

formula of Gompertz, as modified by Mr. Makelham. This last is based on the assumption that a person's power of resisting death decreases as his years increase, so that at the end of infinitely small periods of time, he loses infinitely small portions of his remaining power to resist destruction, death being considered as the consequence of two generally co-existing causes—the one a progressive, necessary deterioration; the other, chance.

Calculations and corrections based on such formulae as these give interesting results and are useful to life insurance work, but they are unnecessary for the purposes of the sanitary statistician. Even the fundamental hypothesis upon which Gompertz's law is based—that the proportion of deaths at a given age is constant—is always untrue for any given age, as the prevalence of infectious and contagious diseases of various kinds, and of various lethality, varies with different years, and for this reason it is desirable to have the records of deaths for a considerable period of time, at least three years, and better ten to twenty years, in order to correct these variations.

The most useful life tables for sanitary purposes are those which relate to certain circumscribed localities, such as a single city, or even a single ward of a city; but for scientific and medical purposes the most useful are those which relate to particular classes of people, particularly occupations, etc. There is a special difficulty in preparing an accurate life table for a city, due to the effect of migration into and out of the city from and to the surrounding country, which disturbs very much the rates of deaths at different ages. The mortality in a great city, is almost always reported as less than that which the actually existing causes of death and disease tend to produce, because domestic servants, shop girls, and others who have come from the country, go back to their rural homes when their health begins to fail after a year or two of city life, and there die. This is especially the case in regard to deaths from consumption and diseases of that class. The groups of ages which are thus specially affected are those between fifteen and twenty-five years, and therefore the mortality at this group of ages in the large cities as calculated from the number of deaths is too small to properly represent the causes of death acting on the population at those ages. On the other hand, the mortality at the same ages in the rural districts near the city will be correspondingly unduly increased.

The data necessary for the construction of life tables are comparatively rarely available for the purposes of the sanitarian. Hence, while admitting that these furnish the only true measure of public health, registrars of vital statistics and sanitarians have sought for other standards for such measurement, the data for which could be more readily obtained and more easily applied. Especially has the search been made for some means of measuring sanitary conditions and progress from the data furnished by deaths alone without reference to population. One of the most common of these is the use of the period of infancy

from nothing to five years, by comparing the number of deaths at this period with the total number of deaths. It is very certain that the period of infancy gives the most sensitive test of sanitary conditions, but the comparison must be made, not with the total number of deaths at all ages, but with the number of the living population furnishing such deaths.

In Europe it is more common to confine the calculation to children under one year of age, and these are much more valuable there than they would be in this country, because they have there a much more complete registration of births, and therefore the relation between the number of infants born and dying within the first year of life can be ascertained with an exactness which is quite out of the question in this country.

The test of sanitary condition which is most generally employed in this country is the proportion of the number of deaths which occur in children under five years of age to the whole number of deaths reported. This does fairly well in computing the rates of the same city, in which it may be presumed that the general ratio of age distribution is nearly uniform at different times, but it is a very fallacious method of comparing rates of different cities or localities. For example, during the last census year the ratio of deaths under five years per 1,000 of total deaths was, in Alabama, 475.9 for males; in California, 250; but in Alabama the proportion of male children under five years to the total population is 17.5 per cent., while in California it is only 9.1, or but little over half the Alabama ratio, and hence the true rate is actually higher in California than it is in Alabama, although the figures would indicate the reverse.

Another test which has been proposed is that of the mean age at death, which is the quotient of the sum of the ages of different individuals at death divided by the total number of deaths. This is only useful in comparing the conditions of two populations when the age and sex constitutions of these populations are the same. It is out of the question to apply the test to different occupations—as, for example, to compare the mean age at death of major-generals with that of second lieutenants. The chief use of this test is in its application to different causes of death, but even for this purpose the death-rate in relation to population is much better.

A considerable part of the errors to which one is liable in comparing the mean age of different occupations at death may be avoided by excluding from the computation all deaths of children under five years of age.

Although the expectation of life, or mean after life-time, is the standard of comparison almost universally accepted by statisticians, it is, in some respects, not a very satisfactory one, since it is often understood by the public, which is apt to use the word "mean" in the sense of usual or ordinary, that which occurs most frequently. But the ordinary lifetime, or, as Bertillon calls it, the *vie normale*, is a very different matter.

The great majority of the mortality statistics