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Estimates of Abridged Life Tables, Corrected Sex-Age Distribution and Birth and Death Rates for Nepal, 1954

Introduction

IN this paper a life table for Nepal for 1954 is presented along with corrected sex-age distribution and estimates of vital rates for the above period. The basic data for this study are from the 1952-54 census, which was the first census of Nepal to follow modern census procedures.² We have also utilized the data from the 1961 census of Nepal, since this is the only other source of information on which this demographic study of Nepal could be based.

Nepal does not have vital registration system nor have there been any extensive demographic surveys on a sample basis before 1954. Life tables for Nepal-official or otherwise-have not been published so far. Hence, it is hoped that the life tables presented in this paper will be useful for planning and policy making. In East Nepal, the census was conducted in late May and early June of 1952 and in West Nepal, at the same time of the year in 1954.³ The 1952-54 data are available by broad age groups and these are used for the computation of life tables. The 1961 census of Nepal gives the population numbers by region, district, and town, sex and age. We have examined the 1961 census for insight into the demographic patterns of Nepal,* but the present study is restricted to an evaluation of the 1952-54 census and the derivation of life tables for Nepal for 1954 based on the quasi-stable population models (Lopes 1961 ; Coale and Demeny 1966).

1. We are grateful to Shri G. Rama Rao and Mrs. Rama Bhargav for computational assistance and to Dr. Dorothy S. Thomas, for her comments on an earlier draft of the paper.
 2. Nepal had four censuses prior to the 1952-54 census and they were taken in 1911, 1920, 1930 and 1941 but all these suffer from underenumeration of a large and unknown magnitude.
 3. Mahotari district of East Nepal was not enumerated until the 1954 census period.
- This analysis will be presented in a separate paper.

Basic Data for the Study and their Adjustment

We proceed from:

1. The reported age-sex distribution for 1952-54; and
2. The growth rate of population during 1952-61 for East Nepal and for 1954-61 for West Nepal.

The reported sex-age distribution, for both East and West Nepal, suffers from several limitations. The sex ratios for different age groups reveal marked irregularities and the age curve is not smooth, suggesting the incidence of age heaping and age misreporting. For a proper evaluation of the pattern of age heaping and misreporting we would need age data by single years of age, but these are lacking for Nepal. In Table 1 we present the reported percentage sex age distribution and sex ratios by 5 year age groups for East and West Nepal. A striking feature of this distribution is the low proportion of enumerated population in 0-4 relative to the proportion in 5-9. In the absence of any evidence of a recent decline in fertility, the most obvious explanation for the trough in the proportion in 0-4 age group is under-enumeration of children of ages 0-4 years.

TABLE 1
REPORTED SEX RATIOS AND PERCENTAGE SEX-AGE DISTRIBUTION OF POPULATION,
NEPAL 1952-54

Age Group	Sex Ratio	East Nepal		Sex Ratio	West Nepal	
		Percentage Distribution			Percentage Distribution	
		Males	Females		Males	Females
0—4	97.97	13.03	12.81	98.16	13.60	13.45
5—9	101.90	14.72	13.92	103.21	14.12	13.28
10-14	112.67	12.29	10.51	113.81	12.31	10.51
15-19	103.05	9.75	9.12	101.12	10.04	9.64
20-24	86.29	8.27	9.23	88.71	8.56	9.37
25-29	91.70	8.91	9.37	86.75	7.96	8.91
30-34	90.63	7.11	7.57	88.29	6.85	7.57
35-39	104.40	6.73	6.21	96.65	5.90	5.93
40-44	88.55	5.00	5.44	89.17	5.23	5.70
45-49	101.04	4.42	4.21	102.03	4.23	4.02
50-54	87.14	3.41	3.77	95.47	3.86	3.92
55-59	92.95	2.19	2.28	108.24	2.56	2.30
60-64	68.94	1.86	2.61	80.88	2.13	2.56
65-69	79.34	0.92	1.12	91.35	1.06	1.12
70+	73.04	1.39	1.83	87.86	1.56	1.72
All ages		100.00	100.00		100.00	100.00

SOURCE : Computed from *Census of Population of Nepal, 1952-54*, Table 6, pp. 15-31. Mahotari District is included in West Nepal.

The sex ratio, measured in terms of the number of males per 100 females, for the 0-4 age group is suspiciously low, that is, 98.0 in East Nepal and 98.2 in West Nepal. In the 5-9 group, it becomes 101.9 in East Nepal and 103.2 in West Nepal. Generally, there are about 105 males born for every 100 females born, and although the infant mortality rate among males may be higher, the sex ratio for 0-4 age group should still favour males (United Nations, 1955). This is all the more surprising because male children are more desired than the female in the Indo-Aryan culture prevalent in Nepal; and for this reason, one should expect a better reporting of male children compared to female children. The change in the sex ratio between 0-4 and 5-9 suggests that either the under-enumeration in the age group 0-4 is greater among males than among females or a good number of male children aged 0-4 were reported in the 5-9 age group.

An approximate measure of the differentials in the enumeration of ages 0, 1, 2, 3, 4 can be obtained by "reviving" the enumerated population in 0, 1, 2, 3, 4 into the corresponding number of births by using appropriate survival ratios and computing the birth rates by relating these estimated births to the population 0, 1, 2, 3, 4 years prior to the census.⁴ This exercise was done for East and West Nepal and for males and females separately. The results are shown in Chart 1. It is apparent that the enumeration improves as one proceeds from 0 to 3 but this is followed by a trough in some cases at age 4. The trough at age 4 can be explained in terms of a shifting of some children aged 4 to age 5 as suggested in the Nepalese Census Report (Census of Population, Nepal, 1952-54, p. xvi).⁵ This is also indicated by a steep rise in the curve at the 5-9 age group.

Examination of the evidence available to us suggests that a crude birth rate of 50 per 1000 may be taken as reasonable for Nepal. On this basis, the 0-4 and 5-9 age groups have been adjusted by the conventional reverse survival method suggested by the United Nations (United Nations, 1956).

An examination of the reported sex ratios and the percentage age distribution for males and females (Table 1) shows that the age distribution of females for East as also for West, Nepal is relatively more inaccurate than that of males. It was therefore decided to discard the reported female age distributions and depend only upon the

4. Throughout the analysis, the Indian life tables for 1931-41 corresponding to an expectation of life at birth of 26.91 for males and 26.56 for females were adopted. It was not possible to apply this method to individual ages 5 to 9 as single year data were not available for the 5-9 age groups. (Registrar General, 1960, pp. 366 and 368).

5. A comparison of the 5-9 age group in 1951 (estimated on the basis of the 1952-54 census) with the 1961 enumerated population in the age group 15-19 also confirms our suspicion that the age group 5-9 has gained by a shift from neighbouring age groups.

6. The age ratios for females indicate relatively serious omissions of females in the age groups 10-14, 15-19, 20-24, 35-39, 45-49 and 55-59. Further the expectancy of life at birth for females obtained from the female age distribution was five years higher than the expectancy of life for males, obtained in this paper. This is certainly impossible under the condition prevailing in Nepal.

BIRTH RATE CALCULATED BY REVIVING ENUMERATED POPULATION AT AGES 0, 1, 3, 4

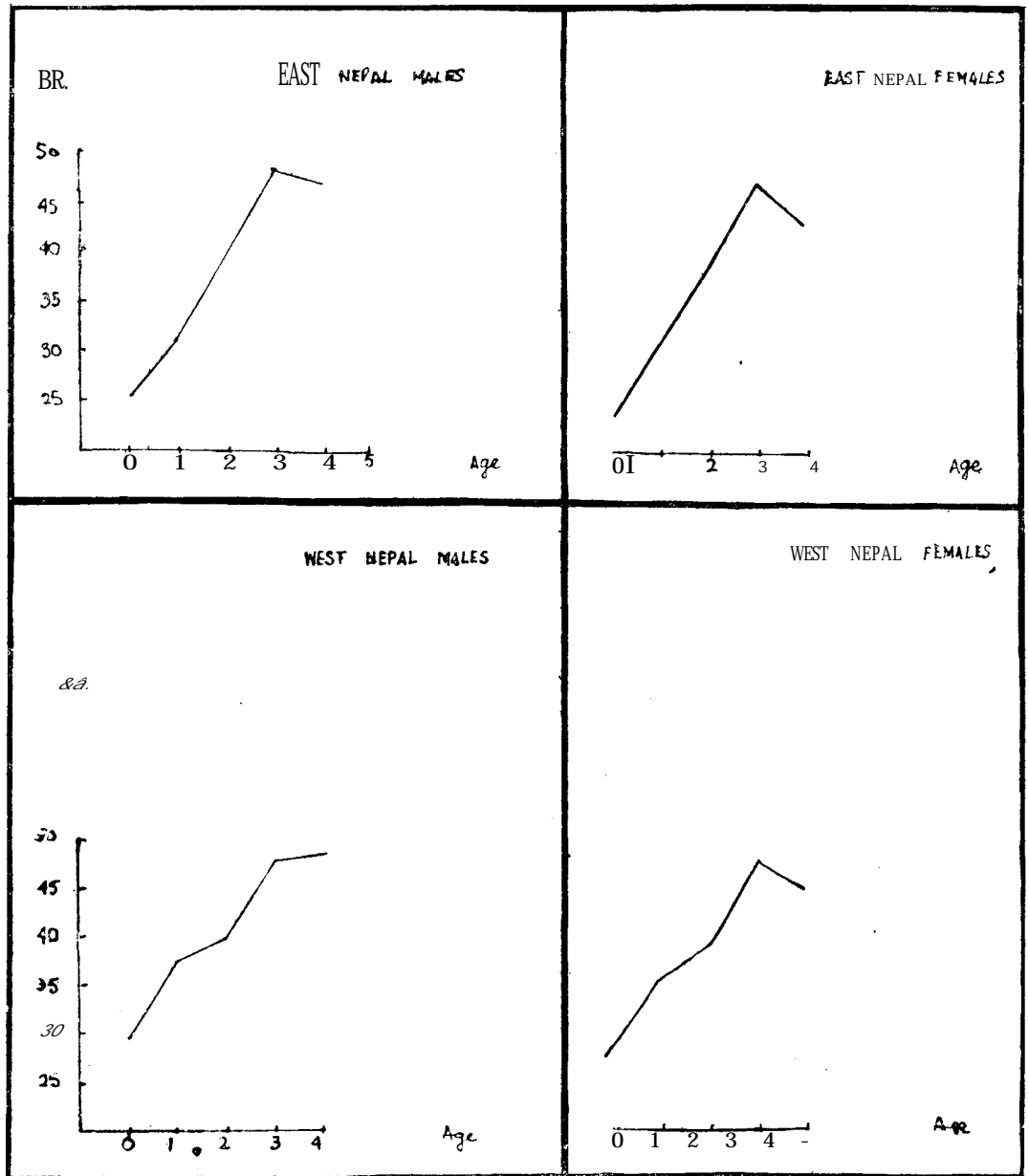


CHART 1

reported male age distributions with adjustment for the subsequent computations. The age distributions of males for East Nepal (1952) and West Nepal (1954) were first adjusted for underenumeration in the 0—4 age group and over-enumeration in the 5—9 age group. The former distribution for East Nepal was then projected to 1954 assuming a rate of growth of 1.1 percent per annum during 1952-54 and combined with the latter age distribution for West Nepal. The age distribution thus obtained is referred to as the "reported" distribution for All-Nepal, 1954.⁷ In order to correct the age distribution of males for the age group 10—14 through 65—69 we have used the following smoothing formula :

$$S_0 = \frac{1}{4} P_{-1} + \frac{1}{2} P_0 + \frac{1}{4} P_1,$$

where S_0 denotes the estimated value and P_{-1} , P_0 and P_1 the observed values for three successive age groups respectively. The age group 70 and over cannot be smoothed and is therefore adjusted with reference to the proportion in the age group found in the Coale-Demeny West Model (level 4). To obtain the age distribution of females, the reported sex ratios were smoothed graphically (See Chart 2) and the smoothed sex ratios were applied to the adjusted number of males in each age group. The percentage age-sex distributions for Nepal after smoothing are given in Table 2. These percentages are used in our computations.

TABLE 2
SMOOTHED AGE DISTRIBUTION OF NEPAL POPULATION, 1954

<i>Age Group</i>	<i>Males</i>	<i>Females</i>
0- 4	16.53	15.85
5- 9	12.97	12.57
10-14	11.87	11.80
15-19	9.86	9.73
20-24	8.53	8.50
25-29	7.79	7.84
30-34	6.93	7.03
35-39	5.97	6.11
40-44	5.05	5.22
45-49	4.23	4.41
50-54	3.42	3.59
55-59	2.56	2.74
60-64	1.81	1.93
65-69	1.17	1.26
70-74	0.78	0.84
75-79	0.37	0.40
80+	0.16	0.18
All ages	100.00	100.00

7. The basis for the assumption of an annual growth rate of 1.1 per cent will be evident from the subsequent discussions. It was decided to combine East and West Nepal as the migration between the two regions might vitiate the results.

REPORTED AND SMOOTHED SEX-RATIO (MALES PER 1000 FEMALES) FOR THE POPULATION OF NEPAL IN 1954

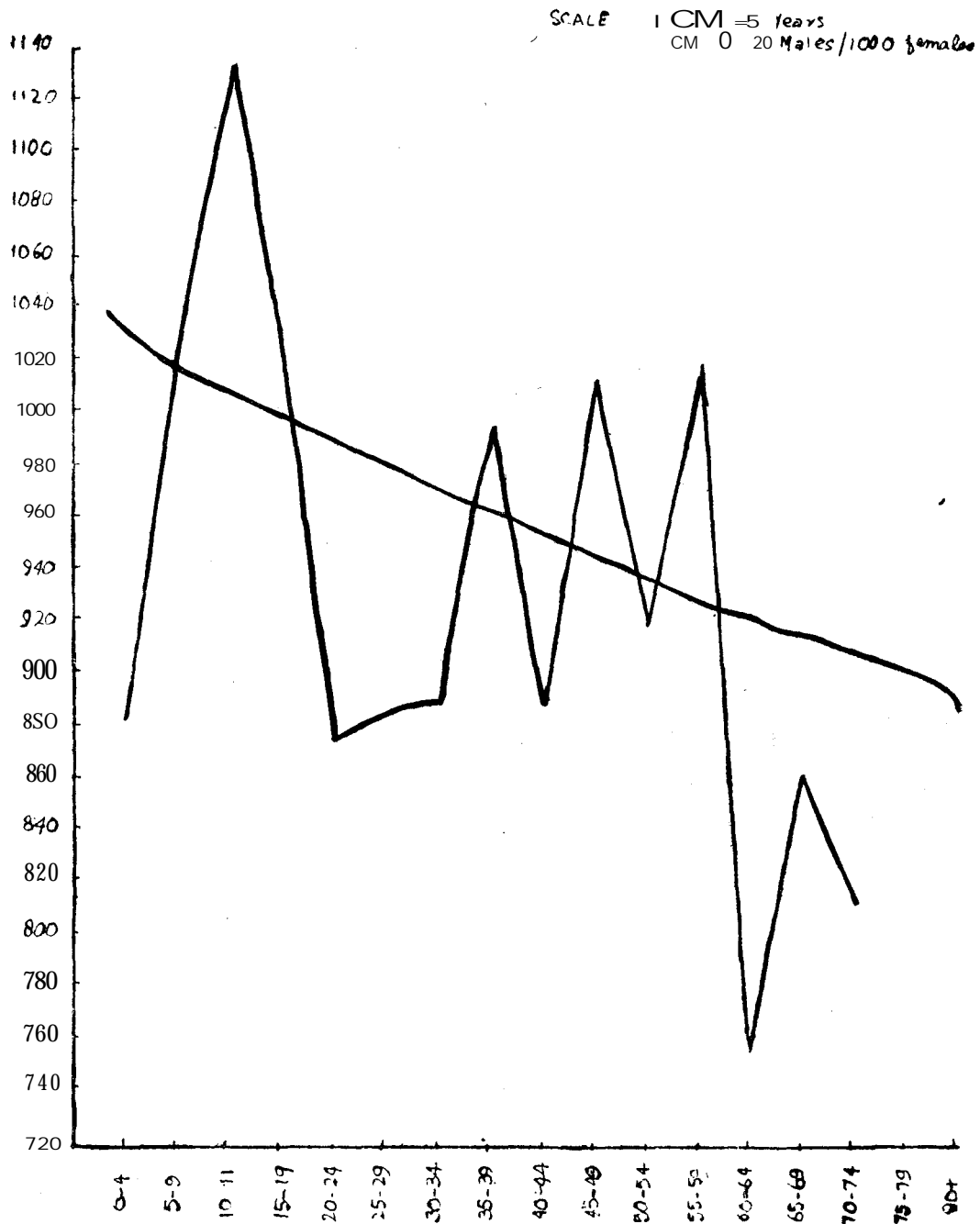


CHART 2

The Growth Rate

Another bit of information available to us is the growth rate (r). The total count for East and West Nepal for 1961 together with the census counts for 1952-54 enables us to obtain the growth rate for East and West Nepal for 1952-61 and 1954-61 respectively. We obtained an average annual growth rate of 1.62 per cent for East Nepal (1952-61), and 1.68 per cent for West Nepal (1954-61). We suspect that the 1961 census is better enumerated than the 1952-54 census which was taken soon after the Nepal revolution and the rate we obtained could be an overestimate.

The United Nations and Thakur have assumed a rate of growth of 1.1 per cent per annum during 1952-54 and the Government of Nepal have adopted a rate of growth of one per cent per annum during 1952-54 (United Nations, 1959; Thakur, 1961; Nepal Census, 1958).

In order to determine the likely growth rate for the 1952-54, we computed the rates of growth for the period 1941-61 (centered on 1951) and 1951-61 for the districts of India bordering Nepal which have, to a certain extent, cultural and ethnic similarity with Nepal and whose level of economic development is also comparable to that of Nepal. The results of those computations are shown, below:

TABLE 3
RATES OF POPULATION GROWTH IN THE DISTRICTS OF INDIA BORDERING NEPAL,
1941-61 AND 1951-61

<i>District</i>	<i>Annual Percent 1941-61</i>	<i>Rate of Growth 1951-61</i>
1. Pithoragarh	1.43	1.70
2. Almorah	1.28	1.40
3. Pilibhit	1.14	2.00
4. Kheri	1.03	1.73
5. Bahraich	0.96	1.10
6. Gonda	0.93	0.99
7. Basti	0.92	0.96
8. Chamoli	1.07	1.54
9. Gorakhpur	1.25	1.36
10. Deoria	0.93	1.22
All the 10 Districts	1.03	1.25

SOURCE: Computed from *Census of India 1961, Vol. XV General Population Tables: Uttar Pradesh*, pp. 143-151.

In only two of the districts considered did the rate of growth of population exceed 1.2 per cent per annum around 1951 and average rate of growth of population for the ten districts was only 1.03 per cent. Even the average annual rate of growth for the 1951-61 decade was not much higher (1.25 per cent), but partly this may be due to some migra-

tion from these districts to other parts of India and into Nepal. In any case the rate of growth of population in Nepal during 1952-54 was probably no larger than 1.1 per cent and it may be taken as 1.2 per cent during 1954.⁸

Methodology

The application of the quasi-stable population model enables us to obtain estimate of the life table for Nepal, along with a corrected age-sex distribution and birth and death rates. The application of this technique depends upon the following assumptions:

1. The population is closed, that is, it is not affected significantly by migration.
2. Fertility has remained constant in the past.
3. Mortality has been declining over a period of time.

Under these circumstances the population preserves a state of quasi-stability, consistent for both sexes, in which the age structure does not change significantly through time (Lopez 1961). We may now examine how far these assumptions hold good for Nepal. While the assumption of a closed population is not strictly valid for Nepal, the violation may not be too serious to distort our estimates. According to the 1952-54 Census, there were 198,000 persons of Nepal origin living abroad and the corresponding figure for 1961 was 328,000. If the difference is taken to indicate emigration, it amounts to less than 0.2 per cent of the population per annum. However, during the 1951-61 decade there has been an unknown amount of return migration as well as immigration of Indians into Nepal, which partially offset the annual outmigration from Nepal (David, 1969). It may be assumed that outmigration may not seriously distort the age distribution of the population.

The second assumption is reasonable since surveys in India, Pakistan and several other similar developing countries have indicated that fertility has remained relatively unchanged for a long time. While Nepal has neither registration data nor survey estimates to justify this assumption, we know that industrialization, urbanization and educational development have not made great enough progress to cause a decline in fertility in Nepal.

While the Western pattern of decline in mortality may not be repeated in Nepal, peace-time changes in mortality of the type observed in many countries in the recent past have only second order effects on the age structure of the population. Secondly, there has been no drastic development in public health in Nepal that could result in a significant change in mortality in the recent past. Moreover, when mortality risks progress in a fairly smooth and monotonic fashion, as is usual, the age distribution tends to remain stable.⁹

8. We obtained a growth rate of 1.1 per cent per annum for All-Nepal when we applied the Coale-Demeny West Model (level 4) to the reported age distribution for males.
9. This stability of the age structure has been observed in countries like India, Chile, Egypt and Columbia.

The procedure for construction of life tables for Nepal followed in this study consists of two parts :

(i) estimation of e_{10} ;

(ii) derivation of the remaining life table functions and the expectation of life birth. For deriving e_0 we have followed the procedure used by Lopez for constructing Columbian Life Tables, (Lopez, 1961). The computations resulted in the estimates of e_0 of 37.39 for males and 38.84 for females.

The results indicate that life expectancy at age 10 is nearly 5 years greater for women than for men. It was felt that this differential is reasonable in the circumstances prevailing in Nepal. The expectancy of life at age 10 for males and females as obtained by us was accepted and the values of $5q_5, 5q_{10}, \dots, 5q_{85+}$ for males and females corresponding to the estimated expectancy of life at age 10 are obtained by interpolation from the Coale Demeny model life tables. The value of $5q_0$ was determined differently. We assumed infant mortality rates of 260 for males and 250 for females and $5q_0$ was determined from the approximate relation $5q_0 = 1.59 I_0$ (Coale and Hoover, 1958). The calculation of L_0, L_{1-4} and L_{80+} was done as below (United Nations Manual, 1956)

$$L_0 = .25 I_0 + .75 I_1$$

$$L_{1-4} = 1.91 I_1 + 2.1 I_5;$$

$$L_{80+} = L_{80} \log L_{80+}$$

Starting with a radix of 100,000 the life table functions l_x, d_x, L_x, T_x and e_x were obtained by the usual life table methodology and the results are presented in tables 4(a) and 4(b).

TABLE 4(a)
NEPAL LIFE TABLES, 1954
Males

Age group	1000 q_x		L_x	T_x	e_x^0
0	260.00	100000	80500	2707899	27.08
1-4	207.30	74000	262400	2627399	35.50
5-9	51.93	58660	285685	2364999	40.32
10-14	37.33	55614	272880	2079314	37.39
15-19	50.64	53538	260913	1806434	33.74
20-24	71.79	50827	245015	1545521	30.41
25-29	80.28	47179	226425	1300506	27.56
30-34	92.64	43391	206905	1074081	24.75
35-39	108.12	39371	186213	867176	22.02
40-44	129.59	35114	164195	680963	19.39
45-49	148.84	30564	141448	516768	16.91
50-54	185.35	26015	118020	375320	14.42
55-59	221.86	21193	94238	257300	12.14
60-64	292.56	16502	70440	163062	9.88
65-69	373.46	11674	47470	92622	7.93
70-74	483.32	7314	27733	45152	6.16
75-79	626.70	3779	12975	17419	4.59
80+	1000.00	14111	4444	4444	3.15

TABLE 4(b)
NEPAL LIFE TABLES, 1954
Females

<i>Age group</i>	<i>1000q_x</i>	<i>L</i>	<i>L_v</i>	<i>T_x</i>	<i>e_x⁰</i>
0	250.00	100000	81250	2852990	28.53
1—4	196.67	75000	269025	2771740	36.96
5—9	55.55	60250	292883	2502715	41.54
10—14	43.42	56903	278340	2209832	38.84
15—19	56.52	54433	264473	1931492	35.48
20—24	70.46	51356	247733	1667019	32.46
25—29	78.82	47737	229278	1419286	29.73
30—34	88.89	43974	210098	1190008	27.06
35—39	97.19	40065	190590	979910	24.46
40—44	104.16	36171	171435	789320	22.07
45—49	111.19	32403	153008	617885	19.07
50—54	142.40	28800	133740	464877	16.14
55—59	178.82	24696	112440	331137	13.41
60—64	254.56	20280	88495	218697	10.78
65—69	328.94	15118	63158	130202	8.61
70—74	448.20	10145	39358	67044	6.61
75—79	583.39	5598	19828	27686	4.95
80+	1000.00	2333	7858	7858	3.37

Once we had accepted life tables, we could proceed to correct the sex age structure of the population and to estimate the birth and death rates. We have followed the procedure described by Lopez assuming a proportionality factor of 105 males for 100 females to allow for the sex ratio at birth. The percentage age distribution derived by the above formula is given in Table 5 along with the reported age distribution and our smoothed age distribution. The overall sex ratio obtained in the present study is 101 as against the reported figure of 97 in 1954. The birth rate for Nepal came to 48.7 per thousand. The death rate (DR) is obtained as a residual of birth and growth rates (BR) and (GR). With the assumed growth rate of 1.2 per cent per annum the death rate for Nepal works out to 36.7 per thousand persons in 1954.

TABLE 5
ESTIMATED AND REPORTED AGE STRUCTURE OF NEPAL POPULATION, 1954

<i>Age Group</i>	Males			Females		
	<i>Reported</i>	<i>Initial smoothing</i>	<i>Estimated</i>	<i>Reported</i>	<i>Initial smoothing</i>	<i>Estimated</i>
0-4	13.7	16.53	16.57	13.19	15.85	16.25
5-9	14.36	12.97	12.99	13.54	12.57	12.78
10-14	12.30	11.87	11.68	10.51	11.80	11.44
15-19	9.92	9.86	10.52	9.43	9.73	10.24
20-24	8.44	8.53	9.30	9.32	8.50	9.03
25-29	8.34	7.79	8.10	9.09	7.84	7.87
30-34	6.98	6.93	6.97	7.57	7.03	6.80
35-39	6.23	5.97	5.90	6.04	6.11	5.81
40-44	5.14	5.05	4.90	5.59	5.22	4.92
45-49	4.31	4.23	3.98	4.10	4.41	4.13
50-54	3.68	3.42	3.12	3.86	3.59	3.40
55-59	2.41	2.56	2.35	2.29	2.74	2.69
60-64	2.03	1.81	1.65	2.58	1.93	2.00
65-69	1.00	1.17	1.05	1.12	1.26	1.34
70-74	1.49*	0.78	.58	1.77*	0.84	.79
75-79		0.37	.25		0.40	.37
80+		0.16	.08		0.18	.14
All Ages	100.00	100.00	100.00	100.00	100.00	100.00

*For 70+

TABLE 6
SUMMARY OF PRESENT AND EARLIER ESTIMATES

	<i>Govt. of Nepal</i>	<i>U.N. Study 1959</i>	<i>U.N. Study 1964</i>	<i>Vaidyanathan Gaige Study 1970</i>
Reference Period	1952-54	1952-54	1952-54	1954
Life expectancy M	25.6	—	—	27.1
F	25.7	—	—	28.5
Growth Rate (%)	1.0	1.1	1.4	1.2
Birth rate per mille	44	44	45	48.7
Death rate per mille	34	33	30	36.7

An Evaluation of the Results

We may now briefly sum up our results and make a comparison of the results of the present study with those of earlier estimates and conjectures for Nepal. As shown in Table 6, we have arrived at higher birth and death rates for Nepal than those estimated earlier. A closer examination of the demographic experience of India and Ceylon seems to indicate that the possibility of such high birth and death rates for Nepal cannot altogether be ruled out. Nepal's population is predominantly Hindu and dependent upon agricultural pursuits retaining the high fertility values of traditional peasant societies. Moreover, unlike India, Nepal had remained for centuries closed to western influence and consequently, the industrialization-modernization process with its concomitant emphasis on smaller families is only now beginning in Nepal. Therefore, a birth rate as high as 48.7 is not surprising given the cultural and social milieu of Nepal.

The high death rate obtained for Nepal can be attributed to three factors, the geographic features, the inadequacy of medical and health services, and the low level of economic development. Nepal is a mountainous country covering an area of 141,000 sq. km. along the Himalayas with the population settled in scattered hamlets and villages, which makes communication difficult. The development of modern medical and health services was started only recently, and there was hardly one doctor for a population of 80,000 in 1958. To add to these problems, the low level of living associated with a per capita income of about 50 U. S. dollars makes even the minimum standards of nutrition, clothing and housing beyond the reach of the common man. We, therefore, conclude that our estimate of the death rate of 36.7 is not inconceivable under the circumstances prevalent in Nepal.¹⁰

The very low level of expectancy at birth (27.1 for males and 28.5 for females) follows as a corollary to the high death rates obtained. These estimates are slightly higher than those assumed by the Government of Nepal for the period 1952-54 (25.6 for males and 25.7 for females) and are consistent with those obtained by Krotki and Thakur for 1961. The fact that the expectancy of life estimated for Nepal is among the lowest in the world should drive home to planners and policy makers in Nepal the urgency for a vigorous development of the health services in the country.

It should be pointed out that a demographer working on Nepal is faced with data that are grossly deficient by any standards, and one has very little information on vital processes, health conditions, patterns of fertility and family formation, or the magnitude and pattern of outmigration to India. No life tables (official or otherwise) exist at present and the estimates of expectancy of life used at present are mostly conjectures based on countries similarly placed in the demographic transition. The life tables presented in this paper, although not the best that can be desired, are probably the best that can be obtained, given the limitations of data available for Nepal.

10. A recent evaluation of the demographic data of Nepal by Krotki and Thakur which has come to our notice after completion of this study confirms our observation (See Krotki and Thakur, 1970).

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