q_0$
Nepal Fertility Survey	
Estimates from Proportions Dead of Children Ever Born, by Region of Mortality Pattern[1]	
North	0.166
South	0.161
East	0.187
West	0.178
Deaths Under One Year of Age Among Births in Nepalese Years 2027-2031 (approximately 1970-74)	0.154
Demographic Sample Surveys[2]	
1974-75	0.133
1976	0.134

[1] See Table 18 for estimates of ℓ_1 ($\ell_1 = 1 - {}_1q_0$) derived from proportions dead of children ever born.

[2] Source: Bourini, A.K. 1976. *The Demographic Sample Survey of Nepal, 1974-1975.* Report prepared for His Majesty's Government of Nepal. Kathmandu.
Bourini, A.K. 1977. *The Demographic Sample Survey of Nepal. Second Year Survey 1976.* Report prepared for His Majesty's Government of Nepal. Kathmandu.

the past to which these estimates pertain (National Academy of Sciences, forthcoming). Values of $_2q_0$, $_3q_0$, and $_5q_0$ derived directly from data on dates of births and infant deaths in the birth fertility history, for the (approximately) corresponding number of years back, are also shown. The two sets of estimates are generally consistent with one another. Since both estimates are based on the same reports of births and deaths, the estimates are forced to be in basic agreement.

Estimates of $_1q_0$ derived from the Nepal Fertility Survey vary between 0.154 and 0.187 (Table 19). These estimates are higher than the estimates of 0.133 and 0.134 obtained from the Demographic Sample Surveys of 1974-75 and 1976 (Bourini, 1976, 1977). Thus, the Nepal Fertility Survey appears to have obtained a more complete record of infant deaths than did the other recent surveys in Nepal. In addition, the reconstruction of proportions dead of children ever born for 1971 from reported dates of birth and death in the Nepal Fertility Survey reveals that reports of infant deaths in the NFS are substantially more complete than those in the 1971 Census (see Table 21).

Table 20 Estimates of Child Mortality Rates ($_2q_0$, $_3q_0$, and $_5q_0$) Derived from Data on Proportions Dead of Children Ever Born and from Dates of Birth and Death in the Fertility Histories

	Derived from Proportions Dead of Children Ever Born		Derived from Birth History	
Rates	Estimate[1]	Approximate Years Back	Estimate	Approximate Years Back[2]
$_2q_0$	0.223	2.3	0.200	2.5
$_3q_0$	0.224	4.2	0.221	4.5
$_5q_0$	0.250	6.6	0.236	6.5

[1] Estimates given are based on West pattern of mortality (Coale and Demeny, 1966); however, estimates for the four regional mortality patterns show very little variation by region.
[2] Direct estimates of $_2q_0$, $_3q_0$, and $_5q_0$ are based on births in the Nepalese calendar years 2030, 2027-2029, and 2025-2027 respectively; the NFS took place during the first few months of 2033.
Source: *Nepal Fertility Survey, 1976.*

Table 21 Proportions Dead of Children Ever Born, by Age of Mother, for the 1971 Census and Reconstructed for 1971 from Reported Dates of Birth and Death in the Nepal Fertility Survey, 1976

Age of Mother	Nepal Fertility Survey	1971 Census[1]
15-19	0.221	0.115
20-24	0.215	0.126
25-29	0.238	0.135
30-34	0.257	0.147
35-39	0.284	0.161
40-44	0.290	0.182

[1] Data taken from the 1971 Census, Tables 33 and 34.

4.2 INFANT MORTALITY RATES FOR PERIODS IN THE PAST

Table 22 shows infant and child mortality rates for five-year periods in the past, obtained from data on dates of all births in the period from 5 to 25 years ago, and dates of deaths for infants among these births who subsequently died. Infant deaths which occurred at heaped ages – 12, 24, 36, 48, and 60 months – were distributed into two consecutive years: e.g. half of the deaths at 12 months were attributed to the first year and half to the second year of age. The extent of age heaping on months of age divisible by 6 and 12 can be seen from Figure 11.

The values of $_1q_0$, $_2q_0$, $_3q_0$, and $_5q_0$ shown in Table 22 fit model life tables quite closely (in particular West model tables; Coale and Demeny, 1966) and indicate a fairly steady decline in infant and child mortality in the 25 years prior to the survey. There is no indication that older women have omitted dead children more frequently than live children, since the reported infant mortality rates continue to increase as one moves backward in time for the period 5 to 25 years prior to the survey. Of course, there could have been still higher infant mortality in the past than is indicated by these estimates if dead children had been selectively omitted.

Table 22 Probabilities of Dying Within One ($_1q_0$), Two ($_2q_0$), Three ($_3q_0$), and Five ($_5q_0$) Years of Birth[1] for Five-year Periods in the Past, Derived from Fertility Histories

	Number of Years Ago[2]			
	5-10	10-15	15-20	20-25
$_1q_0$	0.166	0.183	0.181	0.203
$_2q_0$	0.203	0.223	0.235	0.245
$_3q_0$	0.225	0.245	0.265	0.273
$_5q_0$	0.249	0.272	0.298	0.307

[1] Since infant deaths are greatly heaped on 12, 24, 36, and 60 months, these deaths were distributed as follows: $_1q_0$ includes half of deaths at 12 months, $_2q_0$ includes half of deaths at 24 months, $_3q_0$ includes half od deaths at 36 months and $_5q_0$ includes half of deaths at 60 months.
[2] Calculations were actually performed by calendar years, according to the Nepalese Calendar. So, for example, the period 5 to 10 years ago actually refers to calendar years 2023 to 2027; the Nepal Fertility Survey took place during the first few months of 2033.
Source: *Nepal Fertility Survey, 1976.*

5 Conclusion

Overall, it appears that the detailed fertility histories yield consistent estimates of infant and child mortality: specifically, we find no evident tendency for older women to omit a higher proportion of dead children than of live children in the remote past. Nevertheless, overall omission of births in the remote past seems undeniable, particularly among older women who do not know their ages.

A thorough analysis of data in the Nepal Fertility Survey has revealed systematic biases in the reporting of first marriages and dates of birth for children recorded in the fertility history. Misreporting of first marriages and births appears to have produced misleading indications of trends in age at marriage, aggregate fertility, and age pattern of fertility, by cohort and by time period.

Table 23 shows the ages at which successive cohorts passed certain milestones of marriage and childbearing, as estimated from the detailed histories. An acceptance of events as reported implies a median age at marriage which was lower for intermediate cohorts than for the younger and older cohorts. In addition, the ages at which different parities were attained was ostensibly less for progressively younger cohorts. These data indicate that age at marriage had been subject to no consistent trend but that fertility had been occurring at successively earlier ages and at higher levels for the younger cohorts. The interval between marriage and first birth appears to have declined for younger cohorts, although marriages are reported as occurring at approximately the same ages.

In this analysis, we have presented what we believe to be a more reasonable interpretation of these data: a combination of omission and event displacement has distorted the fertility and marriage histories reported by these different cohorts. According to this explanation, age at first marriage was overstated by the reporting of higher order marriages in place of first marriages, and possibly by displacement of dates of marriage. In addition, average parity was understated by the older women because of omission of births (especially births occurring more than ten years before the survey). The age pattern of fertility was further distorted by the reporting of some births as having occurred too recently.

The biases we have detected should not obscure the much higher accuracy of data in the NFS than in the Nepalese Censuses. In strong contrast to census data, the age distribution by five-year intervals is only slightly distorted, and births, marriages, and infant deaths for the recent past are all apparently reported with negligible error. Most of the defects we have found in reports of events pertain to periods at least five or ten years before the survey.

Table 23 Ages at Which Different Cohorts Passed Certain Milestones of Marriage and Childbearing

Age at Survey	Age of Attainment by Cohort of			
	50 Per Cent Ever Married	Average Parity of		
		1.0	2.0	3.0
20-24	15.8			
25-29	15.2	20.8	24.3	
30-34	15.1	21.0	24.6	27.9
35-39	15.6	21.5	25.2	28.6
40-44	15.7	21.6	25.4	29.0
45-49	15.8	22.2	26.1	29.9

Source: *Nepal Fertility Survey, 1976.*

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Appendix I Methodology for Deriving Demographic Estimates from Marriage and Birth Histories

A RECONSTRUCTION OF MARITAL STATUS AS OF THE CENSUS DATES

Using data on dates of birth, marriage, and interview, for ever-married women interviewed in the individual survey, one can reconstruct age and marital status as of the 1961 and 1971 census dates. Specifically, one can determine the numbers of women who were ever married by age group as of the census dates, to yield the numerators of proportions ever married as of the census dates.

The denominators – the total numbers of women by age group as of the census dates – are slightly more difficult to calculate. A simple reverse count of all women by age group in the Household Survey is not technically correct, since it ignores the non-response rate of ever-married women in the Household Survey: i.e. not all ever-married women in the Household Survey were later interviewed in the individual Survey. Instead, numbers of ever-married women in the proportions of women ever married (in the Household Survey) as of the corresponding age to yield an estimate of the age distribution of all women. These 'inflated' numbers of women as of the NFS date can then be transformed into age distributions as of the census dates by simple reverse counting of age.

The following example illustrates the procedure. Let us assume that the 1971 Census took place exactly five years earlier than the NFS (true to a close approximation) and determine the proportion of 20 to 24-year old women at the time of the 1971 Census who were ever married as of that date. The numerator is simply the number of ever-married women aged 25 to 29 in the NFS whose date of marriage occurred more than five years prior to the survey date. The denominator is the following ratio:

$$\frac{\text{Number of ever-married women aged 25 to 29 as of NFS date}}{\text{Proportion of 25 to 29-year old women who have ever been married (determined from the Household Survey).}}$$

Since no women older than 49 were interviewed in the 1976 NFS, proportions of women ever-married can only be determined through the age group 40-44 for the 1971 Census date and through the age group 30-34 for the 1961 Census date, as shown in Table 2.

B CALCULATION OF FERTILITY MEASURES FROM DATA IN THE BIRTH HISTORIES

Age Specific Fertility Rates Derived From Births in the Past Year

Using data on the number of births during the twelvemonth period prior to the NFS and data on the age of women at that time, one can construct a single-year specific fertility schedule for the year prior to the survey (most of 1975 and part of 1976). Numbers of births during the twelve months, distributed by women's ages at the time of birth, provide numerators for the age specific rates. Numbers of ever-married women by their age six months prior to interview date, divided by proportions of women who have ever been married by age at survey date (obtained from the Household Survey) serve as denominators. (Essentially, we are considering total – ever-married and single – numbers of women by age at survey and then determining women's ages six months prior to survey date. We are implicitly assuming that there are no illegitimate births; i.e. all births can be attributed to ever-married women). For example, the age specific fertility rate for 25-year old women during the year prior to the survey is estimated by:

$$\frac{\text{\# births in past 12 months to women 25-26 at time of birth}}{[\text{\# ever-married women 25-26 as of 6 months prior to interview date}) \div (\text{proportion of women 25½-26½ who have ever been married})]}$$

With direct use of the data tape, the calculation is performed somewhat differently.

Following the procedure described above, we obtained single-year age specific fertility rates for women aged 15 to 49. We noted that the rates for ages 15, 16, and 17 were very low when compared with the corresponding rates obtained from women aged 20-24 at the time of the Survey. (In addition, we could not obtain age specific rates for ages below 15 since women under 15 were not interviewed in the NFS). We attributed these low fertility rates partly to interviewer bias (i.e. women in their teens who already had children were likely to be reported as older) and subsequently corrected the situation by using specific fertility rates for ages 15 through 17 from the cohort 20-24 at survey date. Age specific rates for the remaining ages were derived from births in the past year. As described on p. 21, the schedule did not have to be adjusted for a potentially misstated reference period.

The resulting 'synthetic' age specific fertility schedule is used throughout Section III to represent the 'true' pattern of fertility existing during the past 20 or 25 years, and hence to determine amounts of omission and displacement in the fertility histories. The schedule is given by five-year age groups in Table 6 and by single-year cumulated values in Table 7.

Age Specific Fertility Rates Derived From Current Pregnancies

Data on the proportion of women currently pregnant by age group yield an independent estimate of the pattern (but not of the level) of age specific fertility. Rates of current pregnancy are calculated as the ratio of the number of pregnancies by age group to the total number of women in the corresponding age group. Estimates of the total number of women in each age group are once again obtained by inflating the number of ever-married women by the proportion of women who have ever been married. The resulting rates are linearly interpolated to take into account the fact that women who report current pregnancies will be, on the average, approximately 0.3 years older at the time of birth. The sum of the interpolated rates is adjusted to equal the TFR (6.33) derived from births in the past year. Age specific fertility rates for five-year age groups, derived from current pregnancies, are shown in Table 6.

Fertility Measures by Cohort

In the calculations of children ever born for single-year cohorts (column 1 of Table 7), cumulated values of children ever born for five-year cohorts (Table 12), and age specific fertility rates for cohorts by periods in the past (Tables 10, 16 and 17), the numerators consist of births reported in the fertility histories, while the denominators are estimated as total numbers of women (i.e. numbers of ever-married women in the individual survey divided by proportions ever married obtained from the Household Survey) by either single years of age or five-year age groups. Thus, we assume in all calculations that the fertility of never-married women is negligible.

Appendix II Analysis of Birth Interval Data

A DISTRIBUTION OF BIRTH INTERVALS BY PERIOD

Having detected considerable imprecision in the reports of age and durations of marriage and breastfeeding in the form of heaping on preferred digits, we analyzed data on birth interval lengths to determine whether similar reporting biases were present. Specifically, we analyzed data on the length of closed and open birth intervals by five-year periods prior to the survey, dating back to the interval 20 to 25 years before the survey.

The data reveal little variation in birth interval length by period: the mean and variance of the length of closed inter-birth intervals (for intervals closed within five years) and the proportion of all birth intervals closed within five years show no time trend, even when stratified by age and parity at the start of the interval. The per cent distributions, by month, of closed birth intervals reveal some degree of heaping on the half and whole numbers of years, particularly on 24 and 36 months. Contrary to expectations, the heaping is more prominent in the period 0 to 25 years ago than in more remote periods. Figure A shows the distribution of closed birth intervals for the intervals begun in the most recent five-year period and in the period approximately 20 to 25 years ago.

In general, the heaping on half and whole numbers of years for birth interval data is not extensive. This is likely due to the fact that most women were able to identify months of birth for their children through several probe questions which associated time of birth with the occurrence of festivals and holidays.

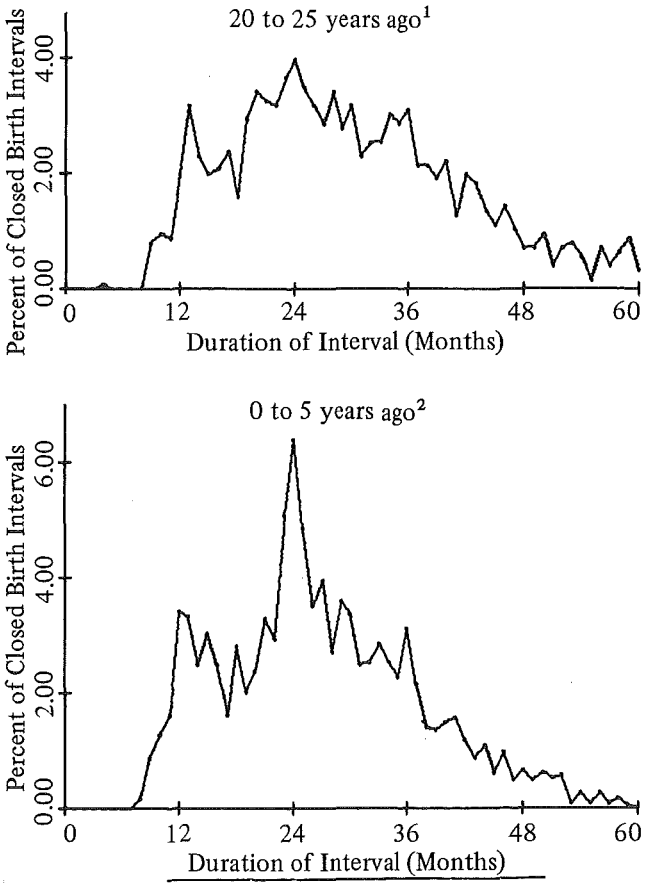

Figure A Percent Distribution of Closed Birth Intervals (for Intervals Closed Within Five Years), for Intervals Begun in Period 20 to 25 Years Ago and Period 0 to 5 Years Ago, Nepal Fertility Survey (1976).

[1] Actual calculation based on Nepalese calendar years 2008-2012.
[2] Actual calculation based on Nepalese calendar years 2028-2032. Since the interview dates occurred during the first few months of 2033, intervals begun during this period have been truncated; however, we are only examining the extent of heaping in interval, length, not mean interval length.

B BIRTH INTERVAL LENGTH RELATIVE TO INFANT SURVIVAL

As a further check on the quality of data, we investigated the relation between the length of birth intervals and the survival of the infants born at the beginning of the intervals. Since an early death of an infant interrupts lactation (and hence post partum amenorrhea), birth intervals for which the infant born at the start of the interval dies at an early age are expected to be shorter then those for which the infant survives. A monotonic relationship between age at death of infants born at the start of birth intervals and the mean length of the subsequent intervals has frequently been noted (Knodel and van de Walle, 1967, Smith, 1960).

Table A shows the mean lengths of birth intervals according to the survival of infants at the start of the interval, derived from data in the NFS fertility histories. The expected relationship is confirmed: the earlier the age at death of an infant, the shorter is the subsequent birth interval. Table A supports our finding that reports of infant death in the NFS appear to be fairly accurate.

Table A Mean Length of Birth Interval According to Survival of Infant at Beginning of Interval

Age of Infant Death	Age of Mother					
	15-19	20-24	25-29	30-34	35-39	40-49
0-1 month	25.6	26.9	29.3	24.5	25.9	26.9
1-6 months	26.9	28.0	28.2	26.9	26.5	27.5
7-12 months	27.8	31.8	30.7	29.4	32.5	30.1
Infant Survived at Least 12 Months	34.3	34.9	34.3	35.0	36.4	34.7

Source: *Nepal Fertility Survey, 1976.*

Appendix III An Alternative Procedure for Detecting Errors in Birth Histories

Rod Little of the World Fertility Survey staff has proposed and carried out the following analysis of misreporting in the fertility histories of the NFS. The purpose of this analysis is to determine the pattern of omission of births which is consistent with an assumption of constant fertility; and to examine whether the resulting pattern is a plausible one or whether timing errors in the dating of births must also have occurred. The procedure described below is applied to the reported cohort period specific fertility rates given in Table 10. True age specific fertility rates for the past 35 years are assumed to be equal to those reported for the five-year period prior to the survey.

The observed cohort period specific fertility rates for the past 35 years (Table 10) are reproduced in Table A. In the absence of reporting errors, these rates would have been equal to those of the most recent five-year period, for the corresponding are groups. The hypothetical cohort period fertility rates are given in Table B. Note that the diagonals of this schedule are constant, as required.

The sums of the columns in Table A equal cumulative parities up to the current age group of the five year cohorts (P values), multiplied by a factor of 1000/5 = 200. Similarly, the sums of the columns in Table B equal the corresponding values of synthetic cumulative parities (F values) – i.e. cumulative parities implied by the fertility rates of the most recent five-year period – also multiplied by a factor of 200.

Under a regime of constant fertility and in the absence of reporting errors, the ratio of these two quantities (P/F ratios) would equal unity. The resulting P/F ratios are shown in the last column of Table B. The values for the younger cohorts (20-24 and 25-29) show little evidence of reference bias in the reporting of events for the past decade or so. However, the ratios decline monotonically for the older cohorts and suggest omissions of births in the fertility histories of these women.

Subtracting the entries in Table B from the corresponding values in Table A, one obtains differences between observed and expected fertility rates, by cohort and period (Table C). As a result of the assumption of constant fertility, entries in the first column are forced to equal zero. The row totals in this table are estimated numbers of omitted births per thousand women in each cohort, whereas the column totals are the corresponding estimates for each period.

Table A Observed Fertility Rates Per 1000 Women by Cohort and Period

	Years before Survey							
Age at Survey	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Sum (200P)
15-19	40							40
20-24	225	44						269
25-29	297	225	49					571
30-34	273	285	208	44				810
35-39	211	277	279	194	45			1006
40-44	130	222	266	269	182	32		1101
45-49	52	149	220	257	264	168	29	1139

Table B Fitted Fertility Rates per 1000 Women by Cohort and Period, Assuming Constant Cohort Fertility Estimated by Cross Sectional Current Fertility Rates.

	Years before Survey								
Age at Survey	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Sum (200F)	P/F
15-19	40							40	1.00
20-24	225	40						265	1.02
25-29	297	225	40					562	1.02
30-34	273	297	225	40				835	0.97
35-39	211	273	297	225	40			1046	0.96
40-44	130	211	273	297	225	40		1176	0.94
45-49	52	130	211	273	297	225	40	1228	0.93

Table C (Observed-Fitted) Fertility Rates per 1000 Women by Cohort and Period

Age at Survey	Years before Survey							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Sum
15-19	–							
20-24	–	+ 4						+ 4
25-29	–	0	– 9					– 9
30-34	–	+12	–17	+ 4				– 1
35-39	–	+ 4	–18	–31	+ 5			– 40
40-44	–	+11	– 7	–28	–43	– 8		– 75
45-49	–	+19	+ 9	–16	–33	–57	–11	– 89
Sum	–	+50	–42	–71	–71	–65	–11	–210

Table D [100 (Observed-Fitted)/Fitted] Fertility Rates by Cohort and Period

Age at Survey	Years before Survey							
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	Mean
20-24	–	(10)						10
25-29	–	0	–(22)					– 3
30-34	–	4	– 8	(+10)				0
35-39	–	1	– 6	–14	(+12)			– 5
40-44	–	5	– 3	– 9	–19	(–20)		– 9
45-49	–	15	+ 4	– 6	–11	–25	(–28)	– 8
Mean		+4	– 4	– 9	–13	–25	–28	– 4

In Table D the above differences are expressed as percentages of the expected values in Table B. The mean omission rates by cohort given in the last column of Table D are expressed as percentages of births which occurred more than five years prior to the survey. Note that the percentages in parentheses are based on small numbers of births and hence are not stable estimates.

The row margins of Table D suggest omission rates for cohorts over age 35, ranging from 5 per cent to 9 per cent of births which occurred more than five years prior to the survey. Similarly, the column margins suggest that omission rates rise steadily from 4 per cent in the period 10 to 14 years before the survey to 28 per cent in the period 30 to 34 years before the survey. In addition there appears to be an overstatement of 4 per cent of births in the period 5 to 9 years before the survey. In fact, the positive entries in Table D indicate an overstatement of births for almost every cohort in this period.

There are several possible interpretations of the estimated omission rates in Table D. If one is willing to believe that all reporting errors can be attributed to omissions of birth (rather than to displacement of dates of birth), the data indicate very large omissions in the remote past and an overreporting of births in the more recent past. For example, if no displacement had occurred, the oldest cohort would have failed to report one-quarter of their births 25 to 29 years ago, but would have overreported their births 5 to 9 years ago by 15 per cent.

A more plausible explanation appears to be that a combination of omission and displacement has distorted the cohort-period specific fertility rates. The very large omission rates in the earliest periods may be the result of the older cohorts omitting some births from the fertility history, *and* displacing the dates of other births toward the survey date. This type of displacement would result in the apparent overstatement of fertility in the past decade.

Yet another explanation of the excess fertility in the period 5 to 9 years before the survey is that fertility has declined in the recent past. However, a higher true level of fertility for the period 5 to 9 years ago would imply even larger omission rates for the earliest periods. Since the level of omissions for the early periods are already quite high, this alternative hypothesis seems less plausible than previous explanations.

In summary, it should be noted that the preceding analysis supports the general conclusions drawn in Section III (pp. 22-30). That is, the fertility histories of the older women appear to have been distorted by a combination of omission of remote births and displacement of dates of birth toward the present. The technique presented in this appendix, however, does not attempt to estimate the level of omission in the remote past in order to analyse the resulting pattern of displacement. Rather, the procedure yields estimates of omission rates which are consistent with constant fertility. These rates shown in Table D suggest that an increasing omission rate for periods further in the past may account for much of the difference between reported and expected fertility rates. Nevertheless, it is plausible that timing errors in the dating of births also occurred.