# Life Table: Meaning, Types and Importance

## Dr. Kumar Satyendra Yadav, Assistant Professor, Statistics, Dept.. Patna University, Patna

### Meaning of Life Table:

Life table is a mathematical sample which gives a view of death in a country and is the basis for measuring the average life expectancy in a society. It tells about the probability of a person dying at a certain age, or living upto a definite age.

According to Bogue, "The life table is a mathematical model that portrays mortality condition at a particular time among a population and provides a basis for measuring longevity. lt is based on age specific mortality rates observed for a population for a particular year."

### Types of Life Tables:

**Life tables are of two types:**

Cohort or Generation Life Table, and Period Life Table. The Cohort or Generation Life Table "summarises the age specific mortality experience of a given birth cohort (a group of persons all born at the same time) for its life and thus extends over many calender years." On the other hand, the "Period Life Table summarises the age specific mortality conditions pertaining to a given or other short time period."

### Assumptions of Life Table:

**A life table is based on the following assumptions:**

1. A hypothetical cohort of life table usually comprises of 1,000 or 10,000 or 1,00,000 births.

2. The deaths are equally distributed throughout the year.

3. The cohort of people diminish gradually by death only.

4. The cohort is closed to the in-migration and out-migration.

5. The death rate is related to a pre-determined age specific death rate.

6. The cohort of persons die at a fixed age which does not change.

7. There is no change in death rates overtime.

8. The cohort of life tables are generally constructed separately for males and females.

## Methods of Constructing Life Table:

Life tables are constructed on the basis of a single cross-sectional time data for a generation. There is also a longitudinal life table method which takes a real cohort of persons that start life at a specific age interval and follow it throughout life until they die.

Further, a complete life table may be constructed on the basis of single years of ages. An abridged life table can also be constructed wherein ages are grouped in 5 or 10 years of interval, taking the intial year as 0-1.

**TABLE 3.4**

**Hypothetical Complete Life Table for India (1971–80)**

| Age x to x+n | dx | fx fx – dx (3– 2) | qx dx/fx (2/3) | px 1 – qx (1– 4) | Lx (fx0 + fx1)/2 | Tx Tx1 = Tx·x0 – Lx·x0 | ex Tx/Fx |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0. | 13000 | 100000 | 0.13000 | 0.87000 | 93500 | 4930250 | 49.3 |
| 1. | 1300 | 87000 | 0.01494 | 0.98506 | 86350 | 4836750 | 55.6 |
| 2. | 1200 | 85700 | 0.01400 | 0.98600 | 85100 | 4750400 | 55.4 |
| 3. | 100 | 84500 | 0.00118 | 0.99882 | 84450 | 4665300 | 55.2 |
| 4. | 800 | 84400 | 0.00948 | 0.99052 | 84000 | 4580850 | 54.3 |
| 5. | 500 | 83600 | 0.00598 | 0.99402 | 83350 | 4496850 | 53.8 |
| 6. | 300 | 83100 | 0.00361 | 0.99639 | 82950 | 4413500 | 53.1 |
| 7. | 200 | 82800 | 0.00242 | 0.99758 | 82700 | 4330550 | 52.3 |
| 8. | 100 | 82600 | 0.00121 | 0.99879 | 82550 | 4247850 | 51.4 |
| 9. | 70 | 82500 | 0.00085 | 0.99915 | 82465 | 4165300 | 50.5 |
| 10. | 65 | 82430 | 0.00079 | 0.99921 | 82398 | 4082835 | 49.5 |
| 11. | 60 | 82365 | 0.00073 | 0.99927 | 82335 | 4000438 | 48.6 |
| 12.. | 80 | 82305 | 0.00097 | 0.99903 | 82265 | 3918103 | 47.6 |
| 13. | 100 | 82225 | 0.00122 | 0.99878 | 82175 | 3835838 | 46.7 |
| 14. | 200 | 82125 | 0.00244 | 0.99756 | 82025 | 3753663 | 45.7 |
| 15. | 210 | 81925 | 0.00256 | 0.99744 | 81820 | 3671638 | 44.8 |
| 16. | 215 | 81715 | 0.00263 | 0.99737 | 81608 | 3589818 | 43.9 |
| 17. | 220 | 81500 | 0.00270 | 0.99730 | 81390 | 3508210 | 43.0 |
| 18. | 225 | 81280 | 0.00277 | 0.99723 | 81168 | 3426820 | 42.2 |
| 19. | 230 | 81055 | 0.00284 | 0.99716 | 80940 | 3345653 | 41.3 |
| 20. | 225 | 80825 | 0.00278 | 0.99722 | 80713 | 3264713 | 40.4 |
| 21. | 230 | 80600 | 0.00285 | 0.99715 | 80485 | 3184000 | 39.5 |
| 22. | 235 | 80370 | 0.00292 | 0.99708 | 80253 | 3103515 | 38.6 |
| 23. | 240 | 80135 | 0.00299 | 0.99701 | 80015 | 3023263 | 37.7 |
| 24. | 245 | 79895 | 0.00307 | 0.99693 | 79773 | 2943248 | 36.8 |
| 25. | 260 | 79650 | 0.00326 | 0.99674 | 79520 | 2863475 | 36.0 |
| 26. | 275 | 79390 | 0.00346 | 0.99654 | 79253 | 2783955 | 35.1 |
| 27. | 285 | 79115 | 0.00360 | 0.99640 | 78973 | 2704703 | 34.2 |
| 28. | 295 | 78830 | 0.00374 | 0.99626 | 78683 | 2625730 | 33.3 |
| 29. | 320 | 78535 | 0.00407 | 0.99593 | 78375 | 2547048 | 32.4 |
| 30. | 350 | 78215 | 0.00447 | 0.99553 | 78040 | 2468673 | 31.6 |
| 31. | 400 | 77865 | 0.00514 | 0.99486 | 77665 | 2390633 | 30.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32. | 450 | 77465 | 0.00581 | 0.99419 | 77240 | 2312968 | 29.9 |
| 33. | 550 | 77015 | 0.00714 | 0.99286 | 76740 | 2235728 | 29.0 |
| 34. | 600 | 76465 | 0.00785 | 0.99215 | 76165 | 2158988 | 28.2 |
| 35. | 700 | 75865 | 0.00923 | 0.99077 | 75515 | 2082823 | 27.5 |
| 36. | 800 | 75165 | 0.01064 | 0.98936 | 74765 | 2007308 | 26.7 |
| 37. | 900 | 74365 | 0.01210 | 0.98790 | 73915 | 1932543 | 26.0 |
| 38. | 1000 | 73465 | 0.01361 | 0.98639 | 72965 | 1858628 | 25.3 |
| 39. | 1050 | 72465 | 0.01449 | 0.98551 | 71940 | 1785663 | 24.6 |
| 40. | 1150 | 71415 | 0.01610 | 0.98390 | 70840 | 1713723 | 24.0 |
| 41. | 1200 | 70265 | 0.01708 | 0.98292 | 69665 | 1642883 | 23.4 |
| 42. | 1300 | 69065 | 0.01882 | 0.98118 | 68415 | 1573218 | 22.8 |
| 43. | 1325 | 67765 | 0.01955 | 0.98045 | 67103 | 1504803 | 22.2 |
| 44. | 1375 | 66440 | 0.02070 | 0.97930 | 65753 | 1437700 | 21.6 |
| 45. | 1400 | 65065 | 0.02152 | 0.97848 | 64365 | 1371948 | 21.1 |
| 46. | 1450 | 63665 | 0.02278 | 0.97722 | 62940 | 1307583 | 20.5 |
| 47. | 1475 | 62215 | 0.02371 | 0.97629 | 61478 | 1244643 | 20.0 |
| 48. | 1500 | 60740 | 0.02470 | 0.97530 | 59990 | 1183165 | 19.5 |
| 49. | 1525 | 59240 | 0.02574 | 0.97426 | 58478 | 1123175 | 19.0 |
| 50. | 1550 | 57715 | 0.02686 | 0.97314 | 56940 | 1064698 | 18.4 |
| 51. | 1600 | 56165 | 0.02849 | 0.97151 | 55365 | 1007758 | 17.9 |
| 52. | 1625 | 54565 | 0.02978 | 0.97022 | 53753 | 952393 | 17.5 |
| 53. | 1650 | 52940 | 0.03117 | 0.96883 | 52115 | 898640 | 17.0 |
| 54. | 1675 | 51290 | 0.03266 | 0.96734 | 50453 | 846525 | 16.5 |
| 55. | 1700 | 49615 | 0.03426 | 0.96574 | 48765 | 796073 | 16.0 |
| 56. | 1725 | 47915 | 0.03600 | 0.96400 | 47053 | 747308 | 15.6 |
| 57. | 1750 | 46190 | 0.03789 | 0.96211 | 45315 | 700255 | 15.2 |
| 58. | 1755 | 44440 | 0.03949 | 0.96051 | 43563 | 654940 | 14.7 |
| 59. | 1760 | 42685 | 0.04123 | 0.95877 | 41805 | 611378 | 14.3 |
| 60. | 1765 | 40925 | 0.04313 | 0.95687 | 40043 | 569573 | 13.9 |
| 61. | 1760 | 39160 | 0.04494 | 0.95506 | 38280 | 529530 | 13.5 |
| 62. | 1750 | 37400 | 0.04679 | 0.95321 | 36525 | 491250 | 13.1 |
| 63. | 1725 | 35650 | 0.04839 | 0.95161 | 34788 | 454725 | 12.8 |
| 64. | 1700 | 33925 | 0.05011 | 0.94989 | 33075 | 419938 | 12.4 |
| 65. | 1675 | 32225 | 0.05198 | 0.94802 | 31388 | 386863 | 12.0 |
| 66. | 1650 | 30550 | 0.05401 | 0.94599 | 29725 | 355475 | 11.6 |
| 67. | 1600 | 28900 | 0.05536 | 0.94464 | 28100 | 325750 | 11.3 |
| 68. | 1575 | 27300 | 0.05769 | 0.94231 | 26513 | 297650 | 10.9 |
| 69. | 1550 | 25725 | 0.06025 | 0.93975 | 24950 | 271138 | 10.5 |
| 70. | 1500 | 24175 | 0.06205 | 0.93795 | 23425 | 246188 | 10.2 |
| 71. | 1475 | 22675 | 0.06505 | 0.93495 | 21938 | 222763 | 9.8 |
| 72. | 1425 | 21200 | 0.06722 | 0.93278 | 20488 | 200825 | 9.5 |
| 73. | 1375 | 19775 | 0.06953 | 0.93047 | 19088 | 180338 | 9.1 |
| 74. | 1350 | 18400 | 0.07337 | 0.92663 | 17725 | 161250 | 8.8 |

The above life table provides the column wise information which is generally provided and followed by all life tables.

Col. 1.x = Specific Age

If the age at birth is x then the age at one year is x + 1. Similarly the age at 15 years is x + 15.

Col. 2. dx = Number of deaths, at any particular age. i.e., at the age x, 13000 deaths occur out of 1,00,000 births, then at age x + 1 : 87,000 persons will be alive. In this age, if 1300 deaths occur then at age x + 2 : 85700 persons will be alive.

Col. 3. fx = The number of persons surviving at age x to x + n i.e., at the age x + 1 = 1,00,000-13,000 = 87,000

Col. 4. qx = Probability of death per person in the specific age i.e., total deaths occurred. (Out of 1,00,000 = 13,000)

Probability = 13,000÷ 1,00,000 = 0.13

Similarly, at the age x + 1, 1300 persons died out of 87,000 live population then

Probability = 1300 ÷ 87,000 = 0.01494.

Col. 5. Px = 1 – Probability of surviving per individual person or 1 – qx, i.e.;

At age x, 1 – .13000 = .87000 and at age x + 1, 1- .01494 = .98506.

Col. 6. Lx = Number of years lived by the cohort in the age x to x + n or

fx of any two age groups ÷ 2

Suppose,

fx- 15 = 81925 [col.: 3, row 15]

fx- 16 =81715 [col.: 3, row 16]

Lx = 163640 ÷ 2 = 81820

Col. 7. Tx – Total number of years lived by the cohort after exact age x.

This can be found out from the reverse side of life table, i.e.,

At the age of 94 Lx = 525 and

at age 93 Lx = 925

then at age x + 93, total number of years lived by

Cohort = 525 + 925 = 1450 and at age x + 92,

it will be 525 + 925 + 1400 = 2850.

Col. 8. Ex = T.v ÷Fx. This gives average life expectancy.

In short, the life table is based on the age of death period of a particular population. By studying this table, we can show the probability of death of any person of any particular age group. It is to be noted that every person of a particular age group does not die according to the estimate of the life table. The life table only shows a trend.

**Importance of Life Table:**

Life tables have been constructed by Graunt, Reed and Merrell, Keyfitz, Greville and other demographers for estimating population trends regarding death rates, average expectation of life, migration rates, etc.

**We detail below the uses of life tables:**

1. Life table is used to project future population on the basis of the present death rate.

2. It helps in determining the average expectation of life based on age specific death rates.

3. The method of constructing a life table can be followed to estimate the cause of specific death rates, male and female death rates, etc.

4. The survival rates in a life table can be used to calculate the net migration rate on the basis of age distribution at 5 or 10 year interval.

5. Life tables can be used to compare population trends at national and international levels.

6. By constructing a life table based on the age at marriage, marriage patterns and changes in them can be estimated.

7. Instead of a single life table, multiple decrement life tables relating to cause specific death rate, male and female death rates, etc. can be constructed for analysing socio-economic data in a country.

8. Life tables are particularly used for formulating family planning programmes relating to infant mortality, maternal deaths, health programmes, etc. They can also be used for evaluating family planning programmes.

9. Now a days, life tables are used by life insurance companies in order to estimate the average life expectancy of persons, separately for males and females. They help in determining the amount of premium to be paid by a person falling in a specific age group.

Besides, if an insured person dies before the policy matures, the life table provides economic support to the insurance company without facing financial loss and it is able to give the insured amount to the legal heirs of the deceased.