

CHAPTER 6

THE INFLUENZA EPIDEMIC IN STATISTICS

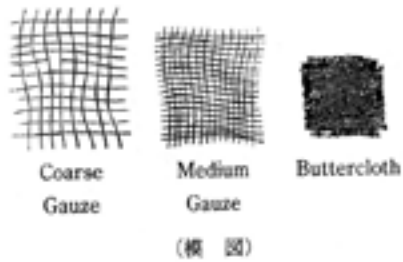


Figure showing structure and use of facemask included in *Ryūkōsei kanbō*, p. 413.

How many people contracted influenza on the Japanese main islands and how many died? In fact, this basic question turns out to be difficult to answer. The Sanitary Affairs Bureau of the Home Ministry document *Ryūkōsei kanbō* [Influenza] gives the following figures:

Early Epidemic:	21,168,398 patients	257,363 deaths
Late Epidemic:	2,412,097 patients	127,666 deaths
Totals:	23,580,495 patients	385,029 deaths

These are the figures cited most often for the “Spanish influenza” and the 385,000 figure is the generally accepted death toll for the 1918–1920 pandemic.<sup>1</sup>

From a scholarly point of view, however, there are questions about just what these figures represent. Firstly the categories given for causes of death, for example, are different from those given in the *Nihon Teikoku shiin tōkei* published by a different arm of government, the Naikaku Tōkei Kyoku (Cabinet Statistics Office).<sup>2</sup> The Home Ministry report was remarkable for its time as a survey and report conducted independently by the Ministry in the face of the emergency posed by the pandemic. Unfortunately, however, it does not provide any definitions for the figures given for those who contracted and those who died from “influenza.”

The *Ryūkōsei kanbō* includes a note saying that the *Shiin tōkei* (Statistics on Causes of Death) reports a much lower number of deaths from “influenza” and other respiratory diseases. In other words, the *Shiin tōkei* gives a figure of only 69,824 people as having died from “influenza” in 1918, so the “deaths from influenza” given in the Home Ministry report “probably also cover deaths from respiratory diseases, especially pneumonia and bronchitis in the *Shiin tōkei*.”<sup>3</sup> It is probably not wise to try to argue whether one or the other of these sources is the correct one. “Cause of death” is a difficult issue to define even today, and it is directly linked to the issues of how death is declared. If human “death” is declared when the heart finally ceases to function, then all causes of death would be “cardiac arrest.” In most cases, however, it is the practice to give the illness or injury sustained immediately prior to cardiac arrest as the cause. When the cause is a genetically transmitted disease, moreover, the facts of the cause of death given on the death certificate might be changed to protect the privacy of the family.

1 According to *Ryūkōsei kanbō*, published in 1922, there was a “third epidemic” from August 1920 to July 1921, which resulted in 224,178 patients and 3,698 deaths, but it is difficult to prove that these deaths were anything different from the usual influenza outbreaks that occurred every year, so I have here left these figures aside.

2 See the “Kaisetsu” by Sakai Shizu, in the *Nihon Teikoku shiin tōkei*.

3 *Ryūkōsei kanbō*, pp. 95–96.

In the case of the 1918–1920 influenza, the high fever and damage to the respiratory organs sometimes led the cause of death to be given as “influenza,” or the influenza that developed into pneumonia or bronchitis before the patient died, leading the cause of death to be pneumonia or bronchitis. Or, when the doctor of that time could not make a clear diagnosis, the cause of death was listed as “unknown.” Considering these factors, in dealing with death from Spanish influenza, it may not be necessary to stick only to the category known as “influenza” at that time. These are the qualitative issues to be considered.

Next are the quantitative problems, and when we look at tables 1 and 2 included at the end of *Ryūkōsei kanbō*, giving figures for numbers of persons who contracted or died of “influenza,” we quickly see that the two tables are incomplete. Table 1, which covers figures for the Early Epidemic, does not show figures for 1919 in Osaka prefecture beyond 16 January. Osaka prefecture, which includes the huge city of Osaka, was one of the places where the largest number of deaths occurred, so even considering that point alone, we can see that the figures for number of deaths recorded should have been larger. Similarly, there are no figures for Iwate prefecture, where there were many deaths in the Early Epidemic. There is no record here also for Okinawa, although the number of deaths there may have been small. The table gives figures for deaths up until July 1919, but reports for some prefectures ceased to have been given for months before that. For Table 2, showing figures for the Late Epidemic, there are no records for Osaka prefecture past the end of February 1920, and no figures are given for the period from the outbreak to the end of 1919 for Chiba, Miyagi, and Iwate prefectures.

The incomplete figures for number of patients and deaths in the Home Ministry’s *Ryūkōsei kanbō* obviously led to underestimations of the numbers. Thus the figure of 385,000 deaths from influenza in Japan is likely to be an underestimation and not a very trustworthy figure. Without having a more reliable figure for number of deaths, however, we cannot confirm the extent of actual damage caused by the 1918–1920 influenza pandemic. So what shall we do?

### Calculation by the “Excess Deaths” Method

The answer to this question for this author was not to use the survey figures given in *Ryūkōsei kanbō* at all, but to calculate the number of deaths from the influenza epidemic in the Japanese homeland at that time by a completely different approach.

The tables in *Ryūkōsei kanbō* do offer some important information. For the Early Epidemic, for example, the report shows that the number of persons who contracted influenza was given at nearly 40 percent of the total population and mortality among influenza patients was given at a little over 12 out of 1,000 patients. A large proportion of the population contracted influenza, so even if mortality among those who had influenza

was low, there were many deaths. For the Late Epidemic the Home Ministry report indicates that a much smaller proportion, just over 4 percent of the total population, contracted influenza, but that mortality for those who had influenza was just under 53 per mil. That high mortality is of course much lower than for the bubonic plague and cholera, but as it is nearly five times that for the Early Epidemic, the threat it posed to people of its day must have been terrifying. So the *Ryūkōsei kanbō* report does give us important information besides numbers of patients and deaths by prefecture and time period, but unfortunately the lack of definitions and complete data makes the figures practically unusable.

As a more reliable method for determining the number of deaths resulting from the influenza epidemic, we may turn to what may be called “excess-deaths” figures. In calculating the number of deaths from a certain infectious disease during the period when it was prevalent, we first determine the standard number of deaths from that particular disease or related conditions in the normal, corresponding periods. We then subtract that standard number of deaths from the deaths during the epidemic period. This approach requires that certain prerequisites be met: the minimum prerequisites are that there were no other infectious diseases spreading during the epidemic period and that “other related conditions” are properly identified.

In this book, the scope of the causes of excess deaths is defined in terms of eight categories of the medium grouping utilized in the Cabinet Statistics Office *Shiin tōkei*: influenza, tuberculosis, acute bronchitis, chronic bronchitis, pneumonia and bronchopneumonia, other respiratory diseases, diagnosis as “unknown,” and cause of death unidentified. The last two have been included because in 1918, these two causes increased by a marked amount from the previous year, suggesting that the doctors in question, while realizing that the condition was not among known causes of illness, did not know how to identify what they found, and therefore gave “unknown” as the cause of death. Other respiratory diseases probably were seriously affected by the influenza, or developed as a result of or along with influenza. One can assume that if there had been no influenza epidemic, mortality from these other conditions would not have changed from a normal year.

If we add up the figures for deaths in the 1916–1917, 1917–1918, and 1920–1921 years for the corresponding months of the Early and Late epidemics (the Early Epidemic period being the eight months from the previous October to the following May, and the Late Epidemic period the six months from the previous December to the following May), we then find the standard number of deaths for each of these normal periods. I then considered these figures in comparison with the number of deaths in the Early and Late epidemic periods, and the difference produced the figure for excess deaths in each influenza epidemic period. (During those periods, it is likely that the population of the country did increase and there was some fluctuation in the number of deaths, but I did not take these into account.) In other words, there were many cases of people who suffered

from respiratory diseases like tuberculosis, pneumonia, bronchitis, etc., who might not have died if the virulent strain of influenza had not attacked Japan at that time. The immediate cause of death was not influenza, but tuberculosis, pneumonia, bronchitis, etc., yet for a patient with any kind of respiratory ailment, an influenza infection was fatal. So what I have done in this book is to consider their deaths as death from influenza.

Meanwhile, even in years when influenza was not spreading, many people died of respiratory diseases. Deaths from tuberculosis especially were rising annually at that time in Japan. That being the case, people would have died of these illnesses even if there had been no influenza epidemic. That is why we first seek the standard number of deaths for a normal period and assume that that standard number continued even during the periods of the influenza epidemics.

Figures calculated in terms of the excess of deaths over normal years are considered, thus, in terms of the assumptions outlined immediately above. Application of this approach is also premised on the assumption that there was no outbreak of any other infectious disease in the normal periods made the basis of calculation. I in fact found that this was an issue in the case of some of the prefectures. During the Taishō era (1912–1926), however, these sorts of fluctuations in the number of deaths were quite “normal,” and if one tried to avoid even such slight fluctuations and change to another standard period, the entire framework of analysis would collapse. I have therefore written this book with full awareness of these points of potential criticism.

The excess-deaths figures determined by this approach are thus considered deaths from influenza in this book. Incomplete as this approach may be, I have gone back to the Cabinet Statistics Office *Shiin tōkei* and sought through statistical processing the number of deaths either directly or indirectly due to influenza. Consequently, these figures are qualitatively different from the figures for deaths given in the Home Ministry’s *Ryūkōsei kanbō* compiled from survey-based but incomplete data, and ultimately they exceeded the *Ryūkōsei kanbō* figures. The “influenza mortality” mentioned in the pages that follow is the figure obtained by dividing “number of deaths from influenza” by the population of the country.”<sup>4</sup>

## Mortality

As already stated, after the “herald wave” in the spring of 1918, the influenza epidemic hit Japan in two waves, with the Early Epidemic starting in October that year and the Late Epidemic beginning in December 1919. Revising the “deaths by influenza” figure

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<sup>4</sup> For population I use here the results of the First National Census conducted 1 October 1920. “Estimated population” figures are available as of the year 1918 and the year 1919, but there are some quite large disparities with the results of the National Census, and since the time of the 1920 Census is very close to the influenza epidemic period, I elected to rely upon its figures as the more reliable.

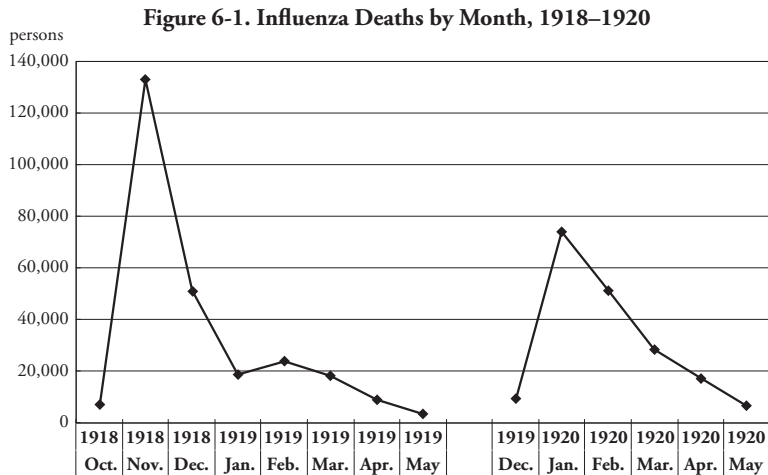
according to the excess-deaths approach, departing from the figures given in the *Ryūkōsei kanbō* and returning to those shown in *Shiin tōkei*, yields the following figures:

Early Epidemic: 266,479  
 Late Epidemic: 186,673  
 Total: 453,152

The total is a much higher figure than shown heretofore<sup>5</sup> (some parts of *Ryūkōsei kanbō* in fact reflect something similar to the excess-deaths approach).<sup>6</sup>

### *Number of Deaths by Month*

Figure 6-1 plots the death by influenza figures month by month in the whole nation for the Early and Late epidemics. For the Early Epidemic, the figure rose sharply in November 1918 to a record 130,000; the following year in January it fell to under 20,000, rose slightly above that in February, and by May the epidemic had mostly ended. In actuality, as we shall see below, there were some differences between urban and rural areas and from one part of the country to another, so the curve is not the same for all parts of the country, but this national-level graph shows clearly the two spikes in deaths resulting from the Early and Late influenza epidemics, the first peak in November 1918 at just over 130,000 and the second in January 1920 at just under 80,000.



5 This figure is slightly smaller than the 489,133 figure cited in Hayami and Kojima 2004, p. 140, because it is more an assumption than an estimate, and the figures for the “normal year” are taken from 1917 alone and those for the epidemic years are taken from 1918, 1919, and 1920. In any case, the results came out between 450,000 and 480,000.

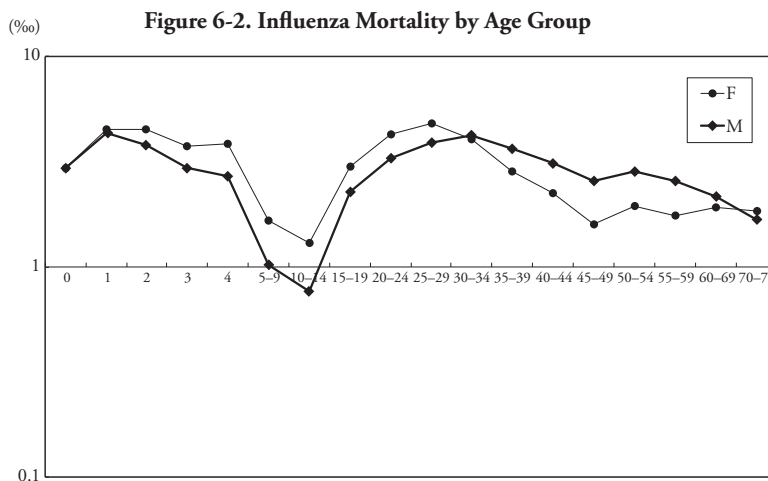
6 *Ryūkōsei kanbō*, p. 95. This report notes the disparity between the number of deaths from respiratory diseases in 1917 and the number of deaths from the same diseases for 1918. It was very close to arriving at the idea of checking the figures by the excess-deaths approach.

There is no doubt that the November 1918 figure of 130,000 deaths from the Early Epidemic came as a great shock to people at the time. The cholera epidemic of 1886 had taken 108,000 lives<sup>7</sup> and 84,000 soldiers had died in the Russo-Japanese War (1904–1905),<sup>8</sup> but these were figures for a whole year or a two-year period. Even the death toll for the devastating Great Kantō Earthquake and Fire of 1923 may have been larger than the figure of 140,000 generally cited (although recent research has shown that the conventional figure may have included duplicate counts and in fact should be reduced to 105,000),<sup>9</sup> giving us a clear understanding of how huge loomed the figure of 130,000 deaths from influenza for just one month.

### *Mortality by Gender and Age*

My analysis did consider possible differences in the mortality among women and men, but found no appreciable gender differences overall. This chapter therefore gives combined figures for men and women unless otherwise mentioned.

Keeping in mind the possibility of gender differences in examining influenza mortality by age group, the figures are calculated separately for men and women, as shown in Figure 6-2.<sup>10</sup> Here the denominator is the age-bracket population as measured in the National Census and the nominator is the number of deaths for both the Early and Late epidemics.



7 Yamamoto 1982, p. 68.

8 Figure cited in the entry on the Russo-Japanese War in *Kokushi daijiten*, vol. 11. 1990.

9 According to the Kokuritsu Tenmondai (National Astronomical Observatory of Japan), ed. *Rika nenpyō Heisei jūshichi-nen* (Chronological Scientific Tables, 2005), the number reported dead or missing in the earthquake disaster was more than 142,000 (p. 720), but in the 2006 edition, the figure was given as approximately 105,000, nearly 40,000 lower. I am indebted to Professor Kito Hiroshi of Sophia University for alerting me to this information.

10 Fortunately the *Nihon Teikoku shiin tōkei* includes statistics on deaths by age group and ailment suffered. They are, however, totals for the entire country.

With the vertical axis given on a logarithmic scale, the graph shows that mortality drops off for young children after about age five, but then rises for young people between the ages of 15 and 19, peaks for men at age 30–34 and for women at ages 25 to 29, and then gradually decreases. In other words the notable feature of influenza mortality among adults is that it is highest in the prime years for both men and women—the years they are most productive in the workforce—the groups whose mortality is ordinarily the lowest. Among older people, moreover, influenza mortality is not particularly high, but is on the decline for people before the age of 80. This trend, too, is different from the curve for normal deaths by age group, and a feature of the 1918–1920 influenza epidemic.

*Mortality by Region*

The monthly number of deaths from the influenza epidemic was not uniform for the entire country. There were fairly large disparities by region, and in order to compare them, it is necessary to use not numbers of deaths but mortality. That the figure is zero means that it is the same as the standard level in a normal year.

Figures 6-3 to 6-8 chart mortality by month for each of the six regions defined in Chapters 4 and 5 above (Kyushu, Chūgoku/Shikoku, Kinki, Chūbu, Kantō, and Tōhoku/Hokkaido). The curves for the Early and Late epidemics are charted separately and in order to visually facilitate comparison, the vertical axis of the charts is unified with the highest rate at 5 per mil.

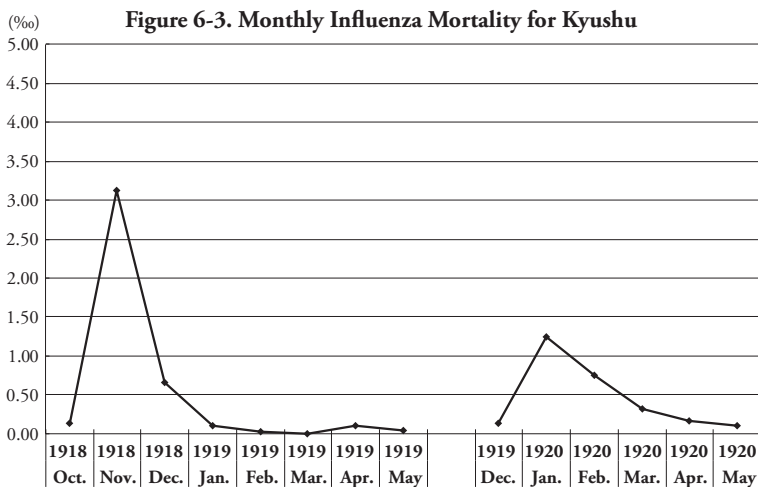




Figure 6-4. Monthly Influenza Mortality for Chūgoku and Shikoku

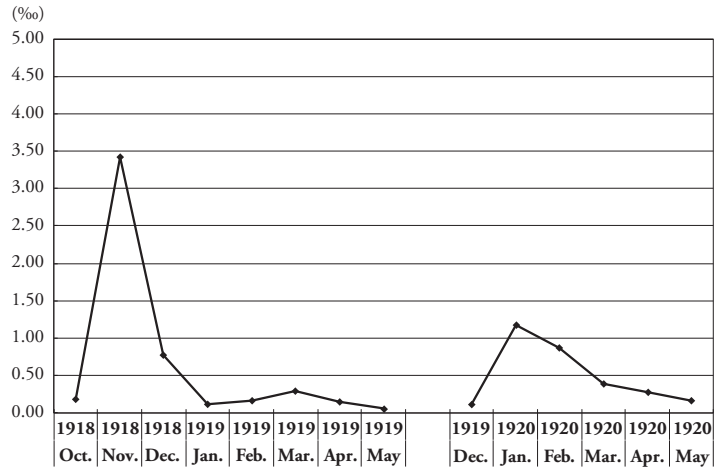


Figure 6-5. Monthly Influenza Mortality for Kinki

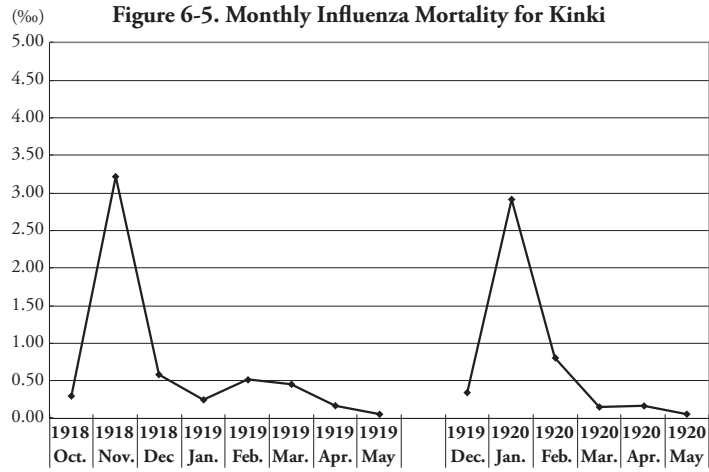
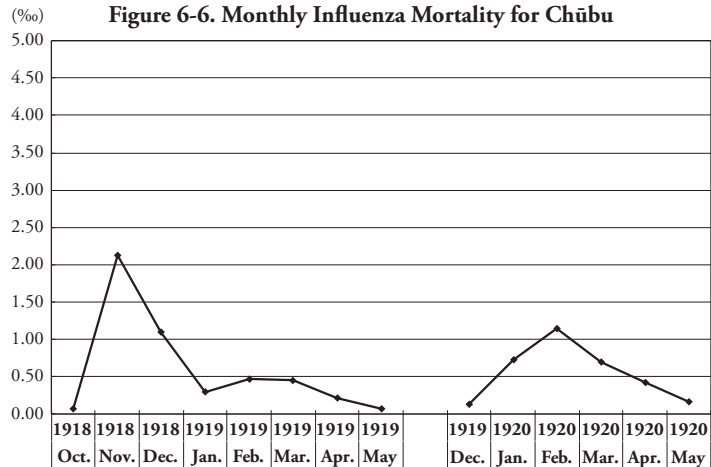
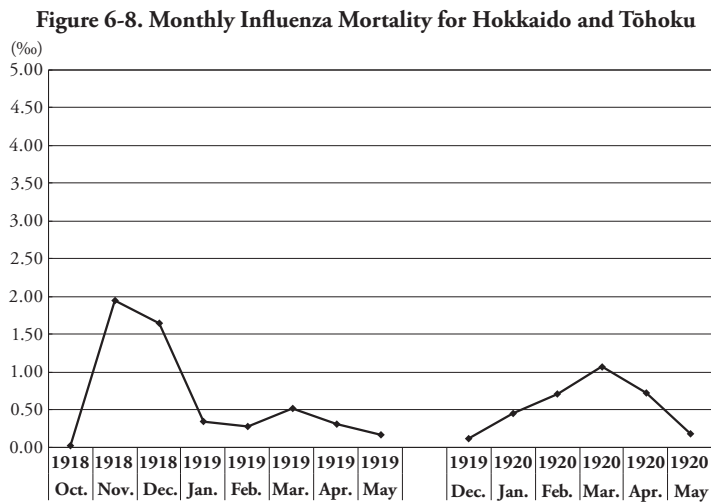
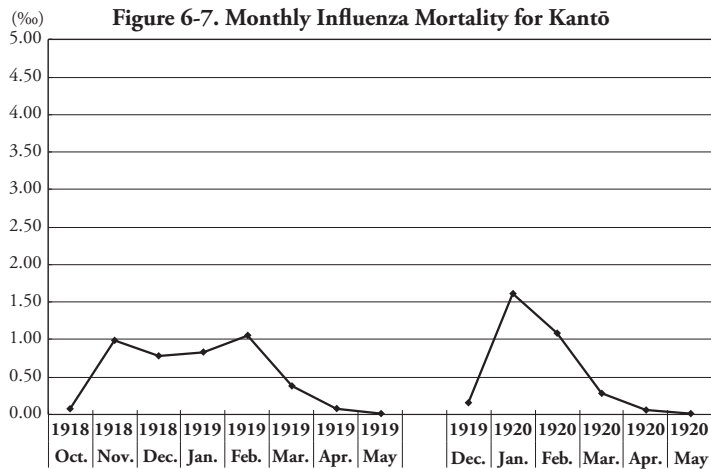


Figure 6-6. Monthly Influenza Mortality for Chūbu





Comparing these six charts, we can see that the curves for Kyushu and for the Chūgoku/Shikoku region are extremely similar, indicating a common pattern in western Japan. They experienced a sharp peak in the mortality of November 1918 of over 3 per mil followed by a gradual decline and end by January of the following year. The period during which the epidemic raged most intensely, then, was relatively short. This is probably the reason why there was little mention of the epidemic in the local newspapers in the first half of 1919. The shape of the curve for the Late Epidemic was a peak in January 1920 at over 1 per mil and then a gradual drop in the mortality toward the end of the epidemic from March onward.

For the Kinki (Kyoto, Osaka, and Kobe) region, the curve is rather different in that the peaks of the mortality for the Early and Late epidemics rose to nearly the same height. The rate for the Early Epidemic rose a peak of 3.3 per mil in November, fell off after

January 1919, rose again in February and March higher than for January, and finally fell off from April onward. For 1920, the curve peaks in January at nearly 3 per mil but then declines steadily from February and returns to a nearly normal level from March onward.

The situation in the ten prefectures of the Chūbu region (areas covering the Pacific coast, mountainous central area, and Japan Sea coastal regions of Honshu Island) is not necessarily uniform, but the mortality was somewhat lower with the peak even in the Early Epidemic rising only a little over 2 per mil. In overall shape, however, the curve is similar to that of the Kinki region, with a drop in the rate in January and a rise above that rate in February and March. For the Late Epidemic, while the peak comes in January for the regions to the west, for Chūbu, the peak is slightly delayed, coming in February, and also rather lower, at just over 1 per mil.

The curve for the Kantō region is rather distinctive. The chart shows that mortality for the Early Epidemic was quite low. Thinking this might be either because the rate was low in actuality, or that there was a problem with my calculations, I recalculated and found that the number of deaths from respiratory diseases between December 1917 and February 1918 was unusually large. For example, for January 1918, the number of deaths from respiratory causes for the region (covering Tokyo metropolis and six other prefectures) was 16,318, which is nearly 10,000 greater than the 7,180 for January 1916 and the 7,452 for January 1921. These figures indicate that there were outbreaks of respiratory disease in the Kantō region from December 1917 through February 1918 (mainly pneumonia and bronchitis in the *Nihon Teikoku shiin tōkei*). Although not as great as for the influenza epidemic period, this year was not an entirely normal year, so in seeking the excess-deaths figures, it became apparent that it was not wise to include this year as a “normal” year. Since there were more deaths that year than in normal times, the disparity with an influenza epidemic year would be smaller, giving a smaller number of deaths by influenza, and underestimating the mortality for influenza. This kind of problem requires further research and refinement.

For the Tōhoku (Ōu) region and Hokkaido, the Early Epidemic was relatively drawn out. Mortality was far higher than that of the Late Epidemic, which peaked in March.

#### *Influenza Mortality in the Cities*<sup>11</sup>

The study identified influenza mortality for cities with populations of more than 100,000 using the same criteria as in the preceding chapters for determining influenza mortality in each region. As of the end of 1918, there were 13 cities with population of over 100,000, and of these, I take up the six principal cities (Tokyo, Yokohama, Nagoya, Kyoto, Osaka, and Kobe) as well as one major city for each of the five regions, namely Hakodate (Hokkaido),

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11 In this book, when I speak of “the cities,” I am referring to the nation’s six principal cities (Tokyo, Yokohama, Nagoya, Kyoto, Osaka, and Kobe) and those with populations of more than 100,000 representing the regions introduced in Chapters 4 and 5.

Sendai (Tōhoku), Kanazawa (Chūbu), Hiroshima (Chūgoku), and Nagasaki (Kyushu). However, as in the case for examining mortality by region, because of the large number of cases of death from respiratory ailments from December 1917 to February 1918 in Tokyo and Yokohama, the calculation is based on a “normal period” made up of December 1916 to May 1917 and another “normal period” of October 1920 to May 1921.

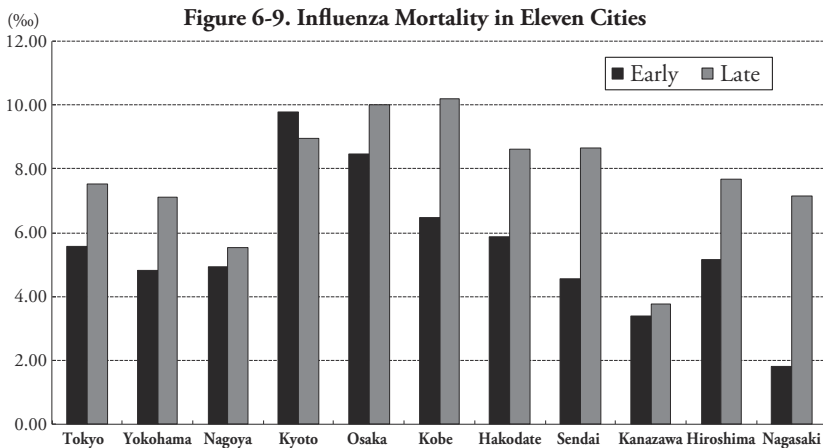
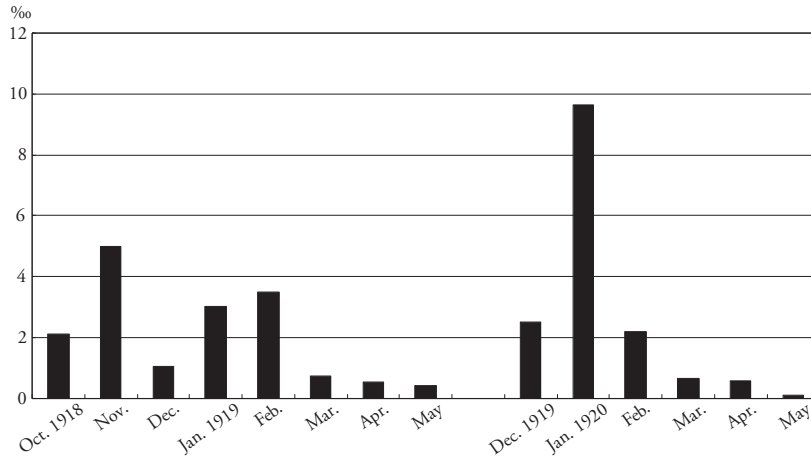


Figure 6-9 shows mortality by city. The time periods are slightly different for the Early and Late epidemics, so all of them are converted as an annual rate. Thus calculated, mortality was higher for the Late Epidemic in all the cities except Kyoto. Overall, the high mortality seen for the three cities of the Kinki region (Kyoto, Osaka, and Kobe) stands out. For both the Early and Late epidemics, the highest mortality was recorded for these three cities. Since the rates for Tokyo and Yokohama are lower than might be imagined, and the lowest of all for Nagoya, we may surmise that population size was not a decisive factor. For the cities other than the “big six,” mortality was higher in the late than in the Early Epidemic and higher for Hakodate, Sendai, and Hiroshima than for Tokyo.

Another statistic that sheds light on the conditions of the influenza epidemic is the proportion of deaths from influenza vis-à-vis all deaths. The figures for influenza deaths and all deaths are taken from the same months. Figure 6-10 shows the percentages of influenza deaths in comparison with all deaths for the Early Epidemic period of October 1918 to May 1919 and for the Late Epidemic period of December 1919 to May 1920.

Figure 6-10. Proportion of Deaths by Influenza to Total Deaths, 1918–1920



Looking at this figure, it is clear that the deaths from influenza match the newspaper reports introduced earlier indicating the peaks in November 1918 for the Early Epidemic and January 1920 for the Late Epidemic. For the Early Epidemic, a short lull came after the first peak, but then went up again in January and February of the following year, as reported by many newspaper articles. As for the Late Epidemic, we know that newspapers portrayed the tragic scene of January 1920, centering on the large cities.

Table 6-1 shows influenza mortality for major cities, of Early and Late epidemics, and the total. We can see the highest mortality in the Early Epidemic in Kyoto, Osaka, and Kobe, the three major cities of the Kinki area. In the other cities, including Tokyo and Yokohama, mortality was about half of the Kinki area figures. In the disparity between the two phases of the epidemic, mortality for the Kyoto, Osaka, and Kobe cities was markedly higher in the Early Epidemic, but except for Nagasaki, there was no pronounced difference between the two phases. Mortality for Kanazawa was low for both phases, indicating that the outbreak was relatively limited there.

Table 6-1. Influenza Mortality for Major Cities

Cities	Population (1920)	Early Epidemic			Late Epidemic			Total		
		A. Number of flu deaths	B. Total deaths	A/B (%)	A. Number of flu deaths	B. Total deaths	A/B (%)	A. Number of flu deaths	B. Total deaths	A/B (%)
Tokyo	2,173,261	8,047	29,705	27.1	8,159	29,785	27.4	16,206	59,490	27.2
Yokohama	422,938	1,355	5,665	23.9	1,502	5,616	26.7	2,857	11,281	25.3
Nagoya	429,997	1,414	6,498	21.8	1,188	5,863	20.3	2,602	12,361	21.0
Kyoto	591,323	3,859	7,513	51.4	2,652	8,694	30.5	6,511	16,207	40.2
Osaka	1,252,983	7,061	17,515	40.3	6,271	18,918	33.1	13,332	36,433	36.6
Kobe	608,644	2,607	6,245	41.7	3,080	8,002	38.5	5,687	14,247	39.9
Hakodate	144,749	568	2,061	27.5	623	2,082	29.9	1,191	4,143	28.7
Sendai	118,984	361	1,640	22.0	515	1,864	27.6	876	3,504	25.0
Kanazawa	129,265	292	2,495	11.7	245	1,965	12.5	537	4,460	12.0
Hiroshima	160,510	554	2,522	22.0	615	2,230	27.6	1,169	4,752	24.6
Nagasaki	176,534	212	1,820	11.6	632	2,077	30.4	844	3,897	21.7
Total	6,209,188	26,329	83,679	31.5	25,483	87,096	29.3	51,811	170,775	30.3

*Number of Influenza Deaths by Prefecture*

The death toll from the 1918–1920 influenza extended throughout Japan and there was quite a bit of difference from one part of the country to another. The differences can be attributed to various factors including the period when the outbreak was at its peak, urban environment, presence of military camps, and features of the natural environment.

Table 6-2 shows influenza mortality by prefecture. The numbers of deaths here were obtained by the excess-deaths approach.<sup>12</sup> The highest numbers were for Tokyo and Osaka prefectures, both over 27,000, followed by Hyōgo prefecture with 25,000. Naturally, most of the deaths in these prefectures occurred in the big cities of Tokyo, Osaka, and Kobe. Other than these, the prefecture with the highest number of deaths (nearly 20,000) was Hokkaido. Hokkaido is one of the prefectures that suffered the greatest toll in the Early Epidemic. Next greatest, with over 15,000 was Fukuoka prefecture, where industrialization and urbanization were relatively more advanced; the numbers were also affected by the presence of many coal mines in the prefecture. We can see that the impact of the epidemic was greatest in prefectures<sup>13</sup> with principal cities or with cities with high levels of industrialization and urbanization.

The prefectures that suffered the least from the epidemic, by contrast, with fewer than 5,000 deaths, were Yamanashi, Nara, Wakayama, Tottori, Kōchi, Saga, Miyazaki, and Okinawa. The population in these prefectures was low to begin with and, other than Okinawa, they had only one city with population over 50,000 that was the seat of the prefectural government, so urbanization was not much advanced. Moreover, these prefectures did not have an army divisional headquarters or naval base, or any large port. They thus lacked conditions that appear to have promoted spread of the epidemic in other parts of the country.

Another feature of this is the regional disparity in the number of deaths for the Early and Late epidemics. Nationwide, there were about 80,000 fewer deaths resulting from the Late Epidemic in comparison with the Early. However, if we put this factor aside and compare the data in the chart, the list of prefectures that have mortality figures 50 percent or higher for the Early Epidemic than for the Late show a preponderance of prefectures in the northern and western parts of Japan: Iwate, Shimane, Wakayama, Akita, Miyazaki, Saga, Mie, Gifu, Kagawa, Ōita, Kōchi, Fukui, Kagoshima, Gunma, Ehime, Kumamoto, Aomori, Okayama, Nagano, Nara, Hokkaido, Kyoto, Tottori, and Miyagi in descending order.

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12 However, for the Kantō area, there were a large number of deaths from pneumonia and other respiratory conditions from the end of 1917 to the beginning of the following year, so it is possible that there was a local outbreak of infection. Some believe that this is evidence that the 1918–1920 influenza began in Japan. The “normal year” for this region was therefore made the period from October 1916 to May 1917.

13 Other than the prefectures with the six major cities mentioned above, the following prefectures had cities of over 50,000 populations: Hokkaido, Miyagi, Tochigi, Gunma, Niigata, Toyama, Ishikawa, Fukui, Yamanashi, Gifu, Shizuoka, Wakayama, Okayama, Hiroshima, Yamaguchi, Tokushima, Fukuoka, Kumamoto, Kagoshima, Okinawa. Of the 15 prefectures that had more than 10,000 influenza deaths, 12 of them are in this group.

Table 6-2. Deaths and Mortality by Influenza for Prefectures

No.	Prefecture	Population in 1920	Number of deaths		Total	Mortality (%)		Total
			Early	Late		Early	Late	
1	Hokkaido	2,359,183	12,103	7,779	19,882	5.13	3.30	8.43
2	Aomori	756,454	5,104	2,980	8,085	6.75	3.94	10.69
3	Iwate	845,540	5,983	1,895	7,878	7.08	2.24	9.32
4	Miyagi	961,768	4,688	3,117	7,806	4.87	3.24	8.11
5	Akita	898,537	4,984	1,802	6,786	5.55	2.01	7.56
6	Yamagata	968,925	4,092	3,674	7,766	4.22	3.79	8.01
7	Fukushima	1,362,750	5,931	5,465	11,396	4.35	4.01	8.36
8	Ibaraki	1,350,400	4,743	3,523	8,266	3.51	2.61	6.12
9	Tochigi	1,046,479	4,534	3,454	7,988	4.33	3.30	7.63
10	Gunma	1,052,610	5,929	2,788	8,717	5.63	2.65	8.28
11	Saitama	1,319,533	6,495	4,613	11,108	4.92	3.50	8.42
12	Chiba	1,336,155	4,696	5,116	9,812	3.51	3.83	7.34
13	Tokyo	3,699,428	13,497	13,787	27,284	3.65	3.73	7.38
14	Kanagawa	1,323,390	4,255	3,788	8,043	3.22	2.86	6.08
15	Niigata	1,776,474	8,479	7,229	15,708	4.77	4.07	8.84
16	Toyama	724,276	3,622	2,472	6,094	5.00	3.41	8.41
17	Ishikawa	747,360	3,042	2,281	5,323	4.07	3.05	7.12
18	Fukui	599,155	4,326	1,840	6,165	7.22	3.07	10.29
19	Yamanashi	583,453	2,030	2,701	4,731	3.48	4.63	8.11
20	Nagano	1,562,722	7,980	4,873	12,853	5.11	3.12	8.23
21	Gifu	1,070,407	7,204	2,938	10,142	6.73	2.74	9.47
22	Shizuoka	1,550,387	5,115	5,627	10,742	3.30	3.63	6.93
23	Aichi	2,089,762	8,164	6,264	14,428	3.91	3.00	6.91
24	Mie	1,069,270	6,693	2,695	9,388	6.26	2.52	8.78
25	Shiga	651,050	3,605	2,475	6,081	5.54	3.80	9.34
26	Kyoto	1,287,147	7,590	4,983	12,573	5.90	3.87	9.77
27	Osaka	2,587,847	14,303	12,998	27,301	5.53	5.02	10.55
28	Hyōgo	2,301,799	13,072	12,479	25,551	5.68	5.42	11.10
29	Nara	564,607	2,985	1,906	4,891	5.29	3.38	8.67
30	Wakayama	750,411	3,651	1,281	4,932	4.87	1.71	6.58
31	Tottori	454,675	1,996	1,326	3,321	4.39	2.92	7.31
32	Shimane	714,712	4,440	1,522	5,962	6.21	2.13	8.34
33	Okayama	1,217,698	4,921	2,972	7,893	4.04	2.44	6.48
34	Hiroshima	1,541,905	7,353	5,581	12,934	4.77	3.62	8.39
35	Yamaguchi	1,041,013	4,374	3,327	7,701	4.20	3.20	7.40
36	Tokushima	670,212	4,418	3,337	7,755	6.59	4.98	11.57
37	Kagawa	677,852	5,074	2,072	7,146	7.49	3.06	10.55
38	Ehime	1,046,720	5,359	2,558	7,917	5.12	2.44	7.56
39	Kōchi	670,895	3,414	1,445	4,859	5.09	2.15	7.24
40	Fukuoka	2,188,249	8,024	8,380	16,404	3.67	3.83	7.50
41	Saga	673,895	3,250	1,236	4,486	4.82	1.83	6.65
42	Nagasaki	1,136,182	3,795	2,959	6,753	3.34	2.60	5.94
43	Kumamoto	1,233,233	5,188	2,725	7,914	4.21	2.21	6.42
44	Ōita	860,282	5,018	2,097	7,116	5.83	2.44	8.27
45	Miyazaki	651,097	3,217	1,221	4,438	4.94	1.88	6.82
46	Kagoshima	1,415,582	6,023	2,650	8,673	4.26	1.87	6.13
47	Okinawa	571,572	1,716	2,445	4,161	3.00	4.28	7.28
	Total	55,963,053	266,479	186,673	453,152	4.76	3.34	8.10

The prefectures in which the number of deaths in the Late Epidemic was greater than for the Early or about the same include those with big cities or those near big cities: Okinawa, Yamanashi, Shizuoka, Chiba, Fukuoka, Tokyo, Hyōgo, Fukushima, Osaka, Yamagata, and Kanagawa in descending order.

Except for the prefectures containing the big cities, we can say from the regional characteristics for the Early and Late epidemics outlined above, that those where the number of deaths was large for the Early Epidemic did not have such high figures in the Late Epidemic, while those that had high figures for the Late Epidemic did not have such high figures for the Early Epidemic. The significance of this information is great because it

shows that since the pathogen was the same for the two epidemics, those that had gained immunity in the Early Epidemic were able to survive the later outbreaks. It also shows that those who did not have immunity gained in the Early Epidemic were more likely to perish in the face of the Late Epidemic of the more highly virulent strain of the virus that hit in the Late Epidemic. This point will be further discussed using statistical data in the following section.

### *Influenza Mortality by Prefecture*

When we look at influenza mortality, as opposed to number of deaths, the features of the epidemic by prefecture emerge even more clearly, as seen in Table 6-1. When looking at numbers alone, differences in prefectural population size influence the results; by relying on mortality, we can more clearly see the differences among the prefectures themselves.

The ten prefectures with the highest mortality for the Early Epidemic shown in this figure are Kagawa, Fukui, Iwate, Aomori, Gifu, Tokushima, Mie, Shimane, Kyoto, and Ōita in descending order. The ten prefectures with the lowest rates, by contrast, are Okinawa, Kanagawa, Shizuoka, Nagasaki, Yamanashi, Ibaraki, Chiba, Tokyo, Fukuoka, and Aichi in ascending order.

Likewise, the ten prefectures with the highest mortality for the Late Epidemic, in descending order, are Hyōgo, Osaka, Tokushima, Yamanashi, Okinawa, Niigata, Fukushima, Aomori, Kyoto, and Fukuoka. The only prefecture also included in the list of ten prefectures with the highest mortality for the Early Epidemic is Tokushima. Also, we find a reverse situation, in which three prefectures that were in the list of ten prefectures with the lowest mortality for the Early Epidemic (Yamanashi, Okinawa, and Fukuoka) are in the list of ten prefectures with the highest mortality in the Late Epidemic.

The ten prefectures with the lowest mortality in the Late Epidemic are clustered in the Kyushu region and Honshu Island's northernmost prefectures, with the exception of Aomori (in ascending order of number of deaths, Wakayama, Saga, Kagoshima, Miyazaki, Akita, Shimane, Kōchi, Kumamoto, Iwate, and Ōita). In the case of Iwate, Shimane, and Ōita, the low rates may be because these prefectures were among the prefectures with the top ten mortality in the Early Epidemic, as a result of which many residents of these prefectures probably had acquired immunity.

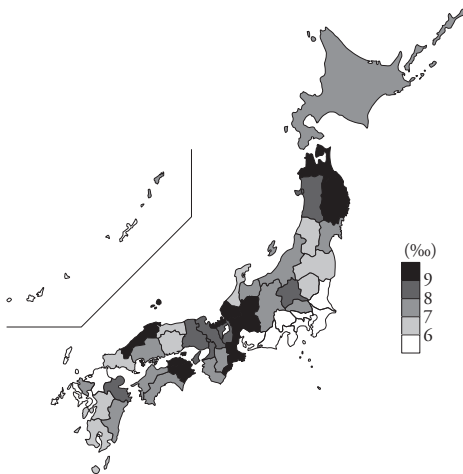
As these observations show, influenza mortality was often the reverse for the Early and Late epidemics in many prefectures other than those with big cities. And as we have already seen for the number of deaths by influenza, these results seem to confirm the possibility that the two outbreaks were caused by the same influenza virus strain. This conclusion is of course based on circumstantial evidence, not on scientific evidence that the genetic base sequence of the virus is the same.

An exception to these general trends was Kanagawa prefecture—with the large port city of Yokohama—where mortality was comparatively low throughout the Early and Late epidemic periods. This may have been because the “spring herald wave” came early

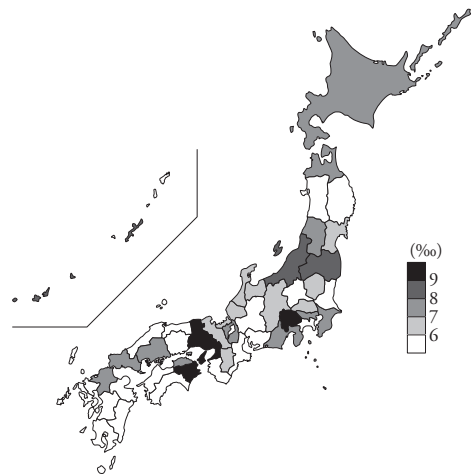


to the city, affecting a large number of its citizens, and through that early exposure to the virus they might have thus acquired some immunity. Notable for the opposite reason—its high mortality in both phases of the epidemic—is Tokushima prefecture, located in the relatively remote eastern part of Shikoku Island. Why was mortality so high in an area without a large city? This is difficult to answer. Unlike Kanagawa prefecture, its normal mortality was probably low, so the virus could easily have been introduced from such large cities as Osaka and Kobe across the Inland Sea.

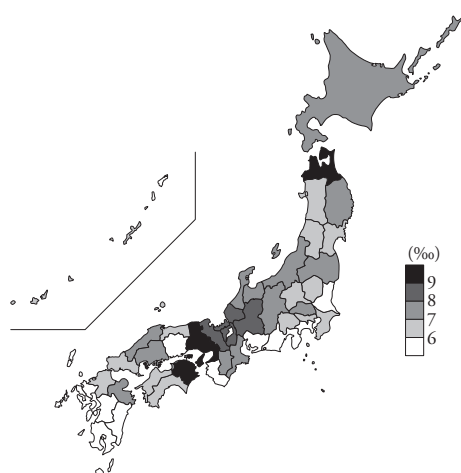
Such questions aside, influenza mortality is the most useful index for looking at the extent of the epidemic by prefecture. So, mortality for the Early and Late epidemic periods as well as for the whole period are shown for all prefectures of the country in the Maps 6A, 6B and 6C. Mortality is converted to annual rates.



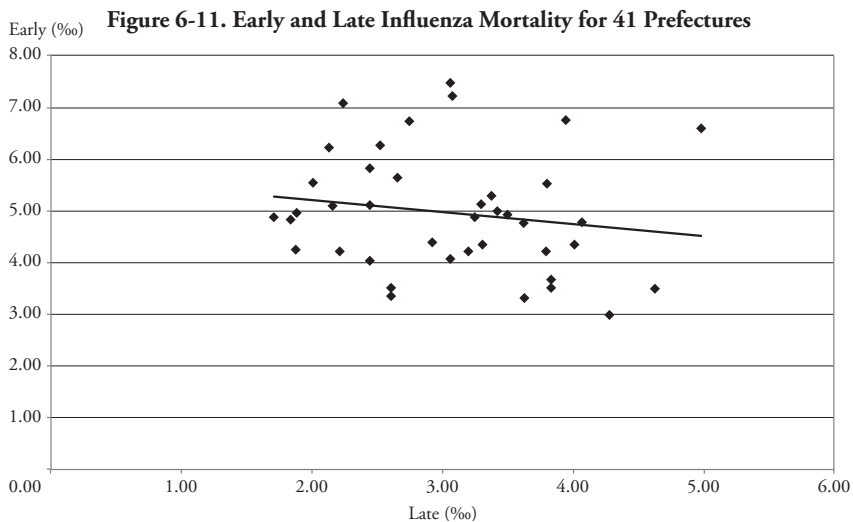
Map 6A. Influenza Mortality by Prefecture (Early Epidemic)



Map 6B. Influenza Mortality by Prefecture (Late Epidemic)

Map 6C. Influenza Mortality by Prefecture  
(Entire Pandemic)

Here let us look at some correlations between the mortality for the Early and Late epidemics. In Figure 6-11, with the Early Epidemic on the vertical axis and the Late Epidemic on the horizontal axis, the data for a total of 41 prefectures (excluding those with the six principal cities) are plotted with dots. Because of the various factors that might have led the prefectures with the “big six” cities to have high mortality for both the Early and Late epidemics, these prefectures are omitted.



If prefectures had high mortality for the Early Epidemic and low mortality for the Late Epidemic, the line of their dots would slant downward to the right. If the line slanted upward to the right it would mean that the prefectures either had high mortality for both the Early and Late epidemics or had low mortality for both.

The results of the plotting of these points produced a line slanting downward to the right, although at only a slight incline. The correlation coefficient was not at all high. Standing at  $-0.165$ , it was not within a statistically significant range. Even so, the incline to the right strongly suggests that in those prefectures where the Early Epidemic raged many people gained immunity and therefore suffered relatively less in the Late Epidemic period and that, conversely, in those prefectures where the Early Epidemic was not prevalent enough to kill many people, few developed immunity, and in the end there were many deaths in the Late Epidemic. If that is the case, the possibility is high that the Early Epidemic and Late Epidemic were caused by the same virus strain.

From the results of the observations above, it is clear that 1918–1920 influenza mortality can only be understood by dividing it between the Early and Late epidemics.