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RECONSTRUCTION OF INDIAN LIFE TABLES FOR 1901-1981 AND PROJECTIONS FOR 1981-2001*

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SUMMARY. An attempt has been made to reconstruct life tables for India from 1901-11 to 1971-81 and to project for the decades 1981-91 and 1991-2001 by adopting Brass relational model. The earlier actuarial life tables seem to have been based on British model of sex differentials in mortality leading to higher life expectancies for females—not in tune with Indian experience. Consistency has been attained in this study by taking recourse to mortality pattern obtained from Sample Registration System.

1. Introduction

Starting from 1881, life tables for India have been constructed by the Census Actuaries on a regular basis excepting in 1921 and 1941. For the two decades 1911-21 and 1931-41, not covered by the Census Actuaries, Kingsley Davis (1951) has presented abridged life tables for all India. The basic principle for preparation of life tables has been to trace a cohort of survivors from one census to another. Special methods have been adopted for the younger and older age groups. Till 1931 life tables for females have not been constructed on the basis of actual age distributions of females as recorded in censuses, which were known to be grossly unreliable. The adjusted age distributions of males were taken as base line and the number of females by age was estimated by using the graduated values of the observed age specific sex ratios in the census returns. Life tables for selected British Provinces were published in the Actuarial Reports upto 1921. In 1931, however, tables were presented for all the provinces of British India. From 1951 onwards zonal life tables have been prepared. In all the above cases the Census Actuaries have presented complete life tables.

With above background, a brief description of the principle of construction of Actuarial Life Tables may be in order. From the earlier reports it is noted that the Census Actuaries estimated rates of mortality likely to be experienced in normal conditions without taking into consideration the effects of any catastrophes like epidemics, famines etc. In deducing the rates of

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mortality at middle ages, cohort survival principle has generally been adopted. Thus in the construction of life tables based on the average or normal age distribution and the average rates of increase, the age distribution for the decade centered at the mid point was projected backward and forward by half a year using the assumed rates of increase. These age distributions were used to obtain the single year survival probabilities. In some other cases projection was carried out by 5 year interval on both sides of the mid point of the decade and these projected figures were used to derive the ten year survival probabilities. Single year probabilities were obtained by interpolation. Infant and child mortality have been estimated by using Proclaimed Clans Statistics in earlier censuses. In more recent censuses, they have been estimated partly based on vital registration data and partly based on the experience of countries with overall mortality level of the same order as that of India and having good documentation of mortality rates in this age range. Mortality rates at older ages have been based on different mathematical models.

In 1901 an average age distribution had been obtained by combining the age distributions of 1881, 1891 and 1901 in the ratio 1 : 2 : 1. This age distribution in conjunction with the estimated average rates of increase produced average mortality tables. The principle adopted in the construction of life tables in each of the actuarial reports of 1911, 1931, 1951, 1961 and 1971 was one of tracing a cohort of persons living in the previous census to their survivors in the current census. In 1921 and 1941 no life tables were however prepared. Life tables for 1976-81 have been based on mortality rates obtained from Sample Registration System (SRS).

Having discussed the principle of construction, it wou.d be appropriate to present a very brief review of the official life tables.

Upto 1911 registration returns for the Proclaimed Clans Statistics in the North West Province had been used for estimation of male mortality at infant and child ages. These statistics had been used to deduce the birth and death rates and it had been assumed that rate of mortality among children was more or less constant in different parts of India. This assumption seems to be unrealistic as it is believed that there are regional variations in mortality, particularly in respect of child mortality.

In the earlier life tables upto 1931 the normal or average age distribution has been obtained by combining two or more different censuses to derive the mortality rates at the intermediate ages. The mean age distribution was graduated by formulae, sometimes a mixture of polynomial and Gompertz and at other times by a Pearsonian type of curve, and that too non-uniformly over different periods or for different provinces in the same period. Surprisingly graduation had been done separately for mean age distribution and rates of increase to arrive at mortality rates during the normal period. We feel, direct comparison of the graduated age cohorts would have yielded better estimates for the probability of survival. For periods experiencing disturbances more than two censuses have been used and weights have been assigned arbitrarily to different censuses. By taking more than two censuses specificity in rates of mortality as regards period is not strictly adhered to.

In earlier censuses the Census Actuaries estimated female mortality not on the basis of actual age distribution of females but on the basis of some reconstructed age distribution with male age distribution taken as base line. As a justification it had been mentioned that female age returns were grossly inaccurate with greater omissions in many provinces. The observed age specific sex ratios (female/male) had been graduated and they had been combined with the adjusted male age distribution to derive the female age distribution. In most of the provinces mortality for females had been worked out to be less than that for males in younger and older ages and greater in intermediate ages. Recent censuses and vital statistics reports of the Sample Registration System (SRS), however, present a different picture. We apprehend that the earlier actuaries had assumed the British model of differentials in sex ratios of mortality at different ages and this might be responsible for the inconsistencies in the mortality differentials between the sexes.

2. The present investigation— rationale and methodology

In reviewing the Actuarial Life Tables some of the short-comings have been high-lighted. An attempt has been made here to present a smooth series of life tables with consistent sex differentials in mortality taking as base line the Actuarial Life Tables. Our object is to fill in the gap in the series of official life tables as well as to provide with a short term projected tables upto the end of this century. Admittedly, Kingsley Davis filled in the gap for the decades 1911-21 and 1931-41. But the state of art in demographic techniques has changed substantially since then. We have therefore closely examined the official series, and using several approaches in the light of recent analytical advances in demographic techniques, tried to generate a new series which would serve the purpose for which life tables are meant for.

To start with, the reported values of the probability of dying within n years for a person aged x at time t, $q(x, n, t)$, were plotted against time for specified values of n and x. The values used were $q(0, 1, t)$, $q(1, 4, t)$, $q(5, 5, t)$, ..., $q(75, 5, t)$ and $q(80, w\text{-}80, t)$, where w is the highest age in the life table. A declining non-linear trend was noted. A slightly better linearisation was attained with the moving average of $q(x, n, t)$ values. Next we tried with logarithmic and logit transforms of $q(x, n, t)$ and the latter conformed to approximate linear trend. It seems to be in accordance with theory as the range of $q(x, n, t)$ is from 0 to 1. Though this linearisation was not adequate by itself, it led us to adapt the well known relational model used by Brass (1971).

The basic equation in our model is logit $q(x, n, t) = a(t)+b(t)$ logit $q(x, n, s)$ where logit $p(x) = \frac{1}{2} \ln \frac{1-p(x)}{p(x)}$, $0 < p(x) < 1$. $q(x, n, s)$ denotes the values corresponding to 'Standard Life Tables' ; $a(t)$ and $b(t)$ are time dependent parameters.

For estimation of parameters $a(t)$, $b(t)$, OLS method was used with the values $q(5, 5)$, $q(10, 5)$, ..., $q(75, 5)$ for a specific value of t. As the probabi.ity distribution of q_x is unknown and as the main object was to obtain a smooth and graduated series of q_x, estimation by OLS seems adequate in the situation. Following Brass principle, terminal ages have been omitted in estimation of $a(t)$ and $b(t)$. We treied with two standards, one an empirical Standard by considering the averages of $q(x, n, t)$ values taken from official life tables, and the other Brass General Standard (Table A). As a first step having estimated $a(t)$ and $b(t)$, the graduated values of $q(x, n, t)$ were obtained for both the standards. The proportionate error defined as

$$\sum_{n} \frac{|q(x, n, t)-q(x, n, s)|}{q(x, n, s)}$$

was calculated for each standard. Based on this test, Brass General Standard has been found to give a smaller proportionate error, and as such has been used in our model.

The constants $a(t)$ and $b(t)$ may be interpreted as the level and the shape parameters respectively for the mortality curve. Five values of a and b corresponding to five decades 1901-11, 1921-31, 1941-51, 1951-61 and 1961-71 for which official life tables are available, were obtained. To fill in the gaps for the decades 1911-21 and 1931-41 and to extend the life tables to 1971-81, we examined the time trend for the parameters. A quadratic progression

TABLE A. BRASS GENERAL STANDARD LIFE TABLE : LOGIT VALUES

0	$-\infty$	20	−0.4551	40	−0.1816	60	0.2100	80	1.2375
1	−0.8670	21	−0.4401	41	−0.1674	61	0.2394	81	1.3296
2	−0.7152	22	−0.4248	42	−0.1530	62	0.2701	82	1.4284
3	−0.6552	23	−0.4103	43	−0.1381	63	0.3024	83	1.5346
4	−0.6219	24	−0.3963	44	−0.1229	64	0.3364	84	1.6489
5	−0.6015	25	−0.3829	45	−0.1073	65	0.3721	85	1.7722
6	−0.5879	26	−0.3686	46	−0.0911	66	0.4097	86	1.9053
7	−0.5766	27	−0.3549	47	−0.0745	67	0.4494	87	2.0493
8	−0.5666	28	−0.3413	48	−0.0574	68	0.4912	88	2.2051
9	−0.5578	29	−0.3280	49	−0.0396	69	0.5353	89	2.3740
10	−0.5498	30	−0.3150	50	−0.0212	70	0.5818	90	2.5573
11	−0.5431	31	−0.3020	51	−0.0021	71	0.6311	91	2.7564
12	−0.5365	32	−0.2889	52	0.0177	72	0.6832	92	2.9727
13	−0.5296	33	−0.2759	53	0.0383	73	0.7385	93	3.2079
14	−0.5220	34	−0.2627	54	0.0598	74	0.7971	94	3.4639
15	−0.5131	35	−0.2496	55	0.0821	75	0.8593	95	3.7424
16	−0.5043	36	−0.2364	56	0.1055	76	0.9255	96	4.0456
17	−0.4941	37	−0.2230	57	0.1299	77	0.9960	97	4.3758
18	−0.4824	38	−0.2094	58	0.1554	78	1.0712	98	4.7353
19	−0.4694	39	−0.1956	59	0.1821	79	1.1516	99	5.1270

Source : Population Studies, Vol. 31, No. 2, July, 1977, page 316.

for $a(t)$ and a linear one for $b(t)$ were found suitable over the period 1901-81. With the fitted values of a and b (Table B) and using the above logit linear model, the life tables for all the decades between 1901-11 and 1971-81 could be generated for ages 5 and above. Since Brass model is known to be less efficient in estimating mortality for the age group 0-5, special method was adopted.

TABLE B. ESTIMATION OF LEVEL [$a(t)$] AND SHAPE [$b(t)$] PARAMETERS FOR LOGIT LINEAR MODEL : 1901-81

census decade	males		females	
	$a(t)$	$b(t)$	$a(t)$	$b(t)$
1901–11	.3171	.8946	.2548	.8455
1911–21	.3168	.8999	.2306	.8423
1921–31	.2849	.9052	.1844	.8391
1931–41	.2214	.9105	.1162	.8359
1941–51	.1263	.9158	.0260	.8327
1951–61	−.0004	.9211	−.0862	.8295
1961–71	−.1587	.9264	−.2204	.8263
1971–81	−.3486	.9317	−.3766	.8231

Estimation of probability of dying at infant age (${}_1q_0$). As mentioned earlier, sex differentials in mortality in infant and child ages were not truly reflected in the Actuarial Reports. For estimation of sex differentials we have taken recourse to recent SRS estimates. To have a stable value, averages of SRS estimates of infant mortality rates for the period 1971-81 were taken as the final estimates of ${}_1q_0$ for males and females and are presented below.

${}_1q_0^m$	${}_1q_0^f$	${}_1q_0$
.12674	.13075	.12880

Note : ${}_1q_0^m$, ${}_1q_0^f$ and ${}_1q_0$ denote the 1 year probabilities of dying at age 0 for males, females and the two sexes combined respectively.

From recent SRS reports and those published by different researchers, estimates of infant mortality rates for 1980 and 1984 have been obtained as 114 and 106 respectively. There are some criticisms in these values, namely they are under-estimates, but even then it is likely that the extent of under-estimation has not changed over the short period 1980-84. We may consider the rate of decline of 2 points per annum, as observed during 1980-84, to be applicable over the period 1971-81 to 1981-91. In view of the Government health policy, which emphasises reduction of infant and child mortality, ${}_1q_0$ is likely to decline at a faster rate in future than assumed above. We therefore assume a conservative 2.5 points decline per year during the decade 1991-2001. As has already been pointed out, infant mortality rate (IMR) for females is consistently lower than that for males in earlier Actuarial Reports. This does not seem to be realistic and we rely on recent Census and Vital Statistics Reports of the SRS. Of course it is expected that with modernization, IMR for females would be approximately at par with that for males by 2001. With this premise, the points of decline in the values of ${}_1q_0$ for the decades 1981-91 and 1991-2001 for the two sexes are assumed as follows :

decade	amount of decline in IMR			${}_1q_0$	
	combined	males*	females*	males	females
1981-1991	20	19	21	.10774	.10975
1991-2001	25	24	26	.08374	.08375

*These figures have been considered so as to yield the assumed values for the two sexes combined, and approximately identical values of IMR for males and females by 2001.

The overall IMR for different decades (Table C) were obtained from actuarial reports and Kingsley Davis (i.e., we are accepting the combined levels of these reports) by combining the male and female rates, assuming sex ratio at birth to be 1.07. The variation in the sex ratio at birth is not likely to affect the combined estimate to a significant extent.

TABLE C. INFANT MORTALITY RATES FOR DIFFERENT DECADES

census decade	reported IMR		estimated IMR
	males	females	combined
1901–11	290.0	284.5	287.3*
1911–21	301.5	279.3	290.8
1921–31	248.7	232.3	240.8
1931–41	217.5	203.9	210.9
1941–51	190.0	175.0	182.8
1951–61	153.0	138.0	145.8
1961–71	130.1	128.4	129.3

$$*287.3 = \frac{1.07\ \mathrm{IMR}(m)+\mathrm{IMR}(f)}{2.07}$$

$$= \frac{1.07 \times 290 + 284.5}{2.07}$$

The above combined estimate of IMR has been apportioned between males and females by taking the ratio of combined IMR to IMR for the particular sex as in 1971-81. Thus we get estimated IMR as shown in Table D.

Estimation of probability of dying in early child ages (${}_4q_1$). For estimation of ${}_4q_1$ special methods were adopted. First, differencing method is tried for obtaining mortality rate in the age group (0–5). In brief, the method is a follows :

The basic equation is :

$$p^t - p^{t+10} \simeq D_{5+}^{(t,\,t+10)}$$

where p^t = total population at time t for a particular sex,

$D_{5+}^{(t,\,t+10)}$— = number of deaths at ages 5 and above during the census decade $(t, t+10)$.

TABLE D. ESTIMATED INFANT MORTALITY RATES BY SEX FOR DIFFERENT DECADES

census decade	estmated IMR	
	males	females
1901–11	282.62*	291.54*
1911–21	286.06	295.09
1921–31	236.87	244.35
1931–41	207.46	214.01
1941–51	179.82	185.50
1951–61	143.42	147.95
1961–71	135.08**	13935**

$$*282.62 = 287.3 \times \frac{\text{IMR } (m, \text{ 1971–81})}{\text{IMR } (c, \text{ 1971–81})}$$

$$= 287.3 \times \frac{126.7}{128.8}$$

$$*291.54 = 287.3 \times \frac{\text{IMR } (f, \text{ 1971-81})}{\text{IMR } (c, \text{ 1971–81})}$$

$$= 287.3 \times \frac{130.7}{128.8}$$

**Since the original figures for 1961–71 do not seem to be in line with others, we estimated them by taking averages of 1951–61 and 1971–81 figures.

Total number of intercensal deaths were estimated by using crude death rate obtained from official publications. By subtraction, number of deaths in the age group (0–5) wss obtained, and hence mortality rate estimated. Using rates for the age group 0—1, ${}_4q_0$ values were derived. This method did not however, succeed possibly due to inaccuracies in the inputs used and the approximation in the basic equation.

Next, regression equations of the form $\ln({}_4q_1) = a + b \ln({}_1q_0)$ were fitted with different model life tables for estimation of a and b. Using these parameters and the ${}_1q_0$ values already obtained for different decades, ${}_4q_1$ values were estimated. The values thus obtained did mot conform to the pattern of ${}_nq_x$ for ages 5 and above. After several searches it appeared that Coale Demeny (1966) West Model Life Tables would be satisfactory for the purpose of estimation. The values of ${}_4q_1$ were finally, derived by interpolating linearly between ${}_1q_0$ values in the Coale Demeny Model Life Tables. The final estimated values of ${}_4q_1$ for different decades by sex are shown below.

Projection of ${}_nq_x$ for ages 5 *and above* : 1981-91 *and* 1991-2001. Initially, the trajectory of the parameter $a(t)$ as well as $b(t)$ of the logit linear model used earlier for both males and females was extended to 2001 to derive ${}_nq_x$ for ages 5 and above. Along with the previously obtained values of ${}_1q_0$ and

TABLE E. ${}_4q_1$ VALUES FOR DIFFERENT DECADES

period	${}_4q_1$	
	males	females
1901–11	.16854	.20508
1911–21	.17084	.20780
1921–31	.13798	.16893
1931–41	.11827	.14558
1941–51	.09986	.12385
1951–61	.07402	.09508
1961–71	.06770	.08849
1971–81	.06167	.08185
1981–91	.04450	.05898
1991–2001	.02892	.03892

${}_4q_1$ for 1981-91 and 1991-2001, two-parameter life tables for the two decades were generated. As a consistency test the values of e_0^0 for both sexes were examined. It was observed that e_0^0 for females in 1991-2001 was broadly in agreement with the values estimated by United Nations andother international bodies and as such was accepted by us. For males, however, e_0^0 derived from this model was observed to be at a much higher level compared to e_0^0 for females. In order to have convergence in e_0^0 for the sexes we considered first the proportional change in ${}_nq_x$ values (excepting ${}_1q_0$ and ${}_4q_1$) between the decades 1961-71 and 1971-81. At the first instance we assume that this proportional change in ${}_nq_x$ for a particular x will remain unchanged as between the decades 1971-81 and 1981-91 and derive ${}_nq_x$ values for 1981-91 (Trial 1, Table F). Next we try with various proportional changes in ${}_nq_x$ (Trials 2-5) so as to arrive at a plausible value for e_0^0 for males in 1981-91 (Trial 5). The proportional change implied by Trial 5 has also been found suitable (as judged by e_0^0 value) for the period 1981-91 to 1991-2001 and has been used to estimate ${}_nq_x$ values for 1991-2001 (Trial 6). The finally derived values of projected e_0^0 for the two sexes for 1981-91 and 1991-2001 along with those provied by the United Nations (1989) for 1995-2000 are shown below.

period	e_0^0	
	males	females
1981-91	57.48	55.94
1991-2001	62.60	63.15
1995-2000 (UN estimate)	62.30	63.40

TABLE F. TRIAL VALUES OF $_nq_x$ (MALES) FOR THE DECADES 1981-1991 AND 1991-2001

age (x)	10^5 ($_nq_x$) for different trials					
	1	2	3	4	5	6
5	1089	1041	1153	1185	1217	925
10	844	807	894	918	943	717
15	1372	1312	1453	1493	1534	1166
20	1829	1748	1937	1991	2044	1553
25	1888	1805	1999	2055	2110	1604
30	1975	1888	2092	2150	2208	1678
35	2211	2113	2341	2406	2471	1878
40	2628	2514	2780	2857	2933	2258
45	3264	3122	3454	3548	3643	2805
50	4276	4093	4521	4643	4765	3717
55	5726	5481	6053	6217	6380	4976
60	8109	7771	8560	8785	9010	7208
65	11555	11080	12188	12505	12821	10385
70	16892	16216	17793	18244	18694	15516
75	25089	24124	26376	27019	27663	23700
80	37763	36398	39583	40493	41403	37677

1981-91 : (1) Unchanged proportions : e.g. ${}_5q_5^{81-91} = .68 \times {}_5q_5^{71-81}$

where

$$\frac{{}_5q_5^{71-81}}{{}_5q_5^{61-71}} = .68$$

(2) 3 points less than (1) : e.g. ${}_5q_5^{81-91} = .65 \times {}_5q_5^{71-81}$

(3) 4 points more than (1) : e.g. ${}_5q_5^{81-91} = .72 \times {}_5q_5^{71-81}$

(4) 6 points more than (1) : e.g. ${}_5q_5^{81-91} = .74 \times {}_5q_5^{71-81}$

(5) 8 points more than (1) : e.g. ${}_5q_5^{81-91} = .76 \times {}_5q_5^{71-81}$

(finally accepted values for 1981-91)

1991-2001 : (6) Unchanged proportions (finally accepted) :

e.g.

$${}_5q_5^{1991-2001} = .76 \times {}_5q_5^{1981-91}$$

where

$$\frac{{}_5q_5^{81-91}\text{ [Trial 5]}}{{}_5q_5^{71-81}} = .76$$

Having obtained $_nq_x$ values for $x = 0, 1, 5, 10, \ldots, 80$ for males and females during 1901-2001 abridged life tables are presented (Tables 1-10). For economy of space only selected life table functions such as l_x, $_nq_x$ and e_0^x have been shown.

TABLE 1. ALL INDIA LIFE TABLES—MALES, 1901-11 AND 1911-21

x	1901-11			1911-21		
	l_x	${}_nq_x$	e^0_x	l_x	${}_nq_x$	e^0_x
0	1.00000	0.28262	24.76	1.00000	0.28606	24.74
1	0.71738	0.16854	33.41	0.71394	0.17084	33.55
5	0.59647	0.06556	35.80	0.59197	0.06434	36.08
10	0.55737	0.05188	33.13	0.55388	0.05083	33.38
15	0.52845	0.08091	29.81	0.52573	0.07952	30.04
20	0.48569	0.10463	27.21	0.48392	0.10302	27.42
25	0.43488	0.10762	25.10	0.43407	0.10599	25.28
30	0.38808	0.11190	22.83	0.38806	0.11031	22.98
35	0.34465	012357	20.39	0.34526	0.12182	20.52
40	0.30206	0.14174	17.91	0.30320	0.13988	18.02
45	0.25925	0.17036	15.46	0.26079	0.16838	15.54
50	0.21508	0.21031	13.12	0.21687	0.20821	13.18
55	0.16985	0.26490	10.94	0.17172	0.26276	10.99
60	0.12486	0.33628	8.98	0.12660	0.33425	9.02
65	0.08287	0.42517	7.27	0.08428	0.42346	7.29
70	0.04764	0.52937	5.80	0.04859	0.52821	5.80
75	0.02242	0.64303	4.50	0.02293	0.64256	4.50
80	0.00800	0.75637	3.11	0.00819	0.75656	3.11

TABLE 2. ALL INDIA LIFE TABLES—MALES, 1921-31 AND 1931-41

x	1921-31			1931-41		
	l_x	${}_nq_x$	e^0_x	l_x	${}_nq_x$	e^0_x
0	1.00000	0.23687	28.26	1.00000	0.20746	31.63
1	0.76313	0.13798	35.96	0.79254	0.11827	38.85
5	0.65783	0.05952	37.41	0.69881	0.05186	39.80
10	0.61868	0.04691	34.62	0.66257	0.04075	36.84
15	0.58966	0.07374	31.20	0.63557	0.06446	33.30
20	0.54618	0.09584	28.48	0.59460	0.08415	30.42
25	0.49383	0.09865	26.24	0.54456	0.08666	27.99
30	0.44511	0.10273	23.84	0.49737	0.09031	25.41
35	0.39939	0.11361	21.28	0.45245	0.10008	22.68
40	0.35401	0.13073	18.69	0.40717	0.11552	19.93
45	0.30773	0.15787	16.12	0.36014	0.14015	17,20
50	0.25915	0.19602	13.67	0.30966	0.17513	14.60
55	020835	0.24807	11·40	0.25543	0.22404	12.17
60	0.15667	0.31843	9.33	0.19820	0.28991	9.96
65	0.10678	0.40650	7.53	0.14074	0.37492	8.00
70	0.06337	0.51136	5.97	0.08798	0.47877	6.30
75	0.03097	0.62752	4.60	0.04586	0.59719	4.80
80	0.01153	0.74498	3.14	0.01847	0.72056	3.20

TABLE 3: ALL INDIA LIFE TABLES—MALES, 1941-51 AND 1951-61

x	1941–51			1951–61		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.17982	35.91	1.00000	0.14342	42.04
1	0.82018	0.09986	42.73	0.85658	0.07402	48.04
5	0.73828	0.04250	43.26	0.79318	0.03272	47.72
10	0.70690	0.03328	40.07	0.76722	0.02553	44.25
15	0.68337	0.05302	36.36	0.74764	0.04097	40.35
20	0.64714	0.06958	33.26	0.71701	0.05406	36.96
25	0.60211	0.07169	30.56	0.67824	0.05574	33.93
30	0.55895	0.07479	27.73	0.64044	0.05821	30.79
35	0.51714	0.08308	24.77	0.60316	0.06482	27.54
40	0.47418	0.09625	21.78	0.56406	0.07540	24.27
45	0.42854	0.11745	18.84	0.52153	0.09258	21.05
50	0.37821	0.14791	16.01	0.47325	0.11760	17.94
55	0.32227	0.19125	13.36	0.41759	0.15388	15.00
60	0.26063	0.25094	10.92	0.35334	0.20518	12.27
65	0.19523	0.33030	8.75	0.28084	0.27581	9.79
70	0.13075	0.43088	6.83	0.20338	0.36948	7.57
75	0.07441	0.55061	5.11	0.12824	0.48739	5.54
80	0.03344	0.68127	3.30	0.06573	0.62460	3.44

TABLE 4. ALL INDIA LIFE TABLES—MALES, 1961-71 AND 1971-81

x	1961-71			1971-81		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.13508	46.98	1.00000	0.12674	52.45
1	0.86492	0.06770	53.28	0.87326	0.06167	59.02
5	0.80636	0.02364	53.01	0.81941	0.01601	58.78
10	0.78730	0.01838	49.23	0.80629	0.01241	54.69
15	0.77283	0.02970	45.11	0.79628	0.02018	50.35
20	0.74988	0.03940	41.41	0.78021	0.02690	46.34
25	0.72033	0.04066	38.01	0.75922	0.02777	42.55
30	0.69104	0.04249	34.51	0.73814	0.02905	38.69
35	0.66168	0.04744	30.93	0.71670	0.03251	34.77
40	0.63029	0.05540	27.35	0.69340	0.03809	30.86
45	0.59537	0.06843	23.81	0.66699	0.04731	26.98
50	0.55463	0.08767	20.37	0.63543	0.06109	23.20
55	0.50601	0.11610	17.09	0.59661	0.08180	19.54
60	0.44726	0.15739	14.01	0.54781	0.11263	16.06
65	0.37687	0.21641	11.15	0.48611	0.15829	12.78
70	0.29531	0.29870	8.55	0.40916	0.22523	9.72
75	0.20710	0.40930	6.12	0.31701	0.32166	6.82
80	0.12233	0.54877	3.63	0.21504	0.45498	3.86

TABLE 5. ALL INDIA LIFE TABLES—MALES, 1981-91 AND 1991-2001

x	1981-91			1991-2001		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.10774	57.48	1.00000	0.08374	62.61
1	0.89226	0.04450	63.39	0.91626	0.02892	67.30
5	0.85255	0.01217	62.25	0.88976	0.00925	65.25
10	0.84218	0.00943	57.99	0.88153	0.00717	60.84
15	0.83424	0.01534	53.51	0.87521	0.01166	56.26
20	0.82144	0.02044	49.31	0.86501	0.01553	51.89
25	0.80645	0.02110	45.29	0.85157	0.01604	47.67
30	0.78767	0.02208	41.21	0.83791	0.01678	43.41
35	0.77028	0.02471	37.08	0.82385	0.01878	39.11
40	0.75125	0.02933	32.96	0.80838	0.02258	34.81
45	0.72921	0.03643	28.88	0.79013	0.02805	30.35
50	0.70265	0.04765	24.88	0.76797	0.03717	26.36
55	0.66917	0.06380	21.00	0.73942	0.04976	22.29
60	0.62647	0.09010	17.26	0.70263	0.07208	18.32
65	0.57003	0.12821	13.72	0.65198	0.10385	14.55
70	0.49694	0.18694	10.37	0.58427	0.15516	10.95
75	0.40405	0.27663	7.18	0.49362	0.23790	7.50
80	0.29227	0.41403	3.96	0.37619	0.37677	4.06

TABLE 6. ALL INDIA LIFE TABLES—FEMALES, 1901-11 AND 1911-21

x	1901-11			1911-21		
	l_n	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.29154	23.23	1.00000	0.29509	23.34
1	0.70846	0.20508	31.69	0.70491	0.20780	32.01
5	0.56317	0.06920	35.37	0.55843	0.06741	35.90
10	0.52420	0.05552	32.82	0.52079	0.05411	33.32
15	0.49509	0.08437	29.60	0.49261	0.08213	30.08
20	0.45332	0.10748	27.10	0.45215	0.10457	27.55
25	0.40460	0.11037	25.06	0.40487	0.10739	25.47
30	0.35994	0.11458	22.86	0.36139	0.11147	23.24
35	0.31870	0.12573	20.49	0.32110	0.12230	20.84
40	0.27863	0.14310	18.08	0.28183	0.13919	18.39
45	0.23876	0.17026	15.68	0.24261	0.16561	15.96
50	0.19811	0.20783	13.38	0.20243	0.20220	13.63
55	0.15694	0.25881	11.24	0.16150	0.25197	11.46
60	0.11632	0.32518	9.29	0.12080	0.31699	9.47
65	0.07849	0.40796	7.56	0.08251	0.39850	7.71
70	0.04647	0.50596	6.05	0.04963	0.49564	6.16
75	0.02296	0.61515	4.69	0.02503	0.60480	4.75
80	0.00884	0.72782	3.18	0.00989	0.71860	3.20

TABLE 7. ALL INDIA LIFE TABLES—FEMALES, 1921-31 AND 1931-41

x	1921-31			1931-41		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.24435	26.97	1.00000	0.21401	30.25
1	0.75565	0.16893	34.61	0.78599	0.14558	37.42
5	0.62800	0.06277	37.26	0.67157	0.05584	39.47
10	0.58858	0.05040	34.59	0.63407	0.04482	36.66
15	0.55891	0.07649	31.29	0.60565	0.06808	33.26
20	0.51616	0.09743	28.68	0.56441	0.08684	30.51
25	0.46587	0.10006	26.50	0.51540	0.08920	28.17
30	0.41926	0.10388	24.17	0.46943	0.09263	25.69
35	0.37571	0.11402	21.68	0.42594	0.10175	23.05
40	0.33287	0.12984	19.15	0.38260	0.11602	20.38
45	0.28965	0.15467	16.64	0.33821	0.13850	17.73
50	0.24485	0.18922	14.22	0.29137	0.16999	15.18
55	0.19852	0.23648	11.96	0.24184	0.21348	12.77
60	0.15157	0.29877	9.89	0.19021	0.27155	10.56
65	0.10629	0.37776	8.04	0.13856	0.34650	8.56
70	0.06614	0.47334	6.40	0.09055	0.43928	6.78
75	0.03483	0.58273	4.90	0.05077	0.54845	5.13
80	0.01453	0.69920	3.25	0.02293	0.66849	3.33

TABLE 8. ALL INDIA LIFE TABLES—FEMALES, 1941-51 AND 1951-61

x	1941-51			1951-61		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.18550	34.09	1.00000	0.14794	39.95
1	0.81450	0.12385	40.79	0.85206	0.09508	45.84
5	0.71362	0.04807	42.29	0.77105	0.03840	46.46
10	0.67932	0.03856	39.30	0.74144	0.03078	43.21
15	0.65313	0.05866	35.78	0.71862	0.04691	39.50
20	0.61481	0.07494	32.85	0.68491	0.06007	36.32
25	0.56874	0.07699	30.31	0.64376	0.06173	33.49
30	0.52495	0.07998	27.63	0.60402	0.06415	30.53
35	0.48297	0.08793	24.82	0.56528	0.07061	27.45
40	0.44050	0.10041	21.97	0.52536	0.08080	24.34
45	0.39627	0.12017	19.14	0.48291	0.09703	21.26
50	0.34865	0.14806	16.41	0.43606	0.12015	18.28
55	0.29703	0.18698	13.83	0.38366	0.15288	15.43
60	0.24149	0.23975	11.44	0.32501	0.19811	12.77
65	0.18359	0.30928	9.25	0.26062	0.25935	10.30
70	0.12681	0.39769	7.28	0.19303	0.34009	8.03
75	0.07638	0.50531	5.43	0.12738	0.44304	5.89
80	0.03778	0.62845	3.43	0.07095	0.56783	3.58

TABLE 9. ALL INDIA LIFE TABLES—FEMALES, 1961-71 AND 1971-81

x	1961-71			1971-81		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.13935	44.27	1.00000	0.13075	49.13
1	0.86065	0.08849	50.39	0.86925	0.08185	55.48
5	0.78449	0.02962	51.10	0.79810	0.02176	56.25
10	0.76125	0.02373	47.58	0.78074	0.01742	52.45
15	0.74319	0.03623	43.68	0.76713	0.02664	48.34
20	0.71626	0.04648	40.23	0.74670	0.03422	44.59
25	0.68297	0.04778	37.07	0.72115	0.03519	41.08
30	0.65034	0.04967	33.80	0.69577	0.03659	37.49
35	0.61804	0.05473	30.44	0.67031	0.04036	33.82
40	0.58421	0.06274	27.05	0.64326	0.04633	30.14
45	0.54756	0.07557	23.70	0.61346	0.05595	26.48
50	0.50618	0.09400	20.43	0.57913	0.06989	22.90
55	0.45860	0.12043	17.29	0.53866	0.09009	19.43
60	0.40337	0.15764	14.32	0.49013	0.11903	16.11
65	0.33978	0.20935	11.53	0.43179	0.16025	12.95
70	0.26865	0.28001	8.92	0.36260	0.21859	9.94
75	0.19342	0.37461	6.41	0.28334	0.30065	7.02
80	0.12097	0.49669	3.76	0.19815	0.41398	4.97

TABLE 10. ALL INDIA LIFE TABLES—FEMALES, 1981-91 AND 1991-2001

x	1981-91			1991-2001		
	l_x	$_nq_x$	e_x^0	l_x	$_nq_x$	e_x^0
0	1.00000	0.10452	56.27	1.00000	0.07864	63.50
1	0.89548	0.05898	61.81	0.92136	0.03892	67.90
5	0.84266	0.01522	61.56	0.88550	0.01012	66.58
10	0.82984	0.01218	57.48	0.87654	0.00811	62.23
15	0.81973	0.01863	53.15	0.86943	0.01240	57.72
20	0.80446	0.02396	49.11	0.85865	0.01595	53.41
25	0.78519	0.02464	45.26	0.84495	0.01641	49.24
30	0.76584	0.02563	41.34	0.83109	0.01707	45.02
35	0.74621	0.02829	37.36	0.81690	0.01885	40.76
40	0.72510	0.03251	33.38	0.80150	0.02168	36.49
45	0.70153	0.03935	29.41	0.78413	0.02627	32.24
50	0.67392	0.04930	25.52	0.76353	0.03299	28.05
55	0.64070	0.06388	21.71	0.73634	0.04290	23.92
60	0.59977	0.08507	18.02	0.70666	0.05747	19.88
65	0.54875	0.11589	14.46	0.66605	0.07903	15.94
70	0.48515	0.16091	11.03	0.61341	0.11135	12.09
75	0.40709	0.22723	7.67	0.54511	0.16087	8.29
80	0.31458	0.32523	4.19	0.45742	0.23863	4.40

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