Japan Review, 1998, **10**: 53-71

Mortality Crises in the Tokugawa Period —A View from *Shūmon Aratame-Chō* in Northeastern Japan

KINOSHITA Futoshi
Konan Women's College, Aichi, Japan

Pre-industrial society is often characterized by its periodical mortality peaks due to war, famines, epidemic diseases, or a combination of these disasters. Mortality crises in the past are thought to have worked as a strong Malthusian positive check on population growth. In reality, however, the demographic feature of mortality crises has been poorly understood. Analyzing a historical document called *shūmon aratame-chō* of a small village in Northeastern Japan, this paper attempts to clarify some demographic features of Tokugawa mortality crises. This paper argues several points. First, at a village level, mortality crises broke out frequently, perhaps more frequently than previously thought. The great famines such as Kyōho, Temmei and Tempō, to which historians pay most attention, were only three of many mortality peaks. Second, mortality crises were more often associated with outbreaks of various epidemic diseases than with harvest failure. Third, there existed a considerable amount of regional variations in the severity of crises even in the same geographical area. This localized nature of crises makes it difficult to generalize the severity in one locality to other localities or to Japan as a whole. Fourth, the mortality structure of crisis years significantly differed from that of normal years in terms of not only the magnitude of deaths but also in terms of the age distribution and the relationship between mortality levels and socio-economic status.

Key words: HISTORICAL DEMOGRAPHY, *SHŪMON ARATAME-CHŌ*, FAMINE, EPIDEMIC DISEASES, LIFE EXPECTANCY, DEATH RATE, MALTHUSIAN CHECK, TOKUGAWA PEASANTS, NORTHEASTERN JAPAN

1. Introduction

Among the most distinct demographic characteristics of pre-industrial society are its periodical mortality crises due to war, famines, an outbreak of epidemic diseases, or a combination of these disasters. Mortality crises are often thought to have operated as a strong check on population growth in the past. Malthus, for example, considered a famine the ultimate mechanism by which population and its resource could be kept in balance (1960; orig. 1798). In this context, the Great Irish Famine is often regarded as being a typical example of a breakdown of this fragile balance (e.g., Ó Gráda, 1989: 25-31).

In reality, however, the basic demographic feature of mortality crises, such as their effects, magnitude, duration, causes of death, is not well understood. Reexamining the Malthusian notion through careful analysis, recent empirical studies have begun to shed light on the demographic feature of famine, or mortality crises in general, in the past as well as at the present time. The issue in this area covers diverse topics. For example, Watkins and Menken (1985) and Mercer (1985) examine the impact of mortality crises (or lack of crises) on population growth. Some investigate into whether mortality crises were caused by famines, epidemic diseases, or by other factors, for example, the so-called entitlement to food (e.g., Sen, 1981, Livi-Bacci, 1983, Watkins and van de Walle, 1983, De Wall, 1989, Walter and Schofield, 1989). Others, seeking for some regularities of mortality crises, concentrate on basic features of mortality crises, such as the magnitude, frequency, distribution of death (e.g, Dyson, 1991a, 1991b, Hart, 1993, McCaa, 1995). For example, with regard to the magnitude of death, Wrigley and Schofield (1991: 333) report death rates in crisis years ranging from 30 to almost 65 per thousand in pre-industrial England. In nineteenth-century India, regional death rates reached 40 to 70 per thousand in the years of severe famine (Dyson, 1991 a : 11). More recently in Africa, famine mortality in 1985 rose to over 40 per thousand in Darfur, Sudan (De Wall, 1989).

It is widely recognized among Japanese scholars that during the Tokugawa period, three great famines, Kyōho (1732-33), Temmei (1782-87), Tempō (1833-38), severely damaged the country, particularly Northeastern Japan, and took a heavy toll of peasants' lives. The traditional view among historians and economic historians is that these famines worked as a strong Malthusian positive check on the population, and their devastating effect raised mortality to the level where the population growth of the period remained stagnant (e.g., Sekiyama, 1968, see Aoki, 1967 for the severity of famine).[1] Some recent studies appear to prove the validity of this view. For example, Osaka, a metropolis of Tokugawa Japan, lost 11 per cent of its population during the Tempō famine (Hayami, 1986). Okago, a village in Northeastern Japan, lost over 20 per cent of its population in the same period (Takagi, 1991). In Southwestern Japan, Fukuoka Domain (han) experienced a population loss of 20 per cent as a result of the Kyōho famine (Kallard and Pedersen, 1984). In all of these cases, a significant portion of population was lost as a result of the famines.

Some of the results of these studies, however, contradict with findings elsewhere. For example, Takagi (1991) reports that in Okago the proportion of deaths under age 10 dropped in famine years, while the share of adult deaths considerably increased. In Takayama, a castle town in central Japan, the proportion of deaths among children under age 5 declined from 50 per cent in a non-crisis period to 20 per cent in a crisis period (Jannetta, 1992). These results are at odds with the mortality pattern found elsewhere, where mortality crises tend to raise death rates particularly among children under age 10 as well as the elderly (Watkins and Menken, 1985). With regard to this contradiction, we are not certain whether Tokugawa Japan had a different pattern of crisis mortality from those of the other parts of the world, or whether there existed regional variations within Japan, and thus the results of Okago and Takayama were merely an exception rather than a rule.

Despite the literature reviewed above and others (e.g., Takahashi, 1962, Hayami, 1969, Arakawa, 1979, Kikuchi, 1980, Nakajima, 1996), research specifically focusing on mortality crises in Tokugawa Japan is rare, and thus the demographic feature of the crises remains poorly understood. This paper analyzes a historical document called *shūmon aratame-chō* (to be discussed below) of Yambe, a small village in Northeastern Japan, during the latter half of the Tokugawa period (1760-1870), and attempts to clarify some of the basic demographic features of Tokugawa mortality crises.

This paper argues several points with regard to mortality crises in Tokugawa Japan. First, at the village level, mortality crises broke out frequently, perhaps more frequently than previously thought. The great famines such as Kyōho, Temmei and Tempō, to which historians pay most attention, were only three of many mortality peaks. Second, mortality crises were more often associated with outbreaks of various epidemic diseases than with harvest failure. Thus one needs to pay more attention to epidemic diseases in order to better understand Tokugawa mortality crises. Third, there were considerable regional variations in the severity of crises even in the same geographical area. Thus it is difficult to generalize the severity in one locality to other localities or to Japan as a whole. Fourth, the mortality structure of crisis years significantly differed from that of normal years in terms of not only the magnitude of deaths but also in terms of the age distribution and the relationship between mortality levels and socioeconomic status.

2. Geographical Setting and Historical Background

Between the Asahi Mountains and the Ōu Mountain Range in Northeastern Japan, the Yamagata Basin extends north and south along the Mogani River. Located approximately 60 km from the Pacific Ocean and 75 km from the Sea of Japan, Yambe was situated in the central portion of the Yamagata Basin. The territory of the village ranged from 100 to 800 meters in elevation, but the main settlement was concentrated at between 100 and 250 meters. The Yamagata Basin was not well suited for rice cultivation during the Tokugawa period because of its cold climate and mountainous terrain. This forced peasants in the region to rely heavily on a variety of dry field crops such as wheat, barley, soybeans and safflower. Especially, the safflower (benibana), whose flower leaves were used as a dyeing material, was a highly profitable crop. As a result, a small-scale industry developed for processing dried flower leaves of safflower (hoshibana). The small-scale industry created demands for labor and opened up employment opportunities for local peasants.

Yambe's population stood at 427 in 1760 and reached 737 in 1870, representing a 1.73-fold increase in the 110-year period with the average growth rate of 0.50 per cent per year (Kinoshita 1990). The population grew steadily toward the end of the eighteenth century; the growth slowed down in the following 35 years or so; and then the population grew rapidly afterwards toward the end of the period. If one divides the entire period into three subperiods, 1760-99, 1800-35 and 1836-70, with a roughly equal interval, their annual growth rates were 0.55, 0.06 and 0.80 per cent respectively. Thus one can characterize the first subperiod by moderate growth, the second by stagnant growth, and the third by rapid growth.

3. Source of Data

Yambe has continuous records of *shūmon aratame-chō* (SAC hereafter) for over a century from 1760-1870.[2] The SAC in other parts of Japan has been rigorously analyzed for the last three decades and has proved its reliability as a source of demographic data (see Cornell and Hayami, 1986, Kinoshita, 1989: 66-78 for details). The original purpose of the SAC was to restrain Christianity by registering every household of a community into a Buddhist sect. The SAC, however, gradually lost its function over time, and became a basic household register for taxation purposes. The SAC annually recorded household information as well as demographic information for each individual, such as age, sex, birth, marriage and death, although its detailed contents varied from village to village and from domain to domain.

One must be aware of two difficulties inherent in analyzing the SAC. First, the age-counting system in the Tokugawa period reckoned a child as age one at birth, and then added one year on each new year day thereafter. Since the SAC of Yambe did not record the date of birth, it is impossible to convert accurately this traditional age to standard age. Because of this difficulty, the traditional age, instead of standard age, is used throughout this paper. For rough conversion of the traditional age into standard age, one must subtract one year, as the average value, from the traditional age.

Second, because of the nature of recording, unfortunate infants who were born and also died between two registrations were never recorded in the SAC, but only those who survived until the following registration were recorded. As a result, infant mortality cannot be accurately calculated from the SAC. Thus one should bear in mind that the death rates computed below tend to be somewhat underestimated, although this drawback hardly changes the conclusion of this paper (see Kinoshita, 1996 for levels of the underestimation).

4. Trend for Crude Death Rate

Figure 1 presents a trend for Yambe's crude death rates from 1760 to 1870.[3] As seen in the figure, the rates fluctuated in a considerably wide range and showed a number of mortality peaks characteristic of pre-industrial society. The mean of the crude death rates was 25.1 per thousand for the entire period, and the standard deviation showed a relatively high value of 13.6 per thousand. The Temmei and the Tempō famines (the Kyōho famine is excluded here since it occurred prior to the period being studied) undoubtedly raised mortality substantially higher than the normal level. For example, the death rate of 1784, the midst of the Temmei famine, stood at 54.8 per thousand, more than double the mean of the entire period. Similarly, in 1837, the most severe year of the Tempō famine, the death rate reached 65.5 per thousand, 160 per cent above the mean.

Figure 1 also reveals that, in addition to these years of high mortality, there existed many other mortality peaks where morality levels were often higher than in the great famines. In other words, the Temmei and the Tempō famines, to which historians pay much attention, were only two of many mortality crises. It is misleading, therefore, to focus only on the great famines in order to fully understand Tokugawa mortality crises.

5. Mortality Crises

To define a mortality crisis is somewhat arbitrary. Working on national-level data of England, Wrigley and Schofield (1981: 332-336) define mortality crises as years in which the crude death rate was at least 10 per cent above the 25-year moving average. When applied to Yambe village, however, this definition leaves as many as 34 years of mortality crises, almost one-third of the period being studied. When dealing with village-level data, instead of national-level data, Wrigley and Schofield's criterion of 10 per cent may be too low because of a stochastic fluctuation in death rates due to a small sample size. In this paper, I shall use 50 per cent, instead, as a criterion of mortality crisis, which singles out only 14 years, 13 per cent of the 110 years in consideration.

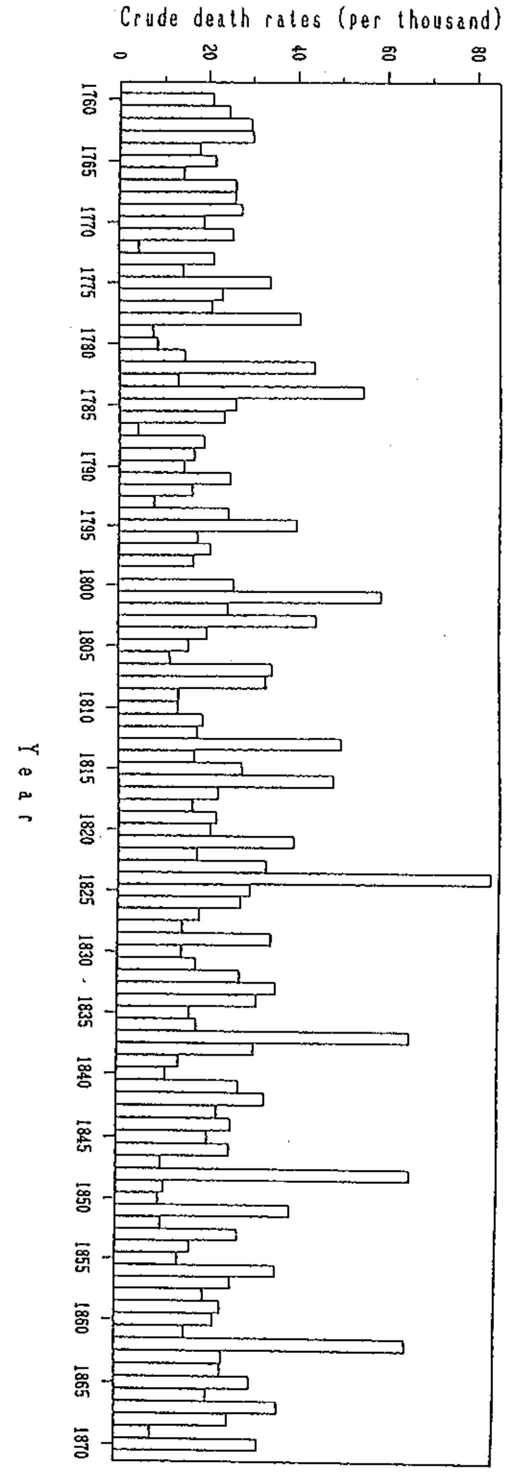

Figure 1. Trend for crude death rates of Yambe, 1760-1870.

Table 1 lists these 14 years with their crude death rates, degree exceeding a trend, and possible causes for high mortality extracted from local descriptive literature. Here we deal with a total of 405 deaths, 209 for males and 196 for females. With the mean of 52.4 per thousand, the death rates in the crisis years ranged from 34.1 per thousand (51 per cent above trend) in 1775 to 83.3 per thousand (197 per cent above trend) in 1824. In other words, a mortality crisis wiped out about 5 per cent of the Yambe population on average, but, in a severe case, the casualties could reach almost 10 per cent.

This level of severity was considerably lower, a half that of Okago discussed earlier, for example. The Ōu Mountain Range extends north and south in the central portion of Northeastern Japan. Okago was located in the east of this mountain range, whereas Yambe was situated in the west. The seasonal wind, which brought the cold rain to Northeastern Japan in the early summer, often caused harvest failure in the past, but this destructive wind from the Sea of Okhotsk hit the east of the mountain range more severely than the west (e.g., Kikuchi, 1994: 39-46). Thus it is likely that this geo-climatic difference was the reason for the difference in death rates between the two villages during mortality crises. As a matter of fact, local descriptive literature tells us a number of destitute peasants who came from Sendai, east of the mountain range, starved to death in the vicinity of Yambe (Tendō Shi, 1987: 518-568, Yamagata Ken, 1987: 74-86). It is clear from this discussion that the severity of mortality crises varied from place to place even in the same geographical region, indicating a highly localized nature of crises. Thus it is misleading for us to assume that the Temmei and the Tempō famines damaged other parts of Japan as badly as they did in the domains located in the east of the Ōu Mountain Range, such as Nambu, Sendai and Tsugaru. We need to take into account considerable regional variations in the severity of the famines when assessing their impact on the population of Tokugawa Japan as a whole.

Table 1 shows that mortality crises were often associated with harvest failure, various epidemic diseases, or a combination of the two, or natural disasters such as major flood. Out of the 14 years listed in the table, epidemic diseases were the main cause for high mortality in six years, harvest failure in one year, a combination of the two in three years, a major flood in one year, and in three years specific causes were unknown. Thus Yambe's mortality crises were often associated with the outbreak of various epidemic diseases. Harvest failure, whether by itself or combined with epidemics, also pushed up mortality levels. But harvest failure was not nearly often associated with mortality crises as many historians might think it would. The impact of harvest failure tended to be emphasized in previous studies (cf. Hanley and Yamamura, 1977), but this suggests that we need to pay more attention to various epidemic diseases in order to fully understand the demographic feature of Tokugawa Japan.

The intervals of the mortality crises ranged from 2 to 13 years with the mean of about 7 years. A careful reading of the table reveals that the distribution of the intervals has two peaks: one around 2-3 years and the other around 10-11 years, suggesting a mortality crisis of a shorter cycle and of a longer cycle. But it is not easy to identify the epidemic diseases listed in the table by modern medical terms, except for measles, smallpox and influenza. These were known in Japan prior to the tenth century, and are relatively easy to identify from their symptoms. Smallpox is known to have a shorter cycle of 3 to 4 years in the Tokugawa period. Influenza was often imported through Nagasaki, the only port which was allowed to trade with foreign countries by the Tokugawa shogunate. This epidemic is also known to have

Table 1. Mortality levels in crisis years and possible causes for high mortality, Yambe 1760-1870.

Year	Per cent above trend	Crude death rate (‰)	Number of deaths	Possible causes
1775	50.68	34.10	16	epidemic (unspecified), fever
1778	86.60	40.79	19	
1782	108.89	43.93	21	epidemic (unspecified)
1784	154.27	54.77	28	harvest failure, epidemic (unspecified)
1795	69.13	40.00	20	harvest failure, smallpox
1801	146.41	58.77	31	harvest failure
1803	81.83	44.33	23	measles
1813	69.86	49.77	26	epidemic (unspecified)
1816	80.76	48.10	26	
1824	197.49	83.26	46	major flood
1837	152.70	65.45	37	harvest failure, epidemic (unspecified)
1848	162.53	65.74	40	smallpox
1851	59.64	39.40	25	
1862	138.31	65.32	47	measles, smallpox, influenza, cholera

NOTE: The possible causes are extracted from Yamagata Meteorological Office (1972), Yamagata Ken Kyodo Kenkyu-kai(1940) and Ishigaki (1954).

had a shorter interval. Measles, on the other hand, had a longer cycle of about 15 to 20 years (Tatsukawa 1976).

In other parts of Japan, many historical documents listed names such as *netsubyō* 熱病, *ribyō* 痢病, and *shōkan* 傷寒 as fatal diseases in crisis periods. Aoki (1967) suspects that *netsubyō*, literally meaning fever, in the Temmei and the Tempō famines was typhus, an epidemic often associated with social disruption due to war and famines. And *ribyō* and *shōkan* are interpreted as dysentery and typhoid respectively (Fujikawa 1969). These bacterial diseases must be candidates for unspecified epidemics in Table 1. Thus it may well be stated that epidemic diseases such as measles, smallpox, influenza, typhus, dysentery and typhoid became widespread in the crisis period, and took hundreds of Yambe villagers' lives.

6. Distribution of Death by Age

Figures 2 and 3 show distributions of death by age in the non-crisis and the crisis years respectively. A general impression of Figure 2 is that deaths occurred in an orderly manner in the normal years. If one draws a line connecting each value of different age groups, it will become a smooth curve. In the figure, two peaks can be seen: a sharp peak at less than age 10 and a very broad peak at older ages. The age group 2-4 accounted for by far the largest proportion, almost 30 per cent of total deaths. Roughly speaking, this age group, combined with the following age group, totaled over one-third of deaths, and deaths over age 60 counted another one-third.

In the crisis period, however, several differences from the non-crisis period can be seen (see Figure 3). First, unlike the smooth curve of the non-crisis period, deaths in the crisis period distributed randomly except for among children, and failed to show any clear pattern. Second, deaths among younger age groups substantially increased ($p<0.003$ for both sexes). For example, the proportion of age 2-4 jumped to 36 per cent for males and 33 per cent for females, and the corresponding figure for age 5-9 also went up to 20 per cent and 18 per cent respectively. In other words, deaths among children under age 10 accounted for more than a half of the total deaths during the crisis period, as opposed to only one-third during the non-crisis period. Third, unlike in the non-crisis period, a broad peak at older ages cannot be seen in the crisis period ($p<0.003$ for males, $p<0.007$ for females). Instead, deaths seem to have occurred unpredictably from adolescents to the elderly.

Figure 2. Distribution of death by age in non-crisis years, Yambe 1760-1870.

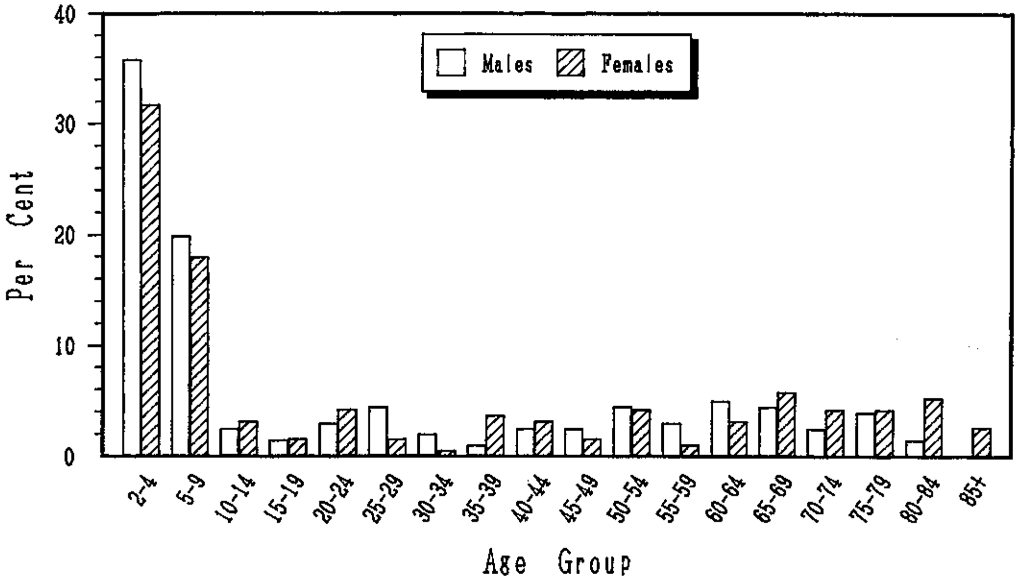

Figure 3. Distribution of death by age in crisis years, Yambe 1760-1870.

7. Comparison of Death Rate and Life Expectancy between Non-Crisis and Crisis Periods

In this section, period life tables are calculated and a comparison in terms of life expectancy and death rates is made between the non-crisis and the crisis periods. During the non-crisis period, Yambe males and females hardly showed any difference in life expectancy. Life expectancy at age 2 was 43.7 years for males and 43.9 years for females.[4] The mortality schedule of Yambe villagers was roughly as follows: 80 out of 100 children at age 2 survived until age 5; then 5 or 6 died before reaching age 10; and another 4 or 5 perished before age 20; thus leaving only 70 villagers or so who were able to survive until age 20. After age 20, 60 persons out of the original 100 survived to age 40; 20 died between age 40 and 60; and, as a result, slightly over 40 persons reached age 60.

In the crisis period, however, life expectancy at age 2 dropped dramatically: 15.1 years for males and 16.8 years for females, one-third that of the non-crisis period. Unlike in the non-crisis period, females showed an advantage of almost 2 years over males (to be discussed below). The following illustrates the severity of the mortality crisis of this magnitude: over a half of Yambe males at age 2 died before reaching age 5; then 20 per cent could not survive until age 20; thus leaving less than 30 per cent who were able to reach age 20. After this, 10 per cent perished before age 40; and another 10 per cent were lost between age 40 and 60; leaving only 10 per cent of Yambe males who managed to survive until age 60.

Figures 4 and 5 compare death rates between the crisis and the non-crisis periods. Starting at less than 100 per thousand at age 2-4 (see Figure 4), the death rate for males in the non-crisis period continued to fall until age 10-14, where the rate reached a nadir. Then it gradually increased to a level of about 10 per thousand at age 30-34, but dropped again to about 5 per thousand at the following age group. After this, the death rate continued to increase with age. This gives a W-like shape to the overall mortality schedule. The drop at the upper thirties is difficult to explain, but mortality schedules in the Tokugawa period and in the following Meiji period (1868-1912) tend to be flat from the twenties to the thirties, or even to have a shallow trough at these age groups (e.g., Smith, 1977, Takahashi, 1991, Saito, 1992).

Compared to the non-crisis period, mortality levels at each age group shifted upwards in the crisis period (Wilcoxon, $p<0.02$). The death rate at age 2-4 in the crisis period stood at over 200 per thousand; fell to a level of about 10 per thousand at age 15-19; then reached its lowest at age 35-39. Despite the upward shift, the W-like shape seen in the non-crisis period remained in the crisis period as well.

As shown in Figure 5, the death rate for females in the non-crisis period moved smoothly with age. The rate stood at 70 per thousand at the youngest age group; declined to a level of about 5 per thousand at age 15-19; and gradually increased afterwards with a small peak at age 20-24. In contrast, the death rate in the crisis period moved in a ragged fashion with age. This reflects not only a stochastic fluctuation due to a small sample size, but also it reflects the unpredictable nature of death during the crisis period as discussed above (Wilcoxon, $p<0.001$). From over 200 per thousand at age 2-4, the death rate fell precipitously to a level of 10 per thousand at age 15-19, and then gradually increased afterwards with wide fluctuations.

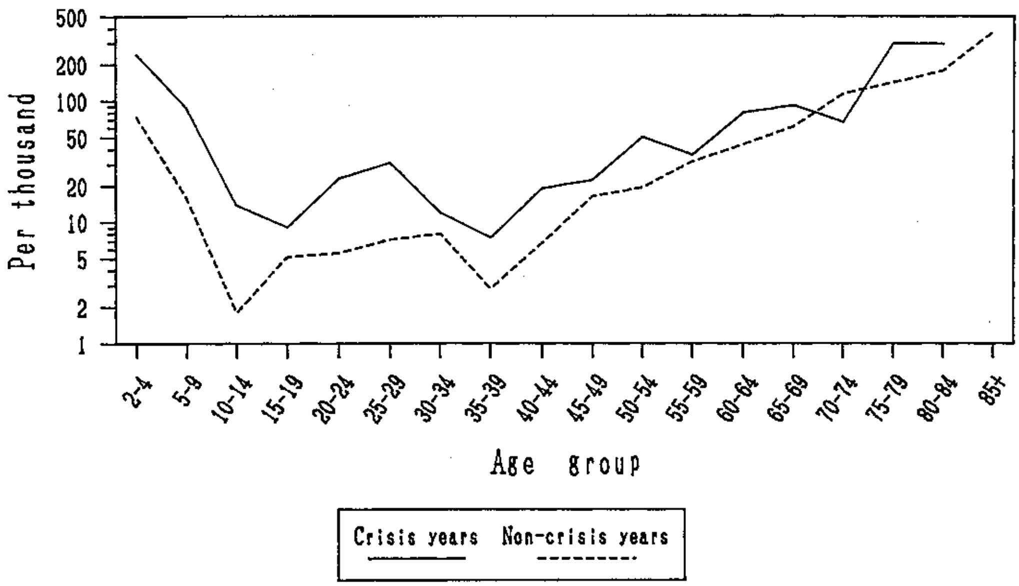

Figure 4. Comparison of death rate in crisis and non-crisis years, Yambe males 1760-1870.

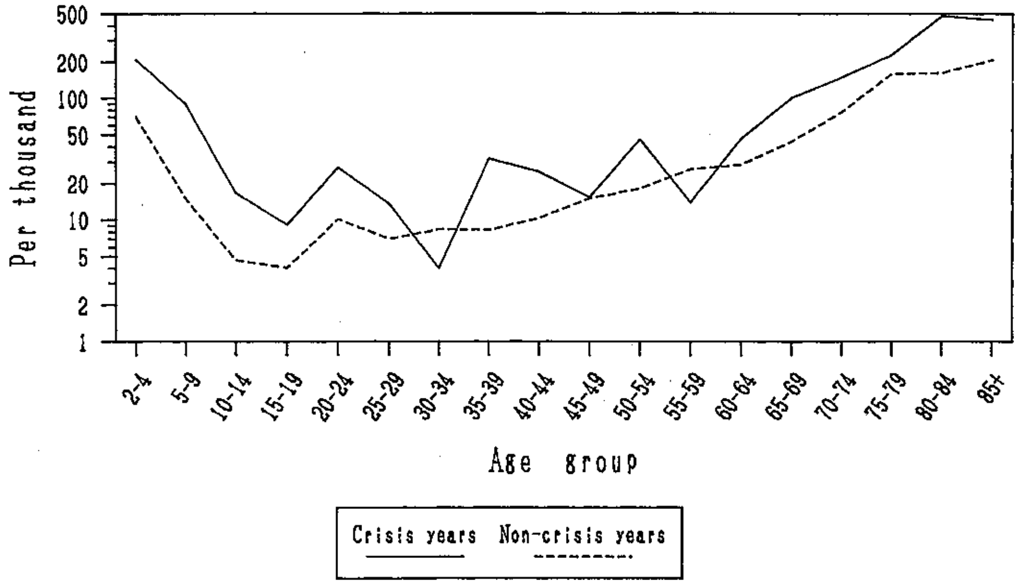

Figure 5. Comparison of death rate in crisis and non-crisis years, Yambe females 1760-1870.

Dyson (1991a, 1991b) calculates a 'proportional' increase of death rates in famine years—ratios of registered deaths (or death rates) in famine years to reference years—in order to elucidate the impact of South Asian famines on death rates at different age groups. A similar analysis is carried out here for Yambe villagers, but several age groups need to be lumped together because of a small sample size (see Figure 6). The result generally confirms Dyson's findings on nineteenth century famines in India. Yambe's mortality crises hit children under age 10 most severely: the ratio peaked at later childhood (age 5-9) for both sexes. For this age group, the death rate in the crisis period was almost six times as high as in the non-crisis period. The ratio of early childhood (age 2-4) was also high, but only a half that of later childhood. After the peak at age 5-9, the ratio gradually declined with age, indicating that the elderly were proportionally less affected by mortality crises than adolescents (10-19) and younger adults (20-39). It is often argued that mortality crises are to push up death rates particularly among children under age 10 and the elderly (e.g., Watkins and Menken, 1985). In Yambe, this argument holds true only of younger children, but fails to hold for the elderly.

Figure 6 also reveals that there was a clear difference between the sexes in the impact of crises on mortality. Unlike for other age groups, the proportional increase from adolescent (10-19) to reproductive (20-39) ages was much greater for males than for females: the death rate of the adolescent age group in the crisis period almost quintupled for males, whereas the rate only trebled for females. Even at reproductive ages, there was a notable difference between the sexes: over threefold for males as opposed to twofold for females. The vulnerability of males to famines or other types of mortality crises is well documented in the literature. Rivers (1988), for example, holds that females are less vulnerable to deprivation

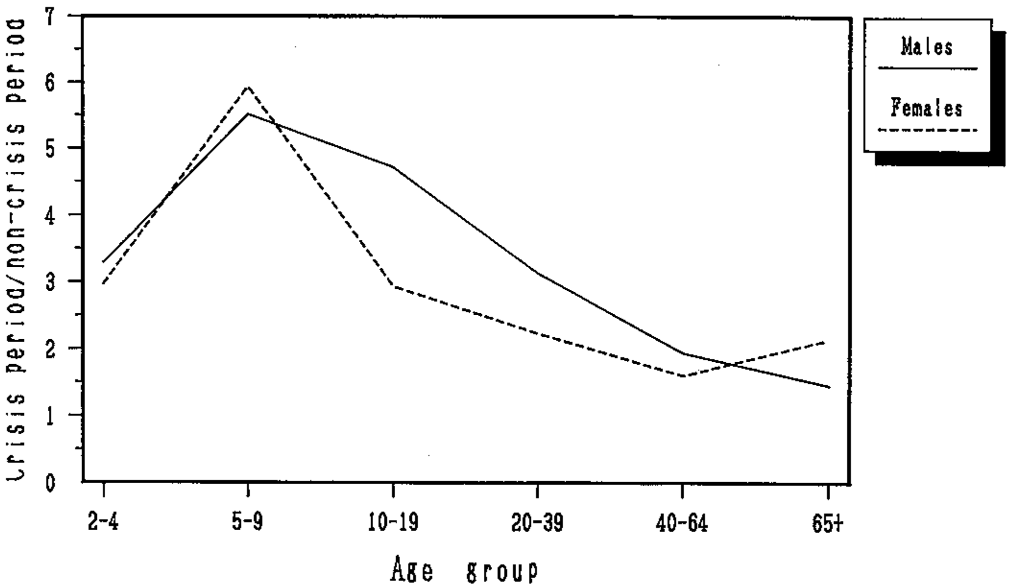

Figure 6. Ratios of death rates in crisis years to non-crisis years, Yambe, 1760-1870.

because they have not only smaller needs for energy and most nutrients, but also they have a lower metabolic rate and a higher body fat. Given that females begin to accumulate their body fat from the adolescent ages and maintain it throughout their reproductive years, the sexual difference seen in Figure 6 might be explained partially by this physiological reason.

As discussed earlier, it is a difficult task to ascertain causes of death among Yambe villagers during the crisis period. Figure 6, however, accords well with a description of local records which listed epidemic diseases such as measles, smallpox and influenza (see Table 1), because these epidemics are known to take a heavy toll of children's lives. Other epidemic diseases often associated with mortality crises include dysentery, typhoid and typhus. Particularly, typhoid is known to have hit young adult males more severely than any other groups (Saito et al., 1964: 207); therefore this intestinal disease can be another candidate to explain the sexual difference in Figure 6.

8. Mortality Differentials by Socio-economic Status in the Crisis Period

In order to examine mortality differentials by socio-economic status, Yambe villagers are divided into three groups (lower/middle/upper) according to assessed rice yield of the household to which they belonged.[5] With regard to the non-crisis period, there was very little difference in life expectancy between different socio-economic strata: mortality schedules of the three statuses followed almost an identical path at all age groups. It follows that socio-economic status played a minimum role in determining the survivorship of the villagers in the normal years, and thus people of well-to-do households were exposed to the same level of risk of dying as those of poor households.

In the crisis period, however, the situation was quite different. Lower status males exhibited consistently lower life expectancy at all ages than their wealthier counterparts (see Figure 7). For example, upper status males had an advantage of 5 to 6 years in life expectancy at age 2 over those of the lower status. This advantage increased to 8 years at age 10, and hardly decreased at most reproductive ages. Thus in the crisis period, socio-economic status became critical in determining the survivorship of Yambe males.

In contrast, the advantage of well-to-do households cannot be found for Yambe females. As shown in Figure 8, there was no major difference in life expectancy at pre-adolescent (2-10) and post-reproductive (after 40) ages. But what is striking about this figure is that lower status females showed a clear advantage, 5 to 7 years, at most reproductive ages over their counterparts of the more privileged class.

The link between mortality and nutritional levels or income levels, for which socio-economic status presumably approximates, is a controversial one (e.g., McKeown, 1976, Preston, 1976, Frisancho, 1981: Rivers, 1988, Livi-Bacci, 1991). The degree to which a nutritional level affects mortality depends not only on a level of malnutrition and types of diseases or pathogens, but also it depends on various other factors such as the immunological history of the infected person, types of nursing care and personal or household hygiene (Johansson and Mosk, 1987: 209-212).

A comparison of Figures 7 and 8 leads us to believe that the link between mortality and socio-economic status is, in effect, a complicated one. It seems that the principle governing

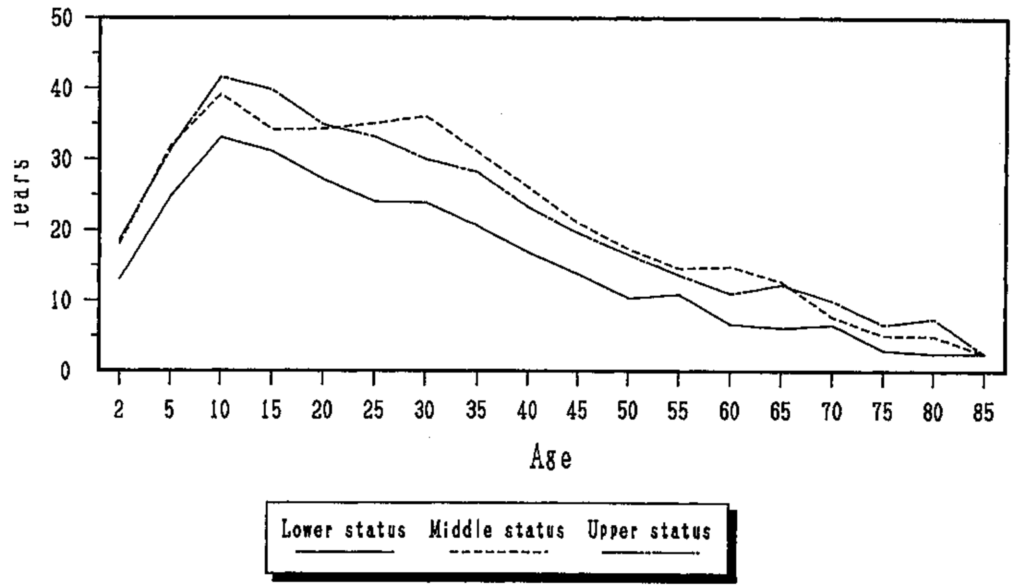

Figure 7. Comparison of life expectancy in crisis years by SES, Yambe males 1760-1870.

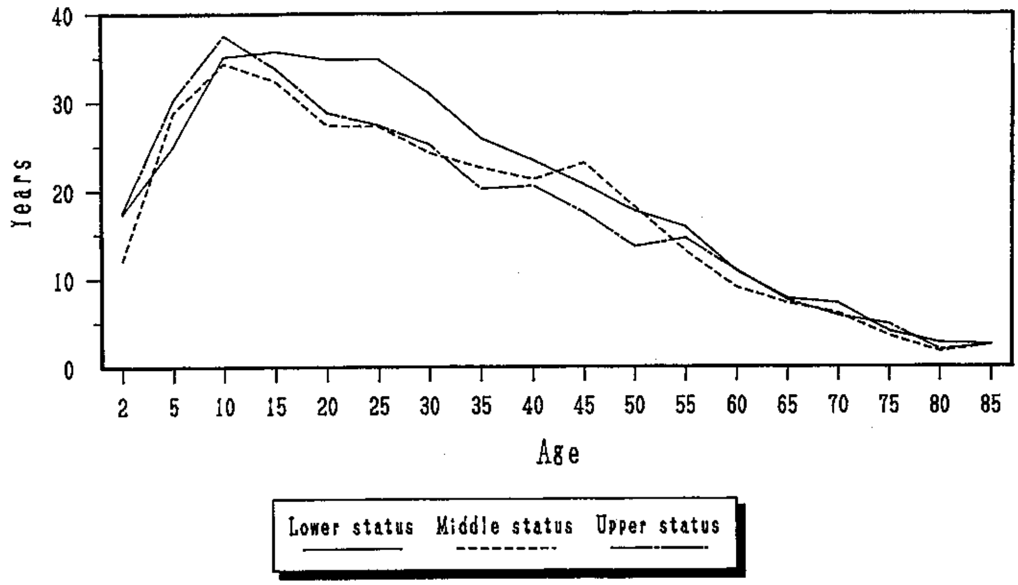

Figure 8. Comparison of life expectancy in crisis years by SES, Yambe females 1760-1870.

the relationship for males between mortality and socio-economic status differed from the relationship for females. For example, one could argue from the result of males that mortality was negatively associated with socio-economic status in the crisis period. Therefore, a number of Yambe's destitute peasants must have died of nutrition-sensitive diseases such as measles, or even they must have starved to death when there was no food available to them. However, one must abandon this argument for females. The situation was reversed: it was women of poor households, not those of wealthier households, who had an advantage in survivorship during the crisis period. What complicates more is that age factors need to be taken into account, because females with this advantage were concentrated in their reproductive ages, and those of other ages were not as fortunate.

9. Conclusions

Pre-industrial society is characterized by its periodical mortality peaks due to war, famine, outbreaks of various epidemic diseases, or a combination of these disasters. Mortality crises in the past are often assumed to have operated as a strong Malthusian positive check on population growth. Regarding this assumption, Tokugawa Japan is no exception. In reality, however, the demographic feature of mortality crises has been poorly understood. This paper analyzed a historical document called *shūmon aratame-chō* of Yambe, a small village in Northeastern Japan, during the latter half of the Tokugawa period, and clarified some basic demographic features of mortality crises. The major findings of this paper can be summarized as follows:

(1) Mortality crises broke out frequently in Yambe, perhaps more frequently than previously thought. The great famines such as Kyōho, Temmei and Tempō, to which historians devote much attention, were only the tip of an iceberg in terms of mortality peaks. Thus it is misleading for us to focus only on the great famines to fully understand Tokugawa mortality crises.
(2) Mortality crises were more often associated with outbreaks of various epidemic diseases than with harvest failure. In the crisis period, epidemics such as measles, smallpox, influenza, typhoid, dysentery and typhus became widespread, and took a heavy toll of peasants' lives.
(3) There existed considerable regional variations in the severity of crises even in the same geographical area. Thus one needs to be careful about generalizing the severity of one locality to other localities. Needless to say, it is not wise to estimate the impact of famine on population growth of the country as a whole based on the experience in severely damaged domains such as Nambu, Sendai and Tsugaru.
(4) Deaths distributed in an orderly fashion during the non-crisis period. A higher proportion of deaths among young children and the elderly and a lower proportion between the two are what demographers expect. In contrast, deaths occurred more randomly at most ages in the crisis period, except for children, particularly those of age 5 to 10, who were exposed to an extremely high risk of dying.
(5) There was very little difference in life expectancy between the sexes in normal years: life expectancy at age 2 was both at lower forties. During the crisis period, life expectancy diminished to one-third, but females had an advantage of longer life expectancy over males. Because of physiological reasons such as body fat, females in their adolescent to reproductive ages were particularly less vulnerable to mortality crises.
(6) Analysis of the link between crisis mortality and socio-economic status yields a puzzling result. In the non-crisis period, socio-economic status played a minimum role in determining the survivorship of Yambe villagers. In the crisis period, however, mortality differentials by socio-economic status became more salient, but apparently in a different manner between the sexes. For males, the severity of crisis mortality was negatively associated with socio-economic status. But the situation was reversed for females, and this was particularly true of those in their reproductive ages. This area requires further research.

NOTES

Acknowledgments. I am grateful to Professor Akira Hayami, Reitaku University, for his help and generosity in making basic data sheets of Yambe *shūmon aratame-chō* available to me. I also thank the anonymous referees for useful comments on the paper. But I am solely responsible for the arguments made here as well as for any errors or omissions. This research was supported by a grant-in-aid for creative basic research (head investigator: Akira Hayami) and a grant-in-aid for scientific research on priority areas (head investigator: Akifumi Oikawa) from the Ministry of Education, Science, Sports and Culture. Further support was provided by a research grant from Konan Women's College. An earlier version of this paper was presented at a seminar of the EurAsian project on population and family history, summer 1995, and at the 18th International Congress of Historical Sciences, fall 1995.

1 The traditional view has been challenged by some (e.g., Smith, 1977, Nakamura and Miyamoto, 1982). Hanley and

Yamamura (1977) argue that the impact of these famines is highly exaggerated in the traditional view, and in the latter half of the Tokugawa period death rates closely matched birth rates, which resulted in the stagnant population growth (cf. Mosk, 1979, see Hayami, 1986, Hayami and Kito, 1989 for review). In this argument, the stagnant population growth of Tokugawa Japan is attributed to low fertility rather than to high mortality.

2 Since the SACs of 1761, 1764, 1765 and 1797 are missing, this paper analyzes 107 SACs from 1760 to 1870. Information of the SAC was translated into the BDS (Basic Data Sheet) form by Professor Akira Hayami, Reitaku University, who kindly made it available to me.

3 There are some 340 individuals who made their exit from the SAC for reasons unknown to us. The crude death rate in Figure 1 is calculated on the following two assumptions regarding these individuals: (1) individuals aged over 65 and those aged under 10 are assumed to have been dead regardless of their sex; and (2) the rest are assumed to have followed the mortality schedule computed without taking these individuals into account. As a result, this paper deals with a total of 1513 deaths, 779 for males and 734 for females.

4 Life expectancy at age 2 (of Japanese age) is used in this paper since infant mortality cannot be accurately calculated from the SAC due to the nature of recording as discussed earlier.

5 In the Tokugawa period, land and homesteads were evaluated in terms of rice yield in *koku*, a unit of volume approximately equivalent to 5.1 bushels, for taxation purposes. For estimating socio-economic status in this paper, first, averages of rice yield (kokudaka) are calculated for each household. Then each household is grouped into one of three statuses based on these averages. Lower status households are those in which kokudaka was less than or equal to one koku. Middle status households range from one to 10 koku, and households with more than 10 koku are classified as the upper status. This grouping is somewhat arbitrary, but a consideration is given to leaving the sufficient number of households in each status for analysis. As a result, the total number of deaths counts 768 for the lower status, 320 for the middle status and 425 for the upper status.

References

Aoki, D. (1967): *Ji-in kakocho kara mita Iwate-ken no kikin* (Famines in Iwate Prefecture Viewed from Temple Death Registers). Ou-shidankai, Sendai (in Japanese). 青木大輔（1967）：『寺院過去帳からみた岩手県の飢饉』奥羽史談会.

Arakawa, H. (1979): *Kikin* (The Famine). Kyoiku-sha, Tokyo (in Japanese).

Cornell, L.L. and Hayami A. (1986): The Shumon Aratame-cho: Japan's population registers. *Journal of Family History* 11: 311-328.

De Waal, A. (1989): Famine mortality: A case study of Darfur, Sudan 1684-5. *Population Studies* 43: 5-24.

Dyson, T. (1991a): On the demography of South Asian famines Part I. *Population Studies* 45: 5-25.

—— (1991b): On the demography of South Asian famines Part II. *Population Studies* 45: 279-297.

Frisancho, R.A. (1981) *Human Adaptation.* University of Michigan Press, Ann Arbor.

Fujikawa, Y. (1969 (orig. 1911)): *Nihon shippei-shi* (A History of Disease in Japan). Heibonsha, Tokyo (in Japanese). 富士川游（1969）：『日本疾病史』平凡社.

Hanley, S.B. and Yamamura K. (1977): *Economic and Demographic Change in Pre-Industrial Japan, 1600-1868.* Princeton University Press, Princeton.

Hart, N. (1993): Famine, maternal nutrition and infant mortality: A re-examination of the Dutch hunger winter. *Population Studies* 47: 27-46.

Hayami, A. (1969): Kishu Owase-gumi no jinko susei (Population Trend in Kishu Owase-gumi). Tokugawa Rinsei-shi Kenkyu-jo *Kenkyu Kiyo.* 速水融（1969）：「紀州尾鷲組の人口趨勢」『研究紀要』徳川林政史研究所.

—— (1986): Population changes. In Jansen, M. and Rozman, G. (eds.), *Japan in Transition,* Princeton University Press, Princeton, pp. 380-397.

—— (1992): *Kinsei Nobi Chiho no Jinko, Keizai, Shakai* (Population, Economics and Society in the Nobi Region during the Tokugawa Period). Sobun-sha, Tokyo (in Japanese). 速水融（1992）：『近世濃尾地方の人口・経済・社会』創文社.

Hayami, A. and Kito, H. (1989): Shomin no Rekishi-minseigaku (Historical Ethnology of the Populace). In Shinpo, H. and Saito, O. (eds.), *Kindai Seicho no Taido* (The Growth of Modern Japan), Iwanami-shoten. pp.267-321 (in Japanese). 速水融，鬼頭宏（1989）：「庶民の歴史民勢学」新保博、斎藤修編『近代成長の胎動』岩波書店.

Ishigaki, G. ed. (1959): *Omachi nenbutsu ko-cho* (Chronology of Omachi Nenbutsu Association), Yamagata Ken Kyodo Kenkyu-kai, Yamagata (in Japanese). 石垣元編（1959）：『大町念仏講帳』山形県郷土研究会.

Jannetta, A.B. (1992): Famine mortality in nineteenth-century Japan: The evidence from a temple register. *Population Studies* 46: 427-443.

Johansson, S.R. and Mosk, C. (1987): Exposure, resistance and life expectancy: Disease and death during the economic development of Japan,1900-1960. *Population Studies* 41: 207-235.

Kallard, A. and Pedersen, J. (1984): Famine and population in Fukuoka domain during the Tokugawa period. *Journal of Japanese Studies* 10-1: 31-72.

Kikuchi, I. (1994): *Kikin no shakai-shi* (Social History of Famine), Azekura-shobo, Tokyo (in Japanese). 菊池勇（1994）：『飢饉の社会史』校倉書房.

Kikuchi, K. (1980): *Nihon no rekishi saigai: Edo koki no kikin* (Disasters in Japanese History: Famines in the Later Tokugawa Period), Kokon-shoin, Tokyo (in Japanese). 菊池万雄（1980）：『日本の歴史災害』古今書院.

Kinoshita, F. (1989): *Population and Household Change in Tokugawa Japan,* 1760-1860. Ph. D. dissertation, Department of Anthropology, University of Arizona, University Microfilms, Ann Arbor, MI.

—— (1990): Tōhoku ichi noson no kekkon to shussei, 1760-1870 (Nuptiality and Fertility in a Japanese Village, 1760-1870). *Journal of the Anthroplogical Society of Nippon* 98(3)317-336.

—— (1995): Mortality Crises in Tokugawa Japan, 1760-1870. Paper presented at the 18th International Congress of Historical Sciences, Montreal.

—— (1996): Kiroku sarenakatta shussei (Uncounted births: Estimating the fertility of Tokugawa peasants from shumon aratame-cho. *Bulletin of the National Museum of Ethnology* 21-4: 877-919.

Livi-Bacci, M. (1983): The nutrition-mortality link in past times: A comment, *Journal of Interdisciplinary History* 13-2: 293-298.

—— (1991): *Population and Nutrition,* Cambridge University Press, Cambridge.

Malthus, T.R. (1960 (orig. 1798)): *An Essay on the Principle of Population,* Random House, New York.

Mercer, A.J. (1985): Smallpox and epidemiological-demographic change in Europe: The role of vaccination. *Population Studies* 39: 287-307.

Mosk, C. (1979): The decline of marital fertility in Japan. *Population Studies* 33: 19-38.

McCaa, R. (1995): Spanish and Nahuatl views on smallpox and demographic catastrophe in

Mexico. *Journal of Interdisciplinary History* 25-3: 397-431.

McKeown, T. (1976): *The Modern Rise of Population,* Edward Arnold, London.

Nakajima, Y. (1996): *Kikin nihon-shi* (A History of Japanese Famine), Yuzankaku, Tokyo (in Japanese). 中島陽一郎（1996）：『飢饉日本史』雄山閣.

Nakamura, J.I. and Miyamoto, M. (1982): Social structure and population change: A comparative study of Tokugawa Japan and Ch'ing China. *Economic Development and Cultural Change* 30-2: 229-269.

Ó Gráda, C. (1989): *The Great Irish Famine,* Cambridge University Press, Cambridge.

Preston, S.H. (1976): *Mortality Patterns in National Populations.* Academic Press, New York.

Rivers, J.P.W. (1988): The nutritional biology of famine. In Harrison, G.A. (ed.), *Famine,* Oxford University Press, Oxford. pp. 57-106.

Saito, K., Katunuma, H., Kitani, H. et al. (1964): *Koshu eisei katudo hando bukku* (Handbook for Public Health Activities), Gihodo, Tokyo (in Japanese). 斉藤潔他編（1964）：『公衆衛生活動ハンドブック』技報堂.

Saito, O. (1992): Jinko tenkan izen no nihon niokeru mortality—Pattern to henka—(Mortality in Japan before Demographic Transition—Pattern and Changes—). *Keizai Kenkyu* 43-3: 248-266.

Sekiyama, N. (1968): *Kinsei nihon no jinko kozo* (The Demographic Structure of Early Modern Japan, Yoshikawa Kobunkan, Tokyo (in Japanese). 関山直太郎（1968）：『近世日本の人口構造』吉川弘文館.

Sen, A.K. (1981): *Poverty and Famines: An Essay on Entitlement and Deprivation,* Oxford University Press, Oxford.

Smith, T.C. (1977): *Nakahara: Family Farming and Population in a Japanese Village, 1717-1830,* Stanford University Press, Stanford.

Takagi, M. (1991): Crisis mortality and its effect on fertility in northern Japan, 1830-45". Paper presented at Conference on Demographic Change in Economic Development, Hitotsubashi University, Tokyo.

Takahashi, B. (1962 (orig. 1955)): *Nihon jinko-shi no kenkyu,* Vol. 3 (A Study of Japanese Population History, Vol. 3), Maruzen, Tokyo (in Japanese). 高橋梵仙（1962）：『日本人口史の研究　第三巻』丸善.

Takahashi, S. (1991): Honseki jinko o riyoshita meiji-ki jinko suikei no kokoromi (Estimating Meiji population trends from de jure population). *Kokumin Keizai* 163-5: 39-58.

Tatsukawa, S. (1976): *Nihon-jin no byoreki* (Medical History of Japanese, Chuo Koron-sha, Tokyo (in Japanese). 立川昭二（1976）：『日本人の病歴』中央公論社.

Tendo shi (1987): *Tendo-shi shi* (The History of Tendo City), Tendo Shi,Yamagata (in Japanese). 天童市編（1987）：『天童市史 中巻』天童市.

Walter, J. and Schofield, R. (1989): *Famine, Disease and the Social Order in Early Modern Society,* Cambridge University Press, Cambridge.

Watkins, S.C. and Menken, J. (1985): Famines in historical perspective. *Population and Development Review* 11-4: 647-675.

Watkins, S.C. and van de Walle, E. (1983): Nutrition, mortality and population size: Malthus' court of last resort. *Journal of Interdisciplinary History* 13-2: 205-226.

Wrigley, E.A. 1969. *Population and History,* McGraw Hill, New York.

Wrigley, E.A. and Schofield, R. (1981): *The Population History of England 1541-1871,* Cambridge University Press, Cambridge.

Yamagata ken (1987) *Yamagata ken shi,* Vol. 3 (The History of Yamagata Prefecture, Vol. 3), Yamagata Prefecture, Yamagata (in Japanese). 山形県編（1987）：『山形県史 第三巻』山形県.

Yamagata ken kyodo kenkyu-kai (ed.) (1941): *Omachi nenbutsuko-cho* (Chronology of Omachi Nenbutsu Association), Yamagata ken kyodo kenkyu-kai, Yamagata (in Japanese). 山形県郷土研究会編（1941）：『大町念仏講帳』山形県郷土研究会.

Yamagata Meteorological Office (1972): *Yamagata ken saii nenpyo* (Chronology of Natural Disaster in Yamagata Prefecture), Yamagata chiho kisho-dai, Yamagata (in Japanese). 山形地方気象台編（1972）：『山形県災異年表』山形地方気象台.

徳川期におけるモータリティー・クライシス（死亡危機）
—東北地方の宗門改帳からみた死亡構造—

木下　太志

要旨：前工業期社会は、人口学的には戦争、飢饉、伝染病、あるいはこれらの組み合わせによる周期的な死亡率の上昇（モータリティー・クライシス）によって特徴づけられる。歴史におけるモータリティー・クライシスは、人口増加に対するマルサス的強い積極的制限（positive check）として働いたと考えられてきた。しかしながら、モータリティー・クライシスの人口学的特徴は、未だ十分には理解されていないのが現状である。本稿では、東北地方に残されている宗門改帳の分析を通じ、徳川期のモータリティー・クライシスの人口学的特徴を実証的に明らかにすることを目的とした。

本稿の結論は、大きくわけて以下の４点にまとめることができる。第１点は、徳川期のモータリティー・クライシスは、従来考えられていたよりも頻繁に発生した。享保、天明、天保のいわゆる三大飢饉は、多く発生したモータリティー・クライシスのほんの一部にしか過ぎない。したがって、モータリティー・クライシスを人口史的に理解しようとすれば、三大飢饉にのみ注目するのは適当ではない。第２点は、モータリティー・クライシスは農作物、特に米作の凶作よりも、伝染病の発生とより深い関係がある。第３点は、モータリティー・クライシスが及ぼす被害の程度は、同じ地方（例えば東北地方）においてもかなりの地域差がある。したがって、一地域の被害程度をもって、他の地域、あるいは日本全体のそれを推し測ることは賢明ではない。第４点は、モータリティー・クライシス期の死亡構造は通常期のそれとは顕著に異なる。このことは、単に死亡数の多寡だけではなく、死亡の年齢分布、および死亡率と社会経済的階層の関係についても言えることである。