JOURNAL OF INSURANCE MEDICINE

J Insur Med 2000;32:271–273

GRAPHICS SECTION

A Short History of Mortality

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A short history of mortality: being itself a cautionary tale!

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Key words: Insurance, life expectancy.

Received: May 11, 2000.

Accepted: June 15, 2000.

Insurance as a concept dates back to the time of the Code of Hammurabi, nearly 20 centuries before the Christian era. The first use seems to have been bottomry, or the forgiving of the loan to finance a voyage if the ship was lost. There was no premium, but the risk was figured into the interest on successful loans. Later, Greeks and Romans in occupational guilds paid money into pools, which were then paid out to a member's family in the event of an untimely death. This early form of life insurance was based on biblical and Roman notions of mortality that persisted for the next 17 centuries. Ulpian's life expectancy tables from 225AD were still in use in the 1600s.[1]

Annuity schemes by the British government in the 17th century were based on tables endorsed by Sir Isaac Newton that basically said each person, regardless of age, would survive another 10 years.[2] The resulting annuity scheme was costly to the British government and became a source for foreign investment. By 1653, the first tontine was operating. A group of people purchase tickets and the accumulated cash is claimed by the ticket holder who lives the longest. John Graunt, while investigating mortality and the London population, was the innovator of the statistical method. He, along with his collaborator, William Petty, a former physician, laid the foundation for decisions in uncertainty using sampling and analysis.[1]

Thirty years later, Sir Edmund Halley, after charting the skies of the Southern Hemisphere and calculating the refraction of water causing a rainbow, contemplated the problem of predicting mortality. (This was before he went on to predict the comet that bears his name.)[3] London was not a stable population due to an influx of people either because of the attractions of the city or political unrest of the times. (Graunt was aware of this.) However, Halley knew of a paper published about a town in Silesia where births and deaths were meticulously documented. This paper had been written to disprove the notion that phases of the moon caused disease.[1]

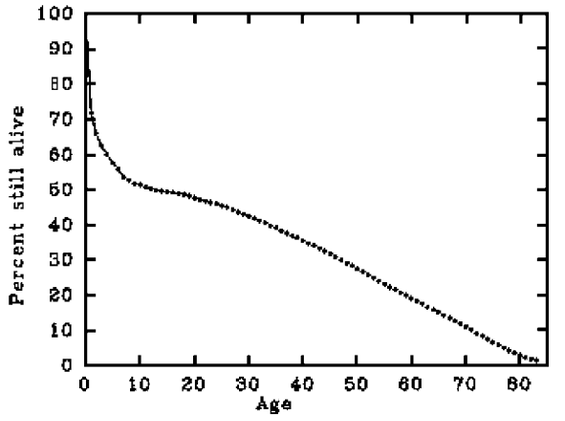

Figure 1. *Survival in Breslau in the 1690s (from Halley).*

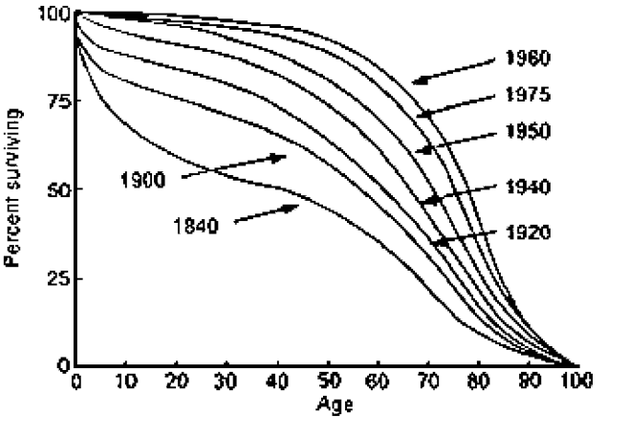

Figure 2. *US survival curve by age, 1840–1980. (Source: US Bureau of Health Statistics.)*

Making a few assumptions, Halley was able to erect a mortality table from the data in 1690. Halley was later an innovator in graphical display, but the graph (Figure 1) is a 20th century rendition of Halley's table by John Cairns.[2,4] Despite Halley's publication, the British government continued selling annuities using the same risk rule without respect for age for another 95 years, losing money in the bargain. More attention was paid to risk in British insurance transactions at Lloyd's coffee house in London.[1]

Cairns used this first mortality curve to compare the mortality of ancient and contemporary primitive societies. The mortality was essentially the same. Mortality in ancient cities was worse, and it was not until the late 19th century that a city could sustain its population without influx from the provinces. Nevertheless, Dickens' London compares well with contemporary and prior populations. Liverpool's mortality was worse than London's and was essentially the same as that of Breslau a century and a half earlier. Once city mortality was recognized in the 18th century, there were proposals for public health by Frank in Germany and Guillotin in France.

Substantial changes in mortality did not begin until the middle to late 19th century and began before considerable advances in medical treatment. Robert Koch, known for isolation of the cholera bacteria as well as the tuberculosis mycobacterium, probably did more in public health by supporting, along with Virchow, the midcentury public health advances in sanitation in German cities. John Snow in London in 1855 attributed Cholera to contaminated water supplies and in doing so founded the epidemiological method. The story is fascinating in that there are other players with earlier discoveries, but we remember Snow and Koch. In both cases, cholera and tuberculosis, the impact of the disease was already on the wane. Tuberculosis had been on a linear decline before Koch isolated the agent, and even the 20th century introduction of streptomycin did not hasten the decline in the tuberculosis mortality curve. The London cholera epidemic was already just past peak when Snow convinced the town to remove the pump handle.[2]

The next graph (Figure 2) is taken from Brackenridge. It shows the advance of survival through the late 19th and 20th centuries.[5] The improvement in mortality is obvious. Cairns points out that the antibiotic age began after World War II, but by 1950, the curves were already on the advance. Much of the mortality improvement is due to a decrease in incidence of diseases that are largely untreatable.[2] Given the age of medicine we are in, it seems largely counterintuitive. Yet recent studies indicate that, controlling for all lifestyle factors, lower socioeconomic classes suffer more disease, just as the ancients did. Most drawings of survival curves imply a limit and not an increase in maximum age attainable.

Mortality and survival calculations ad-

vanced with De Moivre (1729),[6] Gompertz (1825),[6] Makeham (1860),[6] and Weibull (1939).[6] Still, it is the early history that implies the lesson. Seventeenth century pundits endorsed schemes that were unsound. A data cruncher published a relatively accurate table that was ignored for nearly a century—to the detriment of the bottom line. No sooner was the data recognized than the baseline began to change but for reasons that are still not fully understood. Last, the gourmet coffee urn in the cafeteria, as it happens, is part of a tradition in British-born insurance that goes back to Lloyd's coffeehouse.

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