

Life Insurance Mortality Tables

How Mathematicians Arrived at a Man's Expectation of Life

By George Gilbert

Investigation has established the fact that the chance of living or dying at any age for men of average health is a definite quantity. Reliable mortality tables have been formed which show accurately the deaths from year to year among a large body of lives, reaching from early youth to the extreme limit of old age. These tables also show the yearly probability of living and the yearly probability of dying at each age. By combining with these probabilities either interest or discount as the case may be, the correct life insurance premium and annuity rate for every age may be computed with absolute mathematical accuracy.

It is a curious circumstance that the scientific method of calculating the probabilities of living and dying from the mortality records had its origin in a game of cards. About the year 1650, the Chevalier de Mere, a Flemish nobleman who, it is recorded, was both a respectable mathematician and an ardent gamester, attempted to solve the problem of dividing equitably the stakes when a game of chance was interrupted. The problem was too difficult for him, and he secured the assistance of that celebrated Jesuit priest, Abbe Blaise Pascal, author of "Night Thoughts" and one of the most accomplished mathematicians of any age. Pascal solved the problem, and in so doing enunciated what is called "the doctrine of probabilities," or the laws governing so-called chance.

Law of Mortality

Upon this doctrine of theory of probability depends not only the laws governing insurance of all kinds, but the laws governing the motions of the planets in space, and in fact all astronomical science. Pascal illustrated this doctrine or theory by the throwing of dice. When a single die is thrown, the chance of turning up an ace is exactly one in six, or one of the total number of sides or faces. But if a large number of throws are made, it will be found that each face will be turned up an equal number of times. From this Pascal laid down the proposition that results which have happened in any given number of observed cases will again happen under similar circumstances, provided the number be sufficient for the proper working of the law of average. Thus the duration of the life of a single individual is one of the greatest uncertainties, but the rate of mortality of a large number of individuals may be predicted with the greatest accuracy.

That is to say, there is a law governing the mortality of the race which is practically invariable. Recognition of this law is the distinguishing mark of all sound life insurance. Failure to recognize it is the rock upon which unsound insurance schemes such as assessment life insurance, come to grief.

It was through numerous investigations of various records of death, carried out on many occasions, and in different ways, that this law of mortality was ascertained and accurate tables of mortality constructed. These tables of mortality, were little used until the close of the 18th century, after the Northampton Tables of Dr. Price had been published, although one hundred years earlier Halley, the famous British Astronomer Royal, had constructed a mortality table from the data of the population of the town of Breslau in Silesia.

Practical Figures

The two principle sources for obtaining the necessary information from which to compile a reliable mortality table are: Population statistics, covering births and deaths, and life insurance statistics. Other sources have been used, such as particulars of peerage families, widows' and pension funds, employees in large corporations, army and navy statistics, etc. The tables now used by life insurance companies and adopted by the government as standard, are those constructed from life insurance statistics, as they are free from the errors of population statistics, and as they exhibit the actual mortality ex-

perienced in the business. The first table of this kind was based on the experience of the old Equitable Society of London, Eng., and was published in 1834. The most recent and most scientifically constructed tables in existence are what are known as the British Office Life Tables, 1893, or for short, the Om Tables. Practically all the British life companies contribute their experience for the thirty year period between 1863 and 1893, and the number of insured lives under observation was over one million. The work of constructing these tables occupied a large staff of clerks for about ten years.

One of the Om tables comprised a tabulation of the ordinary life, with profits, experience, excluding the first five years of insurance. This is called the Om (5) Table and is the Government standard in Canada for the calculation of policy reserves. The rate of mortality is that which insured lives experienced in Great Britain after the effects of medical selection had disappeared. It is considered that the experience of insured lives in this country will be somewhat more favorable than that shown by this table, which has however, been adopted as a safe standard by which to measure the policy liabilities of our Canadian companies. Prior to 1910, the Dominion Government standard was the Healthy Males Table of Mortality of the Institute of Actuaries of Great Britain, known as the Hm Table. It was formed from the experience of twenty British companies.

The American System

In the United States the recognized standard table of mortality is the American Experience Table, constructed by Sheppard Homans, it is understood, from the experience of the Mutual Life Insurance Co., of New York, though full particulars of the data employed were never given by the author. It has however, furnished a safe basis for measuring the mortality of insured lives in the United States after the first effects of selection have worn off. The premium rates of practically all United States life companies are based on this table. The need for a more modern table is felt, however, and the necessary steps are at present being taken to prepare one which will exhibit the actual results of the American Companies' past experience.

COST OF MODERN WARFARE

A writer in the Scientific American, dealing with the cost of the war, states that every day enough money is being spent to erect seven Woodworth buildings. Every three days the waste equals the cost of the Panama Canal. The aggregate direct cost of the 20 greatest wars in the century and a quarter preceding the present struggle was not in excess of \$22,000,000,000, while to the end of 1916 the Great War cost \$61,000,000,000 and the expenditures are now at the rate of \$105,000,000 a day. The figures for the principal nations involved, exclusive of the United States, are given as follows:

Country	Total cost to Dec. 31, 1916	Present average cost per day
Great Britain	\$14,374,000,000	\$12,000,000
United Kingdom	\$14,374,000,000	\$12,000,000
Canada	400,000,000	900,000
Other Colonies	900,000,000	900,000
Total Great Britain	\$15,274,000,000	\$13,800,000
France	\$12,300,000,000	\$10,000,000
Russia	8,500,000,000	14,000,000
Italy	4,000,000,000	7,000,000
Belgium	2,000,000,000	1,000,000
Serbia	200,000,000	1,000,000
Rumania	250,000,000	2,000,000
Entente Allies	\$41,144,000,000	\$70,000,000
Germany	\$14,000,000,000	\$21,000,000
Austria	5,000,000,000	11,000,000
Turkey	400,000,000	1,000,000
Bulgaria	375,000,000	1,000,000
Central Allies	\$20,025,000,000	\$33,000,000
Grand Total	\$61,169,000,000	\$103,000,000

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