Provisional Abridged Life Tables for Urban and Rural Areas in Pakistan, Based on PGS 1968 and 1971

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Introduction

As is the case in many other countries, mortality has been undergoing substantial, though not precisely understood, changes in Pakistan. In the absence of a reliable and adequate system of vital registration in the country, the precise measurement of these changes is well nigh impossible. In Pakistan, an attempt to estimate levels of fertility and mortality on a sample basis was made through the Population Growth Estimation (PGE) project undertaken from 1962 through 1965 [5, 12]. Subsequently, another demographic survey, called the Population Growth Survey (PGS), was initiated and carried out from 1968 through 1971 [13]. In the PGE a dual system of data collection was utilized based on continuous (Longitudinal) registration and a periodic (Cross-Sectional) survey. In the PGS, data were collected through periodic surveys only. Data from the PGS have only recently been made available to researchers. The present set of life tables is based on the mortality statistics collected in 1968 and 1971 field operations of the PGS.

Mortality conditions in Pakistan have shown considerable improvement during the last 25 years [9, 15]. Information for the early years is based mostly on special studies undertaken by Khan [8,9]. The crude death rate, estimated to range between 29 and 32 deaths per 1,000 population in 1951 [15], fell to the range of 12—16 in 1962-65, as derived from the PGE estimates [5], and is estimated to be 11—12 for 1968-71[1] [13]. We may, however, point out that the

[1]The data for 1971 are based on Provisional Tables provided to the PIDE by the Statistical Division, Government of Pakistan.

lack of reliable and adequate demographic data in Pakistan does not permit estimation of absolute and precise levels of decline.

The current set of life tables presented in this paper is the first attempt to construct separate life tables for urban and rural areas as no data were available to undertake such an exercise in the past. It is recognised that the differentials in mortality indicated by the data may not be wholly depictive of the prevailing mortality conditions in urban and rural areas as the sampling and non-sampling variations may be different for the two sub-sets. However, since there is a need for such a set of life tables for use in population projections and various areas of health-related research, the tables are being presented here with all their limitations. It may be added here that attempts are underway at the Pakistan Institute of Development Economics to estimate the relative reliability of these estimates and, if found necessary, a revised set of life tables will be prepared.

The Data

The Population Growth Survey was undertaken by the Central Statistical Office (now Statistical Division), Government of Pakistan, with the aim to collect information on births, deaths, age, sex, marital status, etc. The survey was launched in January 1968 and was designed to provide demographic information for Pakistan as a whole as well as for urban and rural areas on a calendar-year basis. Initially the survey was conducted in 32 sample areas[2] (16 urban and 16 rural) but was later expanded to 64 sample areas (32 urban and 32 rural). The survey was launched in January 1968 and the first full enumeration of the population was conducted in February 1968.

Data generated through sample surveys are subject to sampling and non-sampling errors and those collected through the PGS are no exception [6,10,16]. A partial[3] assessment of the problem of age mis-reporting for 1968 based on Myers' Index of preferred digits shows that the quality of age data is poor.[4] On the basis of this Index, the relative quality of age reporting is found to be similar not only in urban and rural areas but also for both males and females.

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[2]The sample design excluded the Tribal Agencies and special areas of Peshawar and D.I. Khan districts as defined in the 1961 Population Census of Pakistan. For details of sample design, etc., see [13].

[3]The data generated by the PGS are in the process of being evaluated and a separate report will be forthcoming.

[4]A method for studying digital preference has been devised by Myers, commonly known as Myers' Index [11]. This method estimates the preference of respondents in reporting ages ending with digits O, 1, 2,........ 9. The weighted population total of single year age distributions, called "blended population," are calculated. The index is calculated by summing the absolute difference of percent blended populations for each terminal digit from 10 percent. The range of the index is from 0 to 90, the zero showing no heaping. The single year age distribution of popultion enumerated in the PGS 1968 [13] survey on *de facto* basis was utilized to calculate the index. The results of the analysis as calculated by Mehtab S. Karim are presented below:

Myers' Index of Digital Preference for the Ages 10-79: *PGS* 1968.

Sex	All Pakistan	Urban	Rural
Male	61.5	59.4	64.5
Female	60.9	59.3	60.8

These results are not much different from those observed for the PGE [18].

It is noted that more than half of the ages reported ended in digits 0 and 5. This erratic pattern of age reporting is partly to be resolved by grouping the data into quinquennial age groups. As no attempts have yet been made to estimate the range of the variance of the rates, we are unable to look more critically at the overall quality of the data.

Methodology

Age-specific death rates ($_nm_x$), except for age zero, were computed by using the formula:

$$_nm_x = \frac{_nd_x}{_np_x}$$

where $_nd_x$ = Estimated number of deaths of persons who died between age x and age x+I, and

$_np_x$ = Number of persons alive between age x and age x+I.

The rates were calculated separately for 1968 and 1971, and then their average was calculated to arrive at estimates for Pakistan, and for urban and rural areas (Table I). For age zero, infant mortality rates were used which were computed by adding the 1968 and 1971 deaths and dividing them by total births for the two years. The $_nm_x$ values thus obtained were then graduated to overcome the effect of erratic reporting through the use of Gompertz Curve [4] of the form:

$$_nm_x = K. _ab^x$$

where K, a and b are constants and x is the age at death.

Although the differentials in the risk of mortality at early and late ages would require separate graduation for the two parts of the mortality curve, lack of data in single years for the ages 0—14 did not permit carrying out of such an exercise. As a result of this limitation of data availability only age groups 15 years and over (in 5-year age intervals) were graduated. The graduated values of $_nm_x$ are presented in Table II. The probability-of-dying ($_nq_x$) values for ages above zero which were calculated by relating $_nm_x$ value in each group to its appropriate $_nq_x$ value in the standard Reed and Merrell tables [14] are given in Table III. The value of q_0, however, was taken to be the same as respective infant mortality rates.[5] The abridged life tables were then computed by using the standard actuarial technique [2, 14]. For estimating the number of years lived collectively by the survivors ($_aL_x$) in age groups under 1 and 1—4 the following formulas were used:

$$L_0 = 0.3 \quad l_0 + 0.7 \quad l_1{-}_4$$
$$L_1{-}_4 = 1.9 \quad l_1{-}_4 + 2.1 \quad l_5{-}_9$$

and for age 65 and over

$$L_{65+} = L_{65} \times \log l_{65+}$$

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[5]The separation factors were not calculated due to non-availability of data. See [7].

Table I

Age Specific Death Rates for Pakistan and its Urban and Rural Areas, Based on PGS (196

Age	Pakistan		Urban	
	Male	Female	Male	Female
Under 1	171.2	139.8	148.2	108.6
1 — 4	16.1	18.9	9.2	16.4
5 — 9	3.1	3.2	2.3	2.5
10 — 14	1.8	2.8	1.3	2.1
15 — 19	1.9	2.4	1.0	0.0
20 — 24	2.7	3.8	0.3	2.1
25 — 29	1.1	4.4	0.8	2.0
30 — 34	2.4	4.3	1.8	3.8
35 — 39	2.8	3.3	1.6	6.0
40 — 44	4.7	4.3	4.9	6.8
45 — 49	4.0	7.1	5.8	7.8
50 — 54	10.4	8.6	7.7	2.7
55 — 59	9.8	7.2	8.6	11.0
60 — 64	25.8	11.2	16.7	7.8
65 and over	40.3	40.3	44.5	34.5

Source: [13]

Table II

Age Specific Death Rates (Smoothed) for Pakistan and its Urban and Rural Areas, Based on PGS (1968 and 1971 Average)

Age	Pakistan		Urban		Rural	
	Male	Female	Male	Female	Male	Female
Under 1	0.171200	0.139800	0.148200	0.108600	0.178500	0.149900
1 — 4	0.016100	0.018900	0.009200	0.016400	0.019200	0.019600
5 — 9	0.003100	0.003200	0.002300	0.002500	0.003300	0.003200
10 — 14	0.001574	0.003064	0.000462	0.000804	0.002188	0.003907
15 — 19	0.001688	0.003166	0.000632	0.001446	0.002049	0.003907
20 — 24	0.001846	0.003307	0.000874	0.002296	0.002097	0.003909
25 — 29	0.002070	0.003503	0.001222	0.003305	0.002176	0.003912
30 — 34	0.002396	0.003782	0.001730	0.004401	0.002307	0.003920
35 — 39	0.002888	0.004185	0.002480	0.005514	0.002530	0.003942
40 — 44	0.003668	0.004787	0.003599	0.006584	0.002920	0.004000
45 — 49	0.004978	0.005720	0.005293	0.007571	0.003693	0.004159
50 — 54	0.007355	0.007243	0.007892	0.008450	0.005330	0.004611
55 — 59	0.012116	0.009903	0.011932	0.009214	0.009527	0.006060
60 — 64	0.022932	0.014994	0.018306	0.009864	0.023892	0.012507
65 and over	0.051840	0.025982	0.028513	0.010407	0.102407	0.085289

Source: Table I above.

Table III

Probability of Dying ($_nq_x$ values) for Pakistan and its Urban and Rural Areas, Based on PGS (1968 and 1971 Average)

Age	Pakistan		Urban		Rural	
	Male	Female	Male	Female	Male	Female
Under 1	0.122650	0.105950	0.131150	0.094200	0.121200	0.109150
1 — 4	0.059171	0.068689	0.034761	0.060199	0.066328	0.071032
5 — 9	0.015389	0.015881	0.011437	0.012426	0.016373	0.015881
10 — 14	0.007718	0.015212	0.002304	0.004009	0.010047	0.014897
15 — 19	0.008405	0.015714	0.003152	9.007204	0.010195	0.019361
20 — 24	0.009189	0.016407	0.004359	0.011419	0.010434	0.019367
25 — 29	0.009989	0.017372	0.006093	0.016395	0.010823	0.019382
30 — 34	0.011911	0.018744	0.008613	0.021779	0.011471	0.019423
35 — 39	0.014343	0.020723	0.012326	0.027218	0.012575	0.019530
40 — 44	0.018184	0.023671	0.017846	0.032424	0.014526	0.019817
45 — 49	0.024606	0.028225	0.026144	0.037200	0.018308	0.020594
50 — 54	0.036157	0.035616	0.038748	0.041436	0.026324	0.022808
55 — 59	0.058919	0.048402	0.058049	0.045106	0.046603	0.029883
60 — 64	0.108799	0.067789	0.087771	0.048214	0.113104	0.060763
65 and over	0.230401	0.122414	0.013347	0.049060	0.406976	0.357905

Source: Appendix Tables I A to I C

The age-specific mortality rates show the expected pattern of a U-shaped curve [Figs. I-III].   Male mortality is higher in comparison with female mortality for age zero and for the older ages, a phenomenon generally observed in high mortality populations of Asia and Africa.   The urban-rural mortality differentials show that the mortality among urban males is lower than among rural males at all ages except in age groups 40-49.   For urban females the mortality level is lower in young age groups up to age 30-34 and generally higher in those of age 35 and above.

In Table IV, the expectation of life by age and sex for Pakistan and for urban-rural place of residence is presented. The expected number of years of life at birth varies for urban and rural areas and by sex. The urban male is expected to outlive the rural male by the average of nearly 2 years (e_0^0 : 54.5 against 52.4 years). Similarly, the urban female would live for 53.6 years against

Table IV

Expectation of Life (e_x^0) by Age for Pakistan and Urban and Rural Areas, based on PGS Two-Year Average: 1968 and 1971

Age	Pakistan		Urban		Rural	
	Male	Female	Male	Female	Male	Female
Under 1	52.9	51.8	54.5	53.6	52.4	51.9
1 — 4	59.3	56.9	61.7	58.2	58.6	57.2
5 — 9	58.5	56.7	59.9	57.8	58.4	57.5
10 — 14	54.4	52.8	55.3	53.5	54.6	53.4
15 — 19	49.8	48.6	50.7	48.7	50.1	49.1
20 — 24	45.2	44.4	45.8	44.0	45.6	45.0
25 — 29	40.6	40.1	41.0	39.5	41.1	40.9
30 — 34	36.0	35.7	36.2	35.1	36.5	36.6
35 — 39	31.4	31.4	31.5	30.9	31.9	32.3
40 — 44	26.8	27.0	26.9	26.7	27.3	27.9
45 — 49	22.2	22.6	22.3	22.5	22.6	23.4
50 — 54	17.7	18.1	17.9	18.2	18.0	18.9
55 — 59	13.3	13.7	13.5	13.9	13.4	14.2
60 — 64	9.0	9.3	9.2	9.4	9.0	9.6
65 and over	4.8	4.8	4.8	4.8	4.8	4.8

Source: Appendix Tables I A to I C

PROBABILITY   OF   DYING   (n𝑞ₓ)   BY SE𝑥
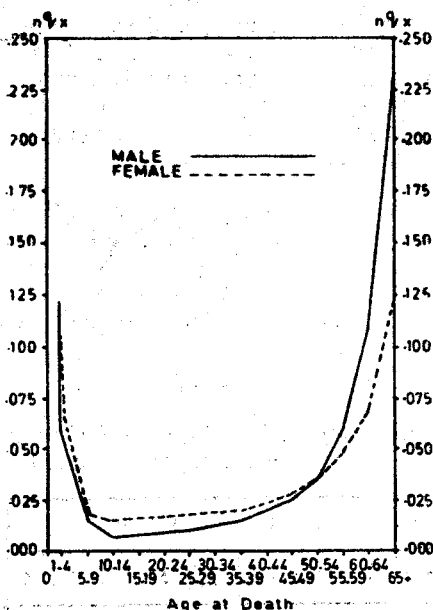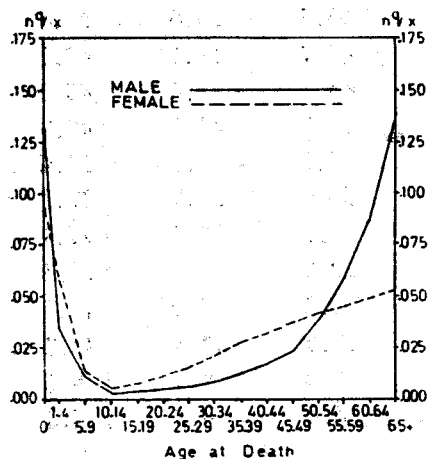PGS 1968   and   1971 (Average)

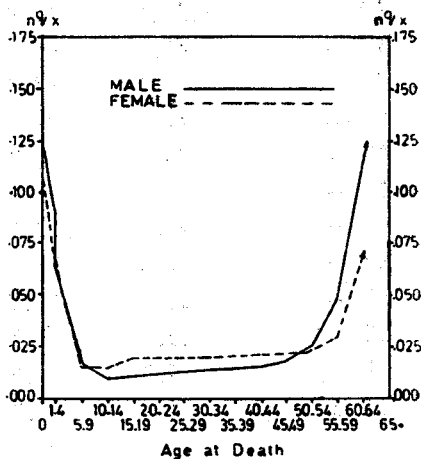FIG. 1 ALL PAKISTAN

FIG. 2 URBAN PAKISTAN

FIG. 3 RURAL PAKISTAN

51.9 for a rural female. It is, however, interesting to note that compared to female the relatively higher male life expectancy at birth diminishes as the age advances and the pattern changes after ages 40-44, an age when the females practically stop bearing children and the risk of mortality, associated with child bearing, ceases to exist.

Some evidence of changing mortality patterns in Pakistan is evident from Table V. The Table shows that the mortality conditions remained unchanged during the period 1931-41 to 1950-52, while substantial decline in mortality occurred between 1950-52 and 1962-65 resulting in a gain of nearly 20 years in life expectancy at birth. We may, however, point out that the sources of data used in different sets of life tables are not from a common series, and as such may not be exactly comparable.

Table V

Expectation of Life at Birth (e_0^o) in Pakistan: 1931-71

Area	Source of data	Year	Male	Female
Undivided India	[8]	1931-41	32.1	31.4
Punjab Province	[8]	1950-52	33.0	34.6
Pakistan PGE				
CD	[1]	1962	49.4	47.4
LR	[1]	1962	50.9	47.8
CD	[19]	1962-64 (Average)	51.5	48.6
CD*	[20]	1962-65 (Average)	49.8	47.9
Pakistan PGS		1968 & 1971 (Average)	52.9	51.8

*Estimate based on Complete Life Table. All others based on Abridged Life Tables.

The above discussion leads us to conclude that mortality levels in Pakistan have registered a substantial decline since 1951. However, Pakistan is still one of the high mortality countries in the ECAFE Region [Appendix Table II]. Furthermore, the rural residents appear to be exposed to higher risks of mortality than urban residents and female mortality in general is higher than male mortality up to the ages 40-44, except for age zero.

Appendix Table I A

Abridged Life Tables for Pakistan, based on PGS: 1968 and 1971 Average

Age Group (x)	Probability of dying between age x and age x+1 $(_nq_x)$	Survivors at exact age x (l_x)	Number of deaths bewteen age x and age x+1 $(_nd_x)$	Years lived between age x and age x+1 $(_nL_x)$	Total years lived after exact (T_x)	Expectation of life.[1] $(e°_x)$
Males						
0	0.1226500	1,00,000	12,265	91,415	52,90,501	52.90
1 — 4	0.0591707	87,735	5,191	3,70,039	51,99,086	59.26
5 — 9	0.0153890	82,544	1,270	4,09,545	48,29,047	58.50
10 — 14	0.0077179	81,274	627	4,04,803	44,19,502	54.38
15 — 19	0.0084049	80,647	678	4,01,540	40,14,699	49.78
20 — 24	0.0091893	79,969	735	3,98,008	36,13,159	45.18
25 — 29	0.0099886	79,234	791	3,94,193	32,15,151	40.58
30 — 34	0.0119114	78,443	934	3,89,880	28,20,958	35.96
35 — 39	0.0143433	77,509	1,112	38,4,765	24,31,078	31.37
40 — 44	0.0181835	76,397	1,389	3,78,513	20,46,313	26.79
45 — 49	0.0246062	75,008	1,846	3,70,425	16,67,800	22.23
50 — 54	0.0361566	73,162	2,645	3,59,198	12,97,375	17.73
55 — 59	0.0589185	70,517	4,155	3,42,198	9,38,177	13.30
60 — 64	0.1087985	66,362	7,220	3,13,760	5,95,979	8.98
65 +	1.0000000	59,142	59,142	2,82,219	2,82,219	4.77

[1] Average number of years lived after exact age x.

—Continued

Appendix Table I A Continued

(x)	$(_nq_x)$	(l_x)	$(_nd_x)$	$(_nL_x)$	(T_x)	$(e°_x)$
Females						
0	0.1059500	1,00,000	10,595	92,544	51,80,117	51.80
1 — 4	0.0686888	89,405	6,141	3,44,724	50,87,573	56.90
5 — 9	0.0158810	83,264	1,322	4,13,015	47,42,849	56.96
10 — 14	0.0152118	81,942	1,246	4,06,595	43,29,834	52.84
15 — 19	0.0157137	80,696	1,268	4,00,310	39,23,239	48.62
20 — 24	0.0164074	79,428	1,303	3,93,883	35,22,929	44.35
25 — 29	0.0173717	78,125	1,357	3,87,233	31,29,046	40.05
30 — 34	0.0187444	76,768	1,439	3,80,243	27,41,813	35.72
35 — 39	0.0207229	75,329	1,561	3,72,743	23,61,570	31.35
40 — 44	0.0236709	73,768	1,746	3,64,475	19,88,827	26.96
45 — 49	0.0282247	72,022	2,033	3,55,028	16,24,352	22.55
50 — 54	0.0356156	69,989	2,493	3,43,713	12,69,324	18.14
55 — 59	0.0484017	67,496	3,267	3,29,313	9,25,611	13.71
60 — 64	0.0677890	64,229	4,354	3,10,260	5,96,298	9.28
65 +	1.0000000	59,875	59,875	2,86,038	2,86,038	4.78

Appendix Table I B

Abridged Life Table for Urban Areas of Pakistan, Based on PGS: 1968 and 1971 Average

(x)	$(_nq_x)$	(l_x)	$(_nd_x)$	$(_nL_x)$	(T_x)	(e^o_x)
Males						
0	0.13115000	1,00,000	13,115	90,820	54,52,879	54.53
1 — 4	0.0347610	86,885	3,020	3,41,199	53,62,059	61.71
5 — 9	0.0114369	83,865	959	4,16,928	50,20,860	59.87
10 — 14	0.0023043	82,906	191	4,14,053	46,03,932	55.53
15 — 19	0.0031519	82,715	261	4,12,923	41,89,879	50.65
20 — 24	0.0043592	82,454	359	4,11,373	37,76,956	45.81
25 — 29	0.0060929	82,095	500	4,09,225	33,65,583	41.00
30 — 34	0.0086134	81,595	704	4,06,215	29,56,358	36.23
35 — 39	0.0123257	80,891	997	4,01,963	25,50,143	31.53
40 — 44	0.0178456	79,894	1,426	3,95,905	21,48,180	26.89
45 — 49	0.0261444	78,468	2,051	3,87,213	17,52,275	22.33
50 — 54	0.0387480	76,417	2,961	3,76,683	13,65,062	17.86
55 — 59	0.0580485	73,456	4,264	3,56,620	9,90,379	13.48
60 — 64	0.0877714	69,192	6,073	3,30,778	6,33,759	9.16
65 +	1.0000000	63,119	63,119	3,02,981	3,02,981	4.80

Appendix Table I B continued

(x)	$({}_nq_x)$	(l_x)	$({}_nd_x)$	$({}_nL_x)$	(T_x)	$(e°_x)$
Females						
0	0.0942000	1,00,000	9,420	93,406	53,64,049	53.64
1 — 4	0.0601988	90,580	5,453	3,50,869	52,70,643	58.19
5 — 9	0.0124255	85,127	1,058	4,22,990	49,19,774	57.79
10 — 14	0.0040092	84,069	337	4,19,503	44,96,784	53.49
15 — 19	0.0072041	83,732	603	4,17,153	40,77,281	48.69
20 — 24	0.0114191	83,129	949	4,13,273	36,60,128	44.03
25 — 29	0.0163954	82,180	1,347	4,07,533	32,46,855	39.51
30 — 34	0.0217792	80,833	1,760	3,99,765	28,39,322	35.13
35 — 39	0.0272184	79,073	2,152	3,89,985	24,39,557	30.85
40 — 44	0.0324244	76,921	2,494	3,78,370	20,49,572	26.65
45 — 49	0.0372001	74,427	2,769	3,65,213	16,71,202	22.45
50 — 54	0.0414361	71,658	2,969	3,50,868	13,05,989	18.23
55 — 59	0.0451061	68,689	3,098	3,35,700	9,55,121	13.91
60 —.64	0.0482135	65,591	3,162	3,20,050	6,19,421	9.44
65 +	1.0000000	62,429	62,429	2,99,371	2,99,371	4.80

Appendix Table I C

Abridged Life Table for Rural Areas of Pakistan, Based on PGS: 1968 and 1971 Average

(x)	$(_nq_x)$	(l_x)	$(_nd_x)$	$(_nL_x)$	(T_x)	$(e°_x)$
Males						
0	0.1212000	1,00,000	12,120	91,516	52,44,168	52.44
1 — 4	0.066328	87,880	5,829	3,39,279	51,52,652	58.63
5 — 9	0.016373	82,051	1,343	4,06,898	48,13,373	58.66
10 — 14	0.010047	80,708	811	4,01,513	44,06,475	54.60
15 — 19	0.010195	79,897	815	3,97,448	40,04,962	50.13
20 — 24	0.010434	79,082	825	3,93,348	36,07,514	45.62
25 — 29	0.010823	78,257	847	3,89,168	32,14,166	41.07
30 — 34	0.011471	77,410	888	3,84,830	28,24,998	36.49
35 — 39	0.012575	76,522	962	3,80,205	24,40,168	31.89
40 — 44	0.014526	75,560	1,098	3,75,055	20,59,963	27.26
45 — 49	0.018308	74,462	1,363	3,68,903	16,84,908	22.63
50 — 54	0.026324	73,099	1,924	3,60,685	13,16,005	18.00
55 — 59	0.046603	71,175	3,317	3,47,573	9,55,320	13.42
60 — 64	0.113104	67,858	7,675	3,20,103	6,07,747	8.96
65 +	1.000000	60,183	60,183	2,87,644	2,87,644	4.78

Appendix Table I C Continued

(x)	$(_nq_x)$	(l_x)	$(_nd_x)$	$(_nL_x)$	(T_x)	(e^o_x)
Females						
0	0.109150	1,00,000	10,915	92,360	51,90,984	51.91
1 — 4	0.071032	89,085	6,328	3,43,052	50,98,624	57.23
5 — 9	0.015881	82,757	1,314	4,10,500	47,55,572	57.46
10 — 14	0.014897	81,443	1,213	4,04,183	43,45,072	53.35
15 — 19	0.019361	80,230	1,553	3,97,268	39,40,889	49.12
20 — 24	0.019367	78,677	1,524	3,89,575	35,43,621	45.04
25 — 29	0.019382	77,153	1,495	3,82,028	31,54,046	40.88
30 — 34	0.019423	75,658	1,470	3,74,615	27,72,018	36.64
35 — 39	0.019530	74,188	1,449	3,67,318	23,97,403	32.32
40 — 44	0.019817	72,739	1,441	3,60,093	20,30,085	27.91
45 — 49	0.020594	71,298	1,468	3,52,820	16,69,992	23.42
50 — 54	0.022808	69,830	1,593	3,45,168	13,17,172	18.86
55 — 59	0.029883	68,237	2,039	3,37,868	9,72,004	14.24
60 — 64	0.060763	66,198	4,022	3,36,088	6,34,136	9.58
65 +	1.000000	62,176	62,176	2,98,048	2,98,048	4.79

Appendix Table II

Expectation of Life at Birth in Some Selected Countries of ECAFE Region

Country	Year	Both Sexes e_o^o	Male e_o^o	Females e_o^o
Afghanistan*	1965—70	37.5		37.5
China*	,,	50.0		50.0
Hong Kong[1]	1968		66.7	73.3
India	1951—60		41.9	40.6
Iran*	1965—70	50.0		
Japan[2]	1968		69.1	74.3
Pakistan[3]	1968—71		52.9	51.8
West Malaysia	1969		63.8	66.7
Nepal	1965—70	40.6		

Source: [17]
*Provisional
[1]Based on the results of a sample survey undertaken in 1966.
[2]Japanese Nationals only.
[3]Based on PGS data, 1968 and 1971.

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