RECENT CHANGES IN THE DEATH RATE FROM INFLUENZA

BY

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The death rate from influenza in England and Wales has been at a relatively low level during the past decade ; indeed, for rates lower than those recorded in the years 1938, 1942, 1944, 1945, 1947, and 1948 it is necessary to go as far back as the period before the epidemic of 1890–1. The explanation that immediately suggests itself for this decrease in mortality is the discovery and general use of antibiotics, which have reduced the risk of fatal respiratory complications. While such advances in treatment may well have been important, a survey of our past experience of influenza would clearly be of interest.

Mortality, 1837 to 1948

The recorded mortality of influenza, like that of other causes of death, has been affected by changes in ,the fashion of certifying deaths, by increasing knowledge, and also by changes in tabulation. The broad trend of the death rates, however, can be accepted for comparative purposes, attention being confined to relative deviations rather than to absolute levels. With this proviso in mind the annual death rate per 1,000,000 living since registration began in 1837 is shown in Table I. Three large outbreaks, it will be seen, divide these rates into distinct parts with differing trends.

The first large outbreak of influenza after the introduction of registration occurred in 1847–8, with a death rate of 459 per million in the latter year. The death rate remained relatively high during the following decade, and there were small peaks in 1851 and 1855, when the rates were 122 and 193 per million respectively Mortality then declined fairly steadily during the next thirty years until influenza as a recorded cause of death almost disappeared. In the nine years 1881–9 only 821 deaths were attributed to it. This position was abruptly upset by the epidemic of 1890–1. The death rate remained very high in 1892, and this outbreak clearly marks a distinct change in the trend of mortality. During the ensuing twenty-five years influenza maintained itself as an important cause of death, producing an annual mortality rate varying from 504 per million in 1900 to 120 in 1911.

In this setting the pandemic of 1918–19 appeared and produced crude death rates of 3,129 and 1,217 per million in these two years. Subsequently, influenza epidemics seemed to follow a two- to four-year cycle. Thus there were outbreaks with a death rate exceeding 400 per million in 1922, 1924, 1927, 1929, 1933, and 1937, and the actual number of deaths in these years varied from 18,635 in 1937 to 29,084 in 1929.

During 1920–30 the annual death rates oscillated considerably, but in the inter-epidemic years the rate was

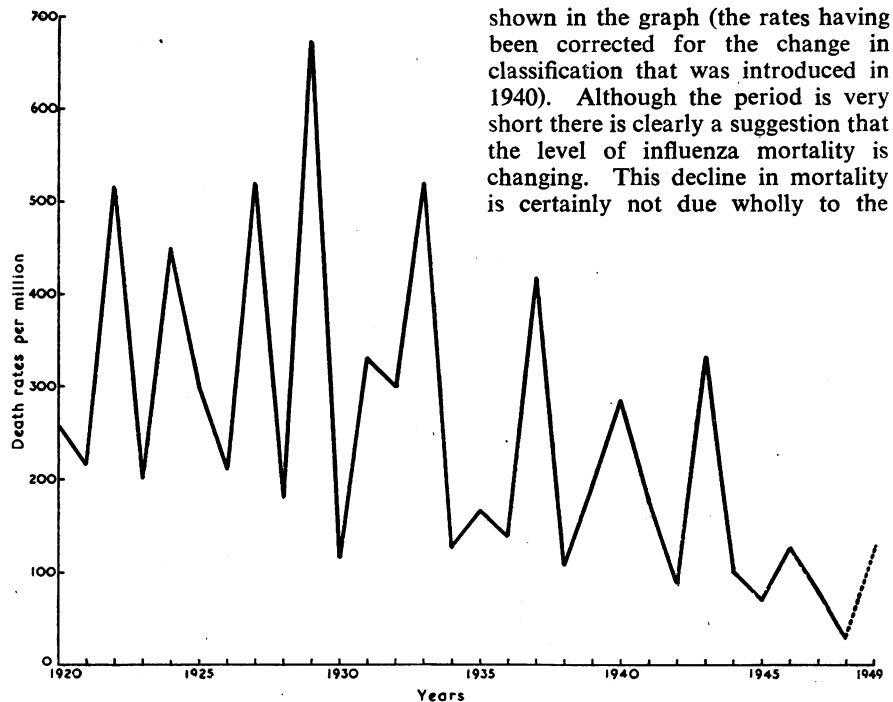TABLE I.—*Influenza in England and Wales. Death Rates per 1,000,000 Living*

Year	Rate	Year	Rate	Year	Rate	Year	Rate
1838	53	1868	14	1895	422	1922	563
1839	57	1869	32	1896	121	1923	220
1840	66	1870	27	1897	195	1924	489
1841	104	1871	15	1898	330	1925	327
1842	55	1872	12	1899	389	1926	229
		1873	12	1900	504	1927	567
1847	285	1874	10	1901	174	1928	196
1848	459	1875	19	1902	224	1929	734
1849	92	1876	8	1903	190	1930	126
1850	78	1877	8	1904	169	1931	330
1851	122	1878	8	1905	205	1932	300
1852	76	1879	10	1906	184	1933	520
1853	99	1880	7	1907	267	1934	127
1854	58	1881	4	1908	288	1935	167
1855	193	1882	3	1909	254	1936	141
1856	55	1883	4	1910	182	1937	418
1857	73	1884	3	1911	120	1938	108
1858	93	1885	5	1912	147	1939	194
1859	57	1886	3	1913	175	1940	286
1860	58	1887	3	1914	161	1941	177
1861	38	1888	3	1915	293	1942	88
1862	45	1889	2	1916	252	1943	333
1863	45	1890	157	1917	213	1944	103
1864	39	1891	574	1918	3,129	1945	70
1865	29	1892	534	1919	1,217	1946	130
1866	31	1893	325	1920	282	1947	79
1867	29	1894	220	1921	237	1948	29

NOTE.—Deaths were not published by causes for the four years 1843–6.

falling almost continuously to a lower level, although the epidemic levels showed no such falling off. From 1930 onwards, however, there has been a distinct damping down of the oscillations, while the fall in the inter-epidemic death rate has also continued. Thus the four lowest rates in the years 1920–9 lay between 196 and 237 per million, while in 1930–9 they ranged from 108 to 141.

In the war years there were two peaks in mortality, in 1940 and 1943. Nevertheless, in both these years the epidemic level was substantially lower than it was in the inter-war years, in spite of the environmental factors of the time, which might well, it was feared, lead to a serious epidemic if not to a repetition of 1918–19. In the next five years, 1944–8, mortality was at a still lower level, and though some rise in the death rate will certainly be shown in 1949 it can be estimated from the experience of the first quarter that a rate of only about 135 per million is to be expected. This will be lower than any peak prior to 1944.

The trend of the death rate from influenza since 1920 is shown in the graph (the rates having been corrected for the change in classification that was introduced in 1940). Although the period is very short there is clearly a suggestion that the level of influenza mortality is changing. This decline in mortality is certainly not due wholly to the

Graph showing death rates from influenza in England and Wales.

use of antibiotics, although it may have been accelerated by it, as it seems that the death rate has fallen since, at least, 1929. A continuation of the present trend will result in influenza again ceasing to be a major cause of death as in the years immediately preceding 1890–1. Faced with the rates of Table I, however, it would be singularly rash to prophesy, and no simple formula could have any value for prediction.

The Epidemic Curve

The weekly returns of deaths from influenza in the great towns of England and Wales are our only source of information on the shape of the epidemic curve. These show that the maximum of an outbreak, as measured by death, almost invariably falls in the first quarter of the year. Following the pandemic of 1918 the week of the maximum varied, but since 1936 it has been remarkably constant. The week of the maximum and the number of deaths registered during this week for the past thirty years are shown in Table II.

TABLE II.—*Influenza Deaths in the Great Towns*

Year			Week of Maximum			No. of Deaths in Week of Maximum
1920	..	..	12	..	..	392
1921	..	..	9	..	..	167
1922	..	..	4	..	..	1,450
1923	..	..	19	..	..	207
1924	..	..	10	..	..	730
1925	..	..	11	..	..	304
1926	..	..	15	..	..	302
1927	..	..	8	..	..	1,023
1928	..	..	12	..	..	135
1929	..	..	9	..	..	2,183
1930	..	..	9	..	..	102
1931	..	..	8	..	..	546
1932	..	..	1 and 2	..	..	412
1933	..	..	4	..	..	1,934
1934	..	..	11	..	..	115
1935	..	..	14	..	..	184
1936	..	..	8	..	..	119
1937	..	..	4	..	..	1,155
1938	..	..	2	..	..	91
1939	..	..	8	..	..	285
1940	..	..	8	..	..	629
1941	..	..	7	..	..	324
1942	..	..	4	..	..	90
1943	..	..	4	..	..	125
1944	..	..	49 of 1943	..	..	1,148
1945	..	..	5	..	..	89
1946	..	..	6	..	..	304
1947	..	..	6	..	..	211
1948	..	..	53 of 1947	..	..	35
1949	..	..	11	..	..	360

The year 1948 is included for the sake of completeness, but in fact a seasonal rise to a peak did not occur in that year, and the disease was only slightly above the endemic level during its first quarter. Table II shows that the variability of the date of the maximum decreased during the period until in 1936 to 1943 it became practically constant at between two and eight weeks. On the other hand, since 1943 the regularity of the trend of influenza seems to have been interrupted. The 1944 outbreak was exceptional in time of occurrence, with a maximum occurring in the last weeks of 1943. In the following year, 1945, the seasonal rise reverted to form, but in 1948 an outbreak with a definite peak did not occur at all, and in 1949 the maximum was later than any in the immediately preceding thirteen years. In the non-epidemic years the variability in the time of the maximum has been larger than in the epidemic years, and in the non-epidemic years of 1920–35 mortality seems to have taken a longer time to come to its peak than in the years after 1935.

The evidence for a change in seasonal trend is very slender, but, since three of the six years 1944–9 show more departure from the previous trend, there is at least a suggestion that the periodicity of influenza mortality may be changing. We are, as already pointed out, limited to the study of mortality. It may be that a varying fatality rate accompanies epidemics, which would explain some of the irregularities that occur both in the annual rates and in the seasonal changes.

The Age Distribution of Mortality

As is well known, one of the most striking features of the pandemic of 1918–19 was the severity with which it fell upon young adults. This remarkable change from the normal incidence of mortality was a feature of the pandemic only, and in the following years the curve of mortality at ages immediately returned to its usual shape. The incidence of mortality by age in England and Wales since then has been one of a relatively high rate in infancy falling to a minimum at ages 10–14 and then steadily increasing throughout life. During this period the mortality from influenza has fallen by half, but the rate of decline has varied at different ages. The improvement in mortality has been less in infancy, late middle life, and old age than in childhood and early adult life. The rates are shown in Table III, together with their relative changes.

TABLE III.—*Influenza Death Rates per Million. England and Wales*

Period	Ages									
	0—	5—	10—	15—	25—	35—	45—	55—	65—	75+
1920–4	418·3	71·2	52·8	120·6	206·4	264·5	375·1	715·9	1,537·3	3,094·8
1925–9	369·4	62·4	46·1	96·7	141·2	271·6	413·4	764·7	1,896·9	4,642·8
1930–4	240·3	42·0	33·0	70·8	102·3	199·7	329·3	534·2	1,123·1	3,349·4
1935–9	152·7	24·3	20·9	44·3	64·6	121·6	228·7	422·4	818·9	2,240·0
1940–4	150·2	16·5	13·3	32·8	42·3	75·7	156·4	320·7	657·4	1,895·4

The death rate in each age group expressed as a percentage of the death rate in 1920–4:

Period	0—	5—	10—	15—	25—	35—	45—	55—	65—	75+
1925–9	88·3	87·6	87·3	80·2	68·4	102·7	110·2	106·8	123·4	150·0
1930–4	57·4	59·0	62·5	58·7	49·6	75·5	87·8	74·6	73·1	108·2
1935–9	36·5	34·1	39·6	36·7	31·3	46·0	61·0	59·0	53·3	72·4
1940–4	35·9	23·2	25·2	27·2	20·5	28·6	41·7	44·8	42·8	61·2

Mortality at all ages in the second quinquennium, 1925–9, was higher than it was in the first, 1920–4, the crude rates being 411 and 358 per million respectively, the former mainly due to the large epidemics in 1927 and 1929. The increase in mortality in 1925–9 fell solely upon older persons, and the death rates in each age group under 35 were, in fact, lower in 1925–9 than they were in 1920–4. It is at each age over 35 that the 1925–9 rates are higher. The rates for 1940–4 are not strictly comparable with those of preceding years, since the method of classification and tabulation of joint causes of death was changed in 1940, with the result that fewer deaths would be assigned to influenza than formerly. The factor for correcting the old classification is 0.917 for all ages, but this cannot be justifiably applied to individual ages.

Summary

An examination of the English death rates from influenza since registration of death was introduced in 1837 shows that the mortality curve over the last 112 years may be divided into three broad periods each of which begins with a severe epidemic. In the first period, which followed the epidemic of 1847–8, influenza (after a slight recrudescence in 1855) almost disappeared as a certified cause of death. The 1890–1 epidemic abruptly restored it to importance, and in the second period, which then ensued, influenza remained, after some epidemic fluctuations, at a high endemic level, with a death rate in 1901–17 varying between 120 and 293 per million. The 1918–19 pandemic ushered in the third period. The early years of this period include epidemics more severe than any that preceded 1918—for example in 1927 and 1929—but since 1929 the mortality from influenza has declined until at present it is at a distinctly low level. In five recent years, 1942, 1944, 1945, 1947, and 1948 the death rate has been at a lower level than any annual rate recorded since 1890. There is a very slight suggestion, from the returns of the deaths in the large towns, that this notable decrease in mortality has been accompanied by changes in the seasonal curve of the deaths.