

IRISH LIFE TABLES

NOS. 9 AND 9A 1978 - 80

A Life Table is a method of deriving measures which are representative of average life expectancy prevailing at a given time. It is compiled in a manner that eliminates the effect of the current age composition of the population in question. This age composition may change over time and thus affect comparisons using other measures such as the number of deaths per 1,000 population.

A Life Table is a purely hypothetical calculation. The basic assumption is that a given cohort of births, 100,000, start in a given year. These are subject, as the survivors pass through each year of age, to the mortality rates prevailing for that age in the years for which the Life Table is being calculated. Thus, the Life Table deals with current mortality rates only and no assumptions are made about future changes. The mortality rates for each age are used to calculate how many of the cohort will reach each year of age until eventually all members of the cohort have died. This enables the total number of years lived by the cohort to be calculated. When this total is divided by the number of persons in the cohort, 100,000, the result is the average number of years lived by each member of the cohort or the mean expectation of life at birth. The total number of years lived by the cohort from any given age can also be calculated and, when divided by the number of survivors in the cohort entering upon that year of age, the figure obtained is the expectation of life in years for those persons.

Life Tables were constructed for males and females which are representative of the mortality experience in Ireland during the three years 1978 to 1980, using the statistics of ages from the 1979 Census of Population and deaths enumerated in the three years 1978, 1979 and 1980. Two tables were constructed, number 9 relating to the entire State and number 9A relating to the Urban Districts of the State. References to previous Life Tables are given below.

The Urban Districts Table relates to the deaths of residents and the population residing within the boundaries of County and Municipal Boroughs and Urban Districts. This is a more limited coverage of areas than that of the Aggregate Town Area used in Census Reports (cf. the Explanatory Notes to Volume 1 of the 1981 Census). This arises from the fact that deaths can be assigned to place of residence only by strict reference to legally defined boundaries.

PUBLICATIONS CONTAINING LIFE TABLES NOS. 1-8

<i>LIFE TABLE</i>	<i>PUBLICATION</i>
<i>No. 1</i>	<i>CENSUS OF POPULATION OF IRELAND, 1926 - Vol. V (Part 1).</i>
<i>No. 2</i>	<i>CENSUS OF POPULATION OF IRELAND, 1936 - Vol. V (Part 1).</i>
<i>No. 3</i>	<i>REGISTER OF POPULATION OF IRELAND, 1941.</i>
<i>No. 4</i>	<i>CENSUS OF POPULATION OF IRELAND, 1946 - Vol. V (Part 1).</i>
<i>No. 5</i>	<i>CENSUS OF POPULATION OF IRELAND - GENERAL REPORT 1946 AND 1951.</i>
<i>No. 6</i>	<i>IRISH STATISTICAL BULLETIN - JUNE, 1965.</i>
<i>No. 7</i>	<i>CENSUS OF POPULATION OF IRELAND, 1971 - Vol. II. IRISH STATISTICAL BULLETIN - MARCH, 1972.</i>
<i>No. 8</i>	<i>IRISH STATISTICAL BULLETIN - MARCH, 1976.</i>

COMPARISON WITH IRISH LIFE TABLES NOS. 8 AND 8A 1970 - 72

Values of the rate of mortality (q_x) and the expectation of life (e_x^0) at ages 0, 10, 20-90 are shown in Tables 1 and 2.

Table 1 reviews the rate of mortality which is the probability that a person who reaches a particular age dies within a year. The table shows relatively high mortality in the first year of life, followed by a decline at 10 years. The mortality rate then becomes larger with increasing age.

TABLE 1 - RATE OF MORTALITY (q_x) 1970-72 AND 1978-80.

Age	Ireland				Urban Districts			
	Males		Females		Males		Females	
	1970-72	1978-80	1970-72	1978-80	1970-72	1978-80	1970-72	1978-80
0	.02078	.01435	.01656	.01142	.02304	.01628	.01773	.01265
10	.00037	.00033	.00023	.00019	.00038	.00039	.00020	.00019
20	.00116	.00107	.00050	.00040	.00101	.00102	.00043	.00037
30	.00119	.00115	.00071	.00055	.00125	.00138	.00058	.00078
40	.00271	.00242	.00176	.00149	.00322	.00260	.00188	.00165
50	.00772	.00736	.00526	.00439	.00899	.00880	.00576	.00479
60	.02096	.02042	.01290	.01152	.02404	.02438	.01389	.01357
70	.05107	.05114	.03125	.02933	.06050	.05864	.03139	.03034
80	.12168	.12625	.09679	.09183	.12432	.12616	.09287	.08882
90	.26246	.25624	.22625	.21597	.25593	.22480	.21019	.19722

TABLE 2 - EXPECTATION OF LIFE (e_x^0) 1970-72 AND 1978-80.

Age	Ireland				Urban Districts			
	Males		Females		Males		Females	
	1970-72	1978-80	1970-72	1978-80	1970-72	1978-80	1970-72	1978-80
0	68.77	69.47	73.52	74.95	67.37	68.06	73.35	74.33
10	60.62	60.80	65.11	66.08	59.36	59.52	65.02	65.59
20	50.97	51.14	55.32	56.24	49.68	49.84	55.23	55.74
30	41.52	41.70	45.62	46.47	40.16	40.38	45.52	46.00
40	32.06	32.23	36.04	36.81	30.68	31.00	35.90	36.40
50	23.28	23.30	26.96	27.62	22.08	22.19	26.88	27.31
60	15.60	15.66	18.68	19.19	14.76	14.91	18.75	19.07
70	9.66	9.47	11.54	11.89	9.20	9.19	11.75	12.03
80	5.35	5.29	6.19	6.42	5.36	5.55	6.47	6.73
90	2.82	2.92	3.24	3.38	2.90	3.40	3.49	3.71

For females for the whole country and the Urban Districts the values for the rate of mortality were lower in 1978-80 than in 1970-72 in all cases except for a slight increase at age 30 in the Urban Districts. For males for the whole country the rate of mortality showed a decrease at ages 0 to 60 and 90 but increases at ages 70 and 80. In the Urban Districts there were reductions only at ages 0, 40, 50, 70 and 90 with slight increases at the other ages.

From Table 2 it can be seen that expectation of life has increased at all ages for females in both life tables. For males in the whole country there were increases at all ages except 70 and 80 where there were reductions in life expectation. In the Urban Districts for males there was a slight reduction in life expectation at age 70 but increases at all other ages.

COMPARISON WITH IRISH LIFE TABLES NOS. 1- 9

The expectation of life at certain ages for Irish Life Tables 1-9 are given in Table 3.

The expectation of life at birth increased from 57.4 years to 69.5 years for males and from 57.9 years to 75.0 years for females over the 53 year period shown in this table. The increases in female expectation were greater than the increases in the male expectation at all ages with the excess in female expectation at birth increasing from 0.5 years in 1925-27 to 5.5 years in 1978-80 and at age 75 years from 0.7 years to 1.7 years. Since the 1960-62 period male expectation at ages 5 and above has remained almost static compared with steady increases for females. It can also be seen that as age increases the difference between male and female life expectation decreases.

TABLE 3 - EXPECTATION OF LIFE AT VARIOUS AGES, 1926-1979.

Irish Life Table No.	Period	Age in Years										
		0	5	10	15	20	25	35	45	55	65	75
MALES:												
1	1925-27	57.4	59.5	55.2	50.7	46.4	42.4	34.4	26.5	19.1	12.8	7.7
2	1935-37	58.2	60.1	55.8	51.2	46.8	42.7	34.4	26.3	18.8	12.5	7.9
3	1940-42	59.0	60.7	56.3	51.6	47.2	43.1	34.8	26.5	18.8	12.3	7.3
4	1945-47	60.5	61.5	56.9	52.2	47.8	43.5	34.9	26.4	18.6	12.0	6.9
5	1950-52	64.5	63.6	58.8	54.0	49.3	44.8	35.8	27.0	19.0	12.1	6.8
6	1960-62	68.1	65.7	60.8	56.0	51.1	46.4	37.0	27.8	19.5	12.6	7.1
7	1965-67	68.6	65.7	60.8	56.0	51.2	46.4	36.9	27.7	19.3	12.4	7.3
8	1970-72	68.8	65.5	60.6	55.7	51.0	46.3	36.8	27.6	19.3	12.4	7.3
9	1978-80	69.5	65.7	60.8	55.9	51.1	46.4	36.9	27.7	19.3	12.4	7.1
FEMALES:												
1	1925-27	57.9	59.2	54.9	50.5	46.4	42.4	34.7	27.0	19.6	13.4	8.4
2	1935-37	59.6	60.4	56.1	51.6	47.3	43.2	35.2	27.2	19.6	13.1	8.4
3	1940-42	61.0	61.4	56.9	52.4	48.0	44.0	35.8	27.6	19.8	13.2	8.1
4	1945-47	62.4	62.5	57.9	53.2	48.8	44.7	36.3	28.0	20.1	13.1	7.7
5	1950-52	67.1	65.4	60.6	55.8	51.2	46.6	37.7	28.9	20.6	13.3	7.6
6	1960-62	71.9	69.0	64.1	59.2	54.3	49.5	39.9	30.7	22.1	14.4	8.1
7	1965-67	72.9	69.6	64.8	59.8	54.9	50.1	40.4	31.1	22.4	14.7	8.4
8	1970-72	73.5	70.0	65.1	60.2	55.3	50.5	40.8	31.4	22.7	15.0	8.5
9	1978-80	75.0	71.0	66.1	61.1	56.2	51.4	41.6	32.1	23.3	15.4	8.8

METHOD OF CONSTRUCTION

The method of construction of the present Life Tables was the same as that employed in preparing the corresponding Tables Nos. 8 and 8A (which were based on the 1971 Census and deaths in the years 1970, 1971 and 1972). Although Census date was the 1st April, 1979, the population was not adjusted to bring it to the middle of the year because, as a result of the large seasonal passenger movement, there was no reason to believe that the population on the 30th June, 1979 was closer than the population on Census date to the average population for the years 1978 - 80.

At ages 0-7 years the system adopted was similar to that used in Life Tables Nos. 8 and 8A and was as follows: The rate of mortality at age 0, q_0 , was calculated simply from the population aged 0 and deaths under 1 year of age in 1978-80, the appropriate "exposure to risk" being allowed for deaths at ages under 1 week, 1 week and under 1 month, 1 month and under 2 months, etc. The central mortality rate for age 1, m_1 , was calculated from the population aged 1 and deaths of children aged 1 in 1978-80 and the mortality rate q_1 derived from it using the relationship $q_1 = \frac{m_1}{1 + \frac{1}{2} m_1}$. The rate for age 2, q_2 , was obtained from the corresponding rate in the 1970-72 Table as follows:-

$$q_2 (1979) = q_2 (1971) \times \frac{(\text{Actual deaths at ages 1, 2 and 3})}{(\text{Expected deaths at ages 1, 2 and 3})}$$

The expected deaths in the denominator of this expression were calculated by applying the 1971 central mortality rates to the 1979 population aged 1, 2 and 3. Similarly q_3 (1979) was obtained from q_3 (1971) by multiplying by the ratio of actual to expected deaths for ages 1, 2, 3, 4 and 5. This procedure was also applied to obtain q_x for ages 4, 5, 6 and 7.

The main portion of the Life Tables was calculated using the method of osculatory interpolation between pivotal values, used by Mr. George King, and described in the Registrar General's Decennial Supplement, England and Wales 1914. Deaths (for 1978, 1979 and 1980 combined) were added into five year groups, namely 5 to 9 years, 10 to 14 years, 15 to 19 years, etc. and from these pivotal values were calculated for ages 12, 17, 22, 27 - up to 92 years, using the formula:-

$$V_x = 0.216 W_x - 0.008 (W_x - 5 + W_x + 5)$$

where V_x denotes the pivotal value and W_x is the five year group total centred at age X. Pivotal values of the population at ages 12, 17, 22-92 were obtained in the same way and from these pivotal values of the central mortality rates m_x and hence q_x were calculated at 5 year intervals. In order to obtain functions of smooth graduation in the case of the Tables for males and females for the whole State, it was necessary to redistribute the deaths in a small number of quinquennial groups while keeping the totals in the corresponding decennial groups unaltered. To do this the number of expected deaths in the 1979 population in each quinquennial age-group was calculated by using the 1971 Life Tables. The actual number of deaths in the decennial group was then divided pro rata with the expected numbers in each of the two quinquennial groups. No such adjustment was necessary in the case of the Tables for the Urban Districts.

The method used in 1971 for equating actual and expected deaths at very old ages proved satisfactory from this point of view and was again used on this occasion. This method was as follows: A second degree curve was obtained, passing through the pivotal value of q_{72} and determined in such a manner that the sum of the weighted squares between the later pivotal values and the corresponding values of q_x on this curve should be a minimum. For each weight the square of the number of deaths in the quinquennial interval containing the q_x was adopted. The values of q_x on this curve were taken as new pivotal values.

Osculatory interpolation was used to calculate the values of q_x from $x = 7$ to $x = 87$. The function $\log (q_x + 0.1)$ was used in the interpolation. At ages above 87 years the values of q_x were obtained from the second degree curve used to determine the pivotal values. Although nine places of decimals were retained in the calculation of the q 's the values were subsequently rounded off to five decimal places, and these values were used in the computation of the remaining columns of the Life Tables.

THE ACTUAL - EXPECTED TEST

A measure of the closeness with which the Life Table reflects the mortality in the population is obtained by comparing the actual numbers of deaths, with those expected on the basis of the Life Table death rates. This is done in Table 4.

TABLE 4 - THE ACTUAL - EXPECTED TEST.

Ages	Males			Females		
	Deaths 1978-80 Annual Average		Deviation: Expected Less Actual	Deaths 1978-80 Annual Average		Deviation: Expected Less Actual
	Actual	Expected		Actual	Expected	
0-4	631	627	- 4	490	481	- 9
5-9	68	70	+ 2	43	44	+ 1
10-14	67	69	+ 2	29	31	+ 2
15-19	136	134	- 2	52	52	-
20-24	158	158	-	55	55	-
25-29	150	149	- 1	57	57	-
30-34	133	134	+ 1	69	68	- 1
35-39	160	160	-	87	88	+ 1
40-44	246	243	- 3	149	149	-
45-54	1,102	1,104	+ 2	653	653	-
55-64	2,874	2,879	+ 5	1,650	1,652	+ 2
65-74	5,418	5,433	+ 15	3,473	3,496	+ 23
75-84	5,243	5,308	+ 65	5,324	5,402	+ 78
85-94	1,936	1,925	- 11	2,811	2,750	- 61
95-99	124	174	+ 50	258	337	+ 79
Total 0-99 years	18,446	18,567	+ 121	15,200	15,315	+ 115

NOTATION

Standard Life Table notation is used in the Tables

l_x = the number of persons surviving to exact age x out of 100,000 aged 0.

d_x = the number of deaths in the year of age x to $x + 1$ out of l_x persons who enter that year.

p_x = the probability of living a year, or the ratio of the number completing the year of age x to $x + 1$ to the number entering on the year.

q_x = the rate of mortality, or the probability of dying in a year. It is the ratio of the number of deaths in the year of age x to $x + 1$ to the number entering on the year.

L_x = the population to be expected according to the Life Table aged between x and $x + 1$ years, assuming that 100,000 births occurred each year.

T_x = the population to be expected according to the Life Table above age x , assuming that 100,000 births occurred each year.

e_x^0 = the expectation of life in years, or the total future life time in years which will on average be passed through by persons aged exactly x .

The following relations hold between these quantities:-

$$p_x = 1 - q_x, \quad l_x - l_{x+1} = d_x, \quad L_x = \frac{1}{2}(l_x + l_{x+1}) \quad (x > 0),$$

$$T_x = \sum_{y \geq x} L_y, \quad e_x^0 = T_x / l_x$$