The construction of cause-of-death statistics database of modern Japan — part (1): issues and approaches

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Abstract

Causes of death are important records for not only demographic research but socio-economic studies. They reflect various conditions of epidemiological circumstance, life environment, and socio-economic system. However, when we adopt a time-series analysis to a cause-of-death statistics, there are two major issues that should be considered.

The first is the temporal inconsistency of cause-of-death categories. Cause of death, needless to say, is influenced by diagnostics that changes along the progress of medicine, therefore unavoidable revision of categories occurs. Usually, retroactive modification is not executed in cause-of-death statistics, when such revision has occurred. It causes a temporal discontinuity of statistics and makes a time-series analysis difficult.

The second is the reliability of cause-of-death. Generally speaking, in historical data, the judgment of cause-of-death is not always accurate. It is influenced by medical skills, social customs, and taboos, and fluctuates with regional variations of medical level. Although to inspect such kind of bias is unavoidable, in most situations, it is not easy to accomplish.

These issues are pointed out in cause-of-death statistics of modern Japan as well as other countries, thus it is generally said that they are major obstacles against long term analysis of cause-specified mortality[1]. In Japan, the government started to accumulate cause-of-death statistics from the beginning of the 20th century. The category of cause-of-death had been revised four times in the prewar period, therefore time-series gaps occurred in a number of series by change of aggregate calculation rules. We inspected these issues through development of Cause-Specified Death Statistics Database (CSDS-DB[2]).

As a result of the inspection of time-series continuity, we found that most of the temporal inconsistencies of category were adjusted by logical processing. Based on the findings above, we sorted whole cause-of-death by status of temporal consistency. We assume that CSDS-DB is constituted as a data source for time-series analysis of Japanese mortality by this processing.

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[1] Cliff, Haggett and Smallman-Raynor (1998), pp. 24.

[2] CSDS-DB had been developed in the research project, "Research on Risk Communication and Management based on CRONOS Authoring Tool" (2002 - 2006), founded by the Japanese Ministry of Education and Sciences.

Although it will be realized that several unresolved discontinuities remain, the reasons of them are accountable. In this paper, we present the time-series discontinuity of cause-of-death statistics of modern Japan, and the procedure of adjustment which we executed to constitute the database. By this disclosure information, we believe that CSDS-DB will be able to contribute for all researchers who are interested in time-series analysis of Japanese mortality.

I. Public Data Sources of Cause-specified Death Statistics

In Japan, the cause-specified death statistics recorded in "Eisei-kyoku Nenpo", the annual report of The Sanitary Bureau of The Home Department, since 1880. However, it had not been organized systematically until 1902. As soon as International Classification of Diseases (ICD) was introduced in 1900[3], The Sanitary Bureau reorganized the categories of causes-of death according to ICD. This statistics is precious data to get to know the epidemiological transition in modern Japan. If we can create the long-period time series database based on this death statistics, the utility value must be high. But when you are going to extract data from this statistics, you will find out that classification is not unified. Some sorts of cause-of-death do not mean same classification, even if their names are same. To resolve such a problem, we scrutinized consistency of the classification system of cause-of-death. As a result, we identified seven classification systems between 1902 and 1959 as follows. (Since the statistics between 1938 and 1950 were unstable by chaos of WWII, this period was excluded from the database)

- Classification System I (1902 - 1906) includes 53 categories
- Classification System II (1907 - 1908) includes 53 categories
- Classification System III (1909 - 1922) includes 61 categories
- Classification System IV (1923 - 1932)* includes 50 categories
- Classification System V (1933 - 1937) includes 89 categories
- Classification System VI (1951 - 1957)** includes 94 categories
- Classification System VII (1958 - 1959) includes 112 categories

*1927 is not available. **period 1938 - 1950 is excluded, because of WWII.

It can be assumed that these seven systems of classifications are reflecting medical knowledge and diagnostic technology of the days. Therefore, we tried to preserve the information of original statistics tables as much as possible in the construction process of database.

On the other hand, the original classification systems were not suitable for a long-term time series analysis because of the inconsistencies between classifications. To clear this problem, we invented the classification system which integrated cause-of-death classifications through the whole period. We named this integrated classification the "I-Classification".[4] The original data series were re-calculated

[3] Carmichael (2009) mentioned the constitutional process of ICD.

[4] Creating "I-Classification" owes much to the great efforts of Ms. Seiko Ishitani and Ms. Wakana Baba. We wish to

based on I-Classification and the time series data set which would be applicable for long-term time series analysis were created. The database was named “CSDS-DB”[5].

II. Method of Database Construction

CSDS-DB is designed for providing of not only long-term time series data but the original statistics data, because some sorts of historical studies require the original condition of data. Especially, the term of each classification system, a classification number, Kanji character used, etc. are reserved as much as possible in the condition of original table. Moreover, the consistent expressions of relations between I-Classification Series (I-Series) and the original series are necessary. Based on such a demand, following guidelines were set up in the design process of database.

(1) To preserve the notation of the original table as exactly as possible: all detailed differences in the notation also shall be recorded.
(2) In principle, I-Series is computed from the original series by fixed procedure: the computation procedure between the original series and I-Series shall be logically defined in the database.
(3) If change of notation within the same classification system is seen frequently, it is recorded on a database as an alias.

As mentioned above, I-Series is computable from the original series. Thus, two data sets exist in CSDS-DB as independent entities;

a I-Series (Conjunct time-series) data set
This is the data set integrated and connected by I-Classification. It is divided into the three types, “Series” (a cause of death that has long-term consistency), “Semi-series” (a cause of death that has long-term consistency in a lesser degree), and “Group” (a cause of death that aggregates related diseases), with the consistency and stability. Table 1. Series, Semi-series and Groups in I-Series data setTable 1 shows Series, Semi-series and Groups are organized by I-Classification in I-Series data set.

b Original time-series data set
This is the data set which recorded the series as the original of a statistical table. It is divided into seven classification systems and compatibility is not guaranteed to the connection during a classification system.

The relation between I-Series data set and Original time-series data set is simple addition and subtraction, and processing of proportional distribution has not been performed. Most of “Series” are simply joined between each classification systems. Arithmetic operations are not needed to convert original data to “Series”. On the other hand, in the case of “Semi-series”, it is necessary to consider the consistency of causes-of-death between each classification system. In order to convert the original

express our gratitude to both people.

[5] “Cause-Specified Death Statistics Database” is available on the Internet; http://www.rekishow.org/CSDS/

data series to “Semi-series”, arithmetic operations are required. Even if the conversion was fairly operated, unresolved gaps or discontinuities exist in Semi-series. To utilize CSDS-DB, it is necessary to disclose the detailed information regarding composition of I-Series. Therefore, let us describe the composition process of major I-Series in the following section.

III. Composition of Time-series Data of Major Causes of Death

1. Cholera

Cholera was recorded as consistent categories from System I to System VII except System V. In System V, cholera was excluded from classification. Because deaths from cholera did not disappeared yet in previous years, thus it is hard to assume that cholera was controlled completely in those days. While the reason of the exclusion of cholera in System V is still uncertain, this exception might be the change of statistical policy. We integrated “Cholera” in each classification system as “Cholera Series”, and defined the data of Cholera Series in the period of System V as “not available”. (See Figure 1)

Additionally, “Kakuran” which had been recorded in the next column of “Cholera” in the original table from System I to System IV was the name of cholera-like symptoms in traditional Chinese medicine. While It is conceivable that “Kakuran” had included the deaths from cholera, we classified “Kakuran” as independent Semi-series because there were few evidence to certify the criteria between “Kakuran” and “Cholera”.

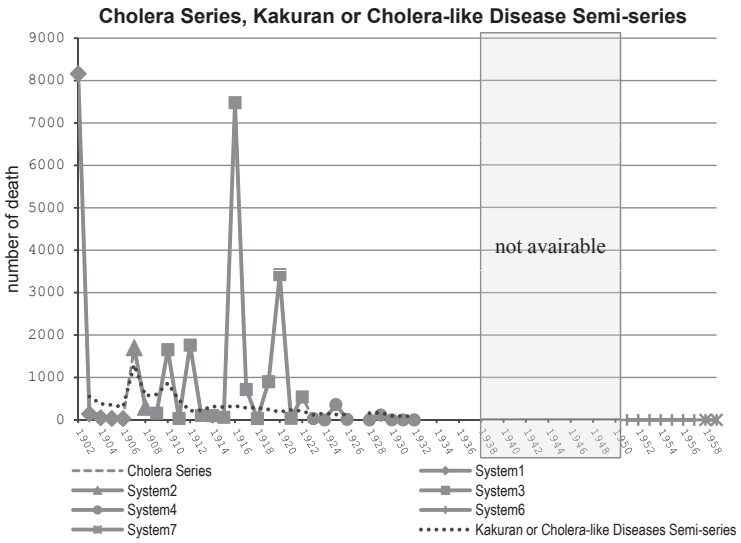

Figure 1. Composition of “Cholera Series” and “Kakuran and Cholera-like Disease Semi-series”

2. Malaria

Malaria was recorded as consistent categories from System I to System VII, thus we integrated them to “Malaria Series”. Generally Malaria in Japan, except Okinawa prefecture, was vivax malaria or

Table 1. Series, Semi-series and Groups in I-Series data set

Series	
1	Cholera
2	Plague
3	Whooping Cough
4	Smallpox
5	Measles
6	Malaria
7	Cancer
8	Influenza
9	Cirrhosis of the Liver
10	Suicide
Semi-series	
1	Kakuran or Cholera-like Diseases
2	Typhoid
3	Dysentery
4	Tuberculosis of the Organs of the Respiratory System
5	Tuberculosis, others
6	Tuberculosis, Intestinal
7	Tubercular Meningitis
8	Hansen's Disease
9	Diphtheria
10	Scarlet Fever
11	Syphilis
12	Typhus
13	Distomatosis
14	Ankylostomiasis
15	Malignant Neoplasms
16	Leukaemia
17	Benign and Unspecified Neoplasms
18	Anaemia
19	Diabetes
20	Beriberi
21	Meningitis, Others
22	Diseases of the Heart
23	Cerebrovascular Diseases
24	Pneumonia
25	Bronchitis
26	Pleurisy
27	Other Diseases of the Respiratory Organs
28	Ulcer of Stomach and Duodenum
29	Diarrhoea and Enteritis
30	Appendicitis
31	Intestinal Obstruction and Hernia
32	Peritonitis
33	Nephritis
34	Diseases of the Female Organs of Reproduction
35	Puerperal Fever and Complications of Pregnancy and Childbirth
36	Puerperal Fever
37	Chikudeki or Convulsions of Children
38	Senility
39	Poisoning
40	Deaths from External Causes
41	Total
Group	
1	Typhoid and Paratyphoid
2	Dysentery and Ekiri
3	Meningitis, Epidemic and Bacterial
4	Syphilis and Its Sequelae
5	Other Infectious and Parasitic Diseases
6	Endocrine, Nutritional and Metabolic Diseases
7	Mental and Behavioural Disorders
8	Other Diseases of the Nervous System
9	Other Diseases of the Circulatory System
10	Diseases of Stomach and the Digestive Organs
11	Diseases of the Skin, Subcutaneous Tissue, the Musculoskeletal System and Connective Tissue
12	Rheumatism
13	Diseases of the Urinary System
14	Congenital Deformity, Congenital Feebleness and Other Diseases of Infancy and Childhood
15	Deaths from Unknown or Unclear Causes
16	Deaths from Other Causes

quartan malaria. Vivax malaria was caused by infection from Plasmodium vivax and quartan malaria was caused by Plasmodium malariae. Needless to say, the vector of both Plasmodium is Anopheles. The characteristics of these types of malaria are cyclic onset of fever.

On the other hand, large part of Malaria in Okinawa was tropical malaria caused by Plasmodium falcipaum. Tropical malaria indicated higher fatality than other types in Japanese archipelago. It is fairly supposed that the description of symptoms of "Okori", the traditional name of disease which had associated cyclic fever, implied the symptoms of vivax or quartan malaria.

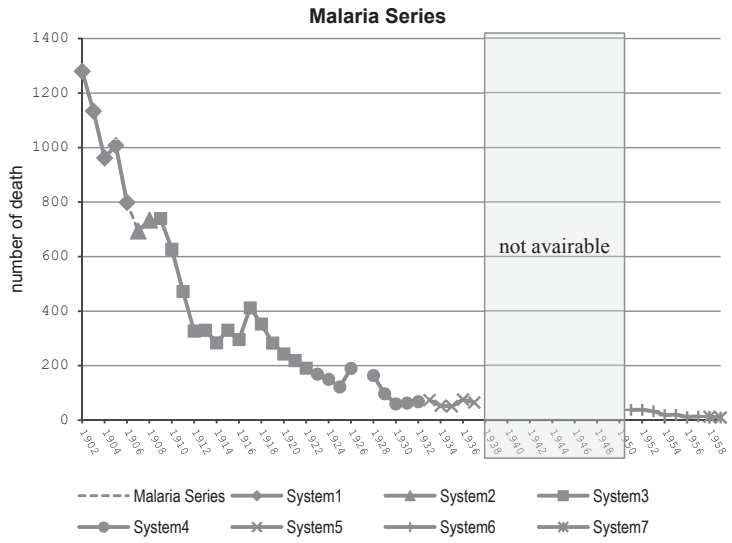

Figure 2. Composition of "Malaria Series"

3. Influenza

Influenza was recorded as consistent categories from System I to System VII. Thus, we integrated "Influenza" in each classification system as "Influenza Series". Great peaks between 1918 and 1920 were, needless to say, caused by pandemic influenza known as "Spanish Flu".

According to the "Eisei-kyoku Nenpo", the number of deaths from influenza counted approximately 220,000 during three years. However, Hayami and Kojima (2004) suggested that the actual damage of pandemic influenza might be more serious, because these statistics had been based on the formal death certificate. They assumed that a part of the number of deaths from bronchitis, pneumonia, respiratory tuberculosis, miscellaneous respiratory diseases, and unknown causes were attributed to influenza. Following the assumption, they estimated the theoretical number of deaths from influenza had been 500,000. If the estimation is appropriate, it indicates that 12% of the total deaths in three years should be identified as the impact of influenza.

4. Measles

Measles was recorded as consistent categories from System I to System VII, thus we integrated them to "Measles Series". (See Figure 4).

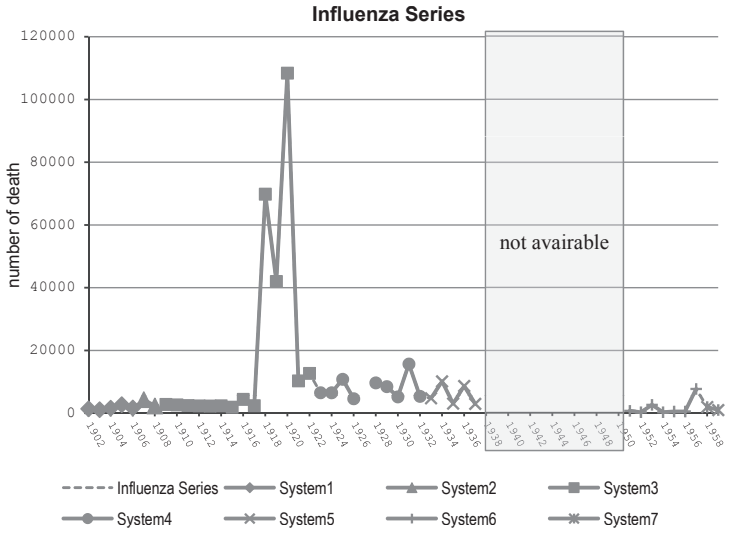

Figure 3. Composition of "nfluenza Series"

The only known host of measles' pathogen is humans and it spreads from person to person primarily by droplet infection. It is unnecessary to consider the complicated factors in the infection process because of this characteristic. Therefore, statistical data of measles is identified as a useful index for epidemiologic studies because of its simple infection mechanism.[6]

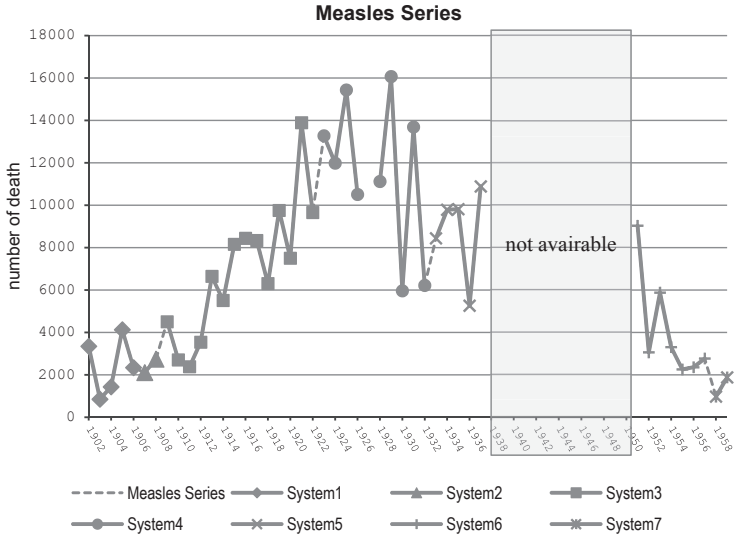

Figure 4. Composition of "Measles Series"

5. Whooping Cough

Whooping cough was recorded as consistent categories from System I to System VII, thus we

[6] Suzuki (2009) applied measles statistics to decipher the spatio-temporal structure of modern Japan by analysis of diffusion patterns of the disease.

integrated them to “Whooping Cough Series”. However, we need to pay attention to the large gap between System IV and SystemV. The number of death from whooping cough in 1933 was almost half of the deaths in 1932. Because whooping cough is an epidemic disease spreading by airborne infection, it is not curious that the number of death indicates up-and-down fluctuation. On the other hand, we cannot deny the possibility that the disorder of death statistics was caused by the differences between classification systems.

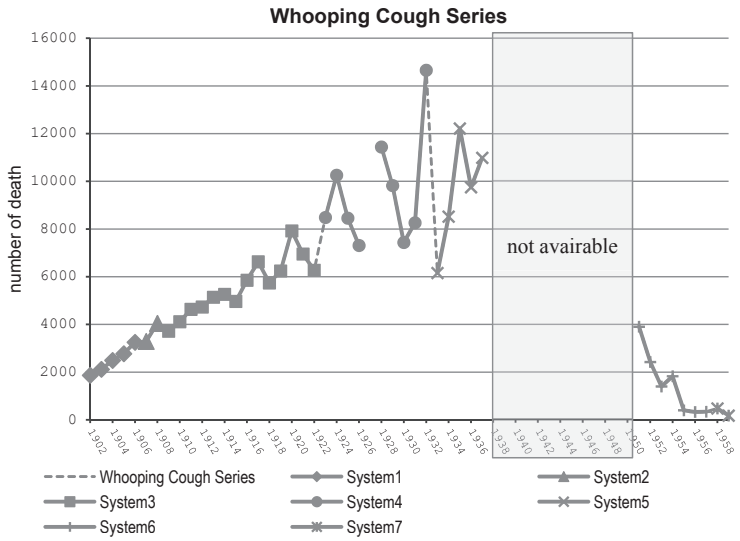

Figure 5. Composition of “Whooping Cough Series”

6. Typhoid and Paratyphoid

In the beginning of twenty first century, typhoid and paratyphoid were not identified exactly because the symptoms of both diseases were very similar. In 1907, Shiga suggested that while the pathogen of paratyphoid had been identified in 1896, the knowledge was not widespread among medical personnel[7]. Actually from System I to System III, there was no mention regarding paratyphoid. In System IV, paratyphoid was mentioned as “Typhoid Fever and Paratyphus”. We identified that “Typhoid Fever” in System I, System II, and System III included paratyphoid possibly. Thus, we integrated following categories with “Typhoid and Paratyphoid Group”: “Typhoid Fever” (System I, II and III), “Typhoid Fever and Paratyphus” (System IV), “Typhoid Fever and Paratyphoid Fever” (System V), and summation of “Typhoid Fever” and “Paratyphoid Fever” (System VI and VII).

7. Dysentery and Ekiri

The data regarding dysentery is divided into “Dysentery and Ekiri Group” and “Dysentery Semi-series” in I-Series data set. This is because there was a period which was unclear regarding the distinction of “ekiri (children’s dysentery)” and “dysentery”. Specifically, it is thought that “Dysentery”

[7] Shiga (1907), pp. 339-367.

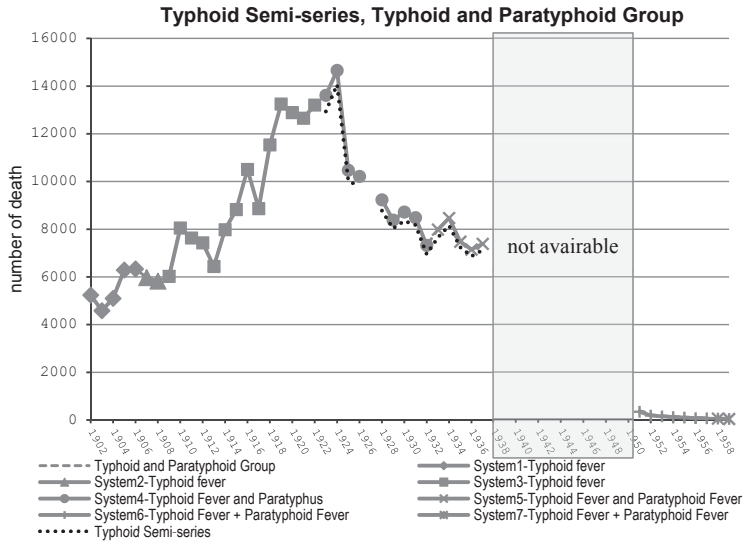

Figure 6. Composition of "Typhoid Semi-series" and "Typhoid and Paratyphoid Group"

in System I and II include ekiri. Moreover, "Dysentery and Ekiri" in System V is a sum total value of dysentery and ekiri. Also in System VI, the category of dysentery was revised as "Dysentery, all forms", therefore System V and VI are discontinuous. These causes-of-death are classified into "Dysentery and Ekiri Group" because of their discontinuity. (See red lines in Figure 7).

On the other hand, we verified that "Dysentery" in System III did not included ekiri by referring to the detailed classification of "Shiin Tokei Shusei (The Corpus of Causes-of-death)". Also "Ditto Dysentery" in System IV and V, the sum total value of "Bacillary dysentery (without symptoms of ekiri)", "Amoebiasis", and "Other protozoal and unspecified dysentery" in System VII are identified as dysentery excluding exiri. Thus, these causes-of-death are integrated to "Dysentery Seki-series", in consideration of the problem of the consistency of criteria. While we cannot acquire the independent data of dysentery in the period of 1902-1908 and 1951-1958, the data of a "Dysentery and Ekiri Group" can be used as a supplemental data.

8. Respiratory Tuberculosis

Deaths from respiratory tuberculosis were recorded as "Lung-tuberculosis" in System I, II, and III. In System IV, the classification name was changed to "Pulmonary Tuberculosis", and then changed to "Tuberculosis of the Respiratory system (including the Lymphatic gland of the trachea and bronchus)" in System V. After WWII, the name was changed to "Tuberculosis of respiratory system" in System VI and VII. The classifications above can be identified as deaths from respiratory tuberculosis commonly. Thus we integrated these classifications into "Tuberculosis of the Organs of the Respiratory System Semi-series". (See Figure 8).

Regarding the integration, there is a point which should be considered. That is a discontinuity of the number of deaths between System IV and V. Deaths from respiratory tuberculosis of all Japan. It

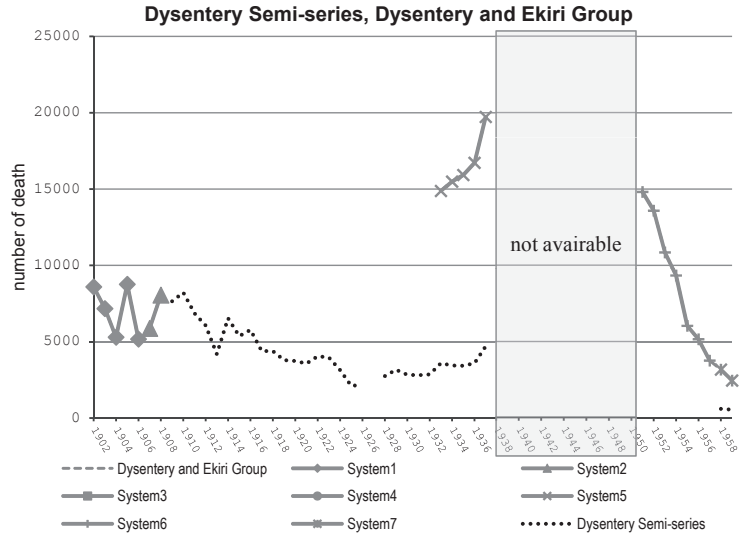

Figure 7. Composition of "Dysentery and Ekiri Group" and "Dysentery Semi-series"

counted 87,427 in 1932 and counted 93640 in 1933; the difference of both years is 6,213. It may seem as too large gap rather than average variation.

Johnstone (1995) suggested that one of possible causes of the gap between 1932 and 1933 was the governmental requirement for accurate reporting of tuberculosis. The central government distributed a pamphlet to physicians to encourage them to report cause of death with greater accuracy, in 1932 and 1937. Johnston supposed that because deaths from respiratory tuberculosis were distinguished strictly from deaths from other respiratory disease, such as pneumonia or bronchitis, the number of deaths from tuberculosis increased as a result[8]. While we cannot neglect the possibility of statistical discontinuity caused by such fluctuation in data acquisition, also cannot deny the possibility of actual increase. However, It is hard to inspect the significance of mention above because of lack of appropriate statistical data.

On the other hand, Johnstone suggested also the possibility that the changes of socio-economic conditions which had been caused by the Depression had influenced mortality transition. In this database, all of possibility above has been left for further considerations, and any adjustments or modifications have not been applied. Thus, it should be remarked that the reevaluation of data consistency might be required when using "Tuberculosis of the Organs of the Respiratory System" Semi-series.

The tuberculosis mortality fell rapidly after the pandemic influenza. It marked 185/100,000 in 1918 and then it decreased to 135/100,000 in 1924. However, after 1930, it began to increase again, and it grew steadily until the post-war era.

Shimao (2008) analyzed the tuberculosis mortality trend between two World Wars based on national

[8] Hunter (1995, 2009) also supported Johnstone's assumption.

statistics, and concluded that the decline of tuberculosis mortality rate after 1920 was aftermath of the pandemic influenza[9]. Hanashima and Tomobe (2012) examined the decline of tuberculosis mortality rate between 1918 and 1924 based on the prefectural data, and verified Shimao's assumption. A similar phenomenon was observed in United States. Noymer & Garenne (2000, 2009) examined a relationship between the influenza epidemic and the tuberculosis mortality in 1918-1920; they concluded that influenza epidemic had affected the tuberculosis patient as selection[10].

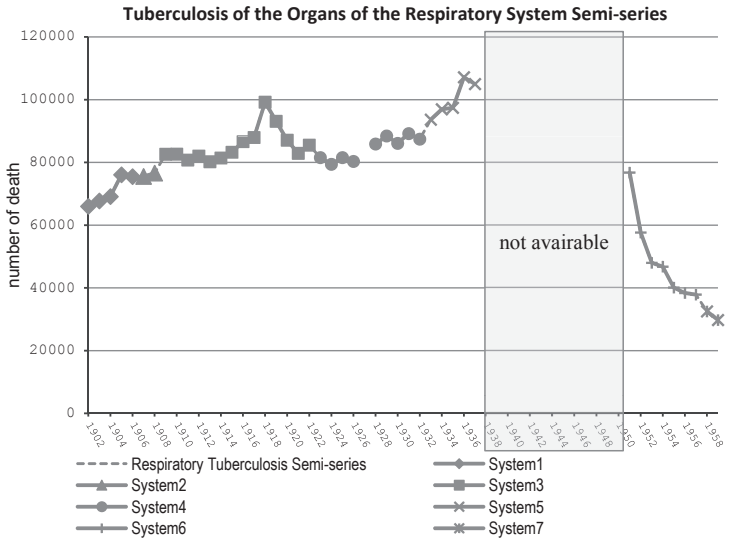

Figure 8. Composition of " Tuberculosis of the Organs of the Respiratory System Semi-series"

9. Diarrhoea and Enteritis

Diarrhea and Enteritis were recorded as "Diarrhea and Enteritis" in System I, II, III, and IV. These categories can be identified as same cause of death, thus we integrated them into "Diarrhea and Enteritis Semi-series".

In System V, since they were divided into "Diarrhea and Enteritis (under 2 Years of age)" and "Ditto (Over 2 Years of age)", we assigned the summation of both categories to "Diarrhea and Enteritis Semi-series". After WWII, in System VI and VII, the categories regarding "Diarrhea and Enteritis" were abolished according to the renovation of classification. Therefore, "Diarrhea and Enteritis Semi-series" is discontinued in 1937. (See Figure 9).

There are few inconsistencies in this semi-series, except a large gap between 1908 and 1909. As the gap is corresponding with the timing of the switch of classification, it is supposed that the gap was attributed to the change of criteria. However, the evidence which verifies the influence of the

[9] Shimao assumed that because of the large number of excess death of tuberculosis patients caused by the pandemic influenza, the death statistics decreased dramatically over several ensuing years.

[10] Although demographers' opinions are divided among on Noymer & Garenne's "Influenza-Tuberculosis selective mortality hypothesis", from historical viewpoint, there might be a considerable validity to the hypothesis.

classification switching has not been identified. In the case of using data from 1902 to 1909 of "Diarrhea and Enteritis Semi-series", the mention above has to be reminded.

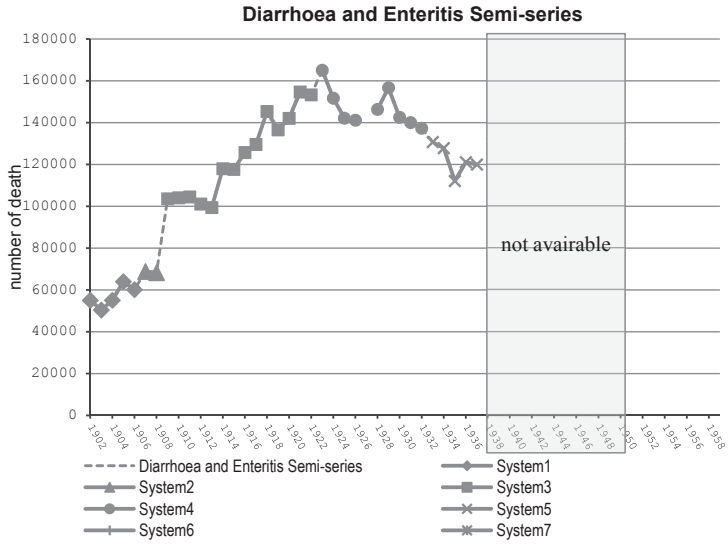

Figure 9. Composition of "Diarrhea and Enteritis Semi-series"

10. Pneumonia

Pneumonia was recorded as "Pneumonia and Broncho-pneumonia" in System I, II, III, and IV. In System V, it was recorded as "Pneumonia". After W.W.II, in System VI and VII, it was divided to "Pneumonia" and "Pneumonia of newborn"; hence, the summation of both categories can be identified as the total number of deaths from pneumonia. There was few inconsistency between the categories above, we, therefore, integrated them to "Pneumonia Semi-series".

As Figure is showing, there were great peaks between 1918 and 1920. It is supposed that these peaks were caused by influences of pandemic influenza, thus the number of deaths from pneumonia should be considered including excess deaths from influenza.

11. Meningitis

Meningitis was recorded as "Meningitis" in System I, II, III and IV, and then was recorded as "Meningitis (tuberculous meningitis excluded)" in System V. In the post-war period, in System VI and VII, it was recorded as "Meningitis, except meningococcal and tuberculous". There are few remarkable inconsistencies between the categories above. We, therefore, integrated them to "Meningitis, Others Semi-series".

While the large decrease (-14%) is observed between 1924 and 1925, we can identify the decreasing as the natural fluctuation because it had occurred in same classification system.

The remarkable characteristic of meningitis is that it was major cause of death of infants in this

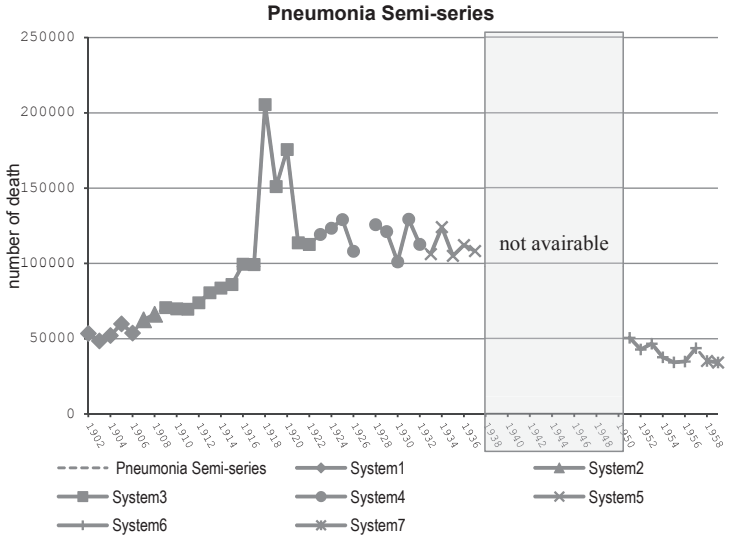

Figure 10. Composition of "Pneumonia Semi-series"

period[11]. Thus it is supposed that the decline of mortality from meningitis contributed to the decrease of infant mortality.

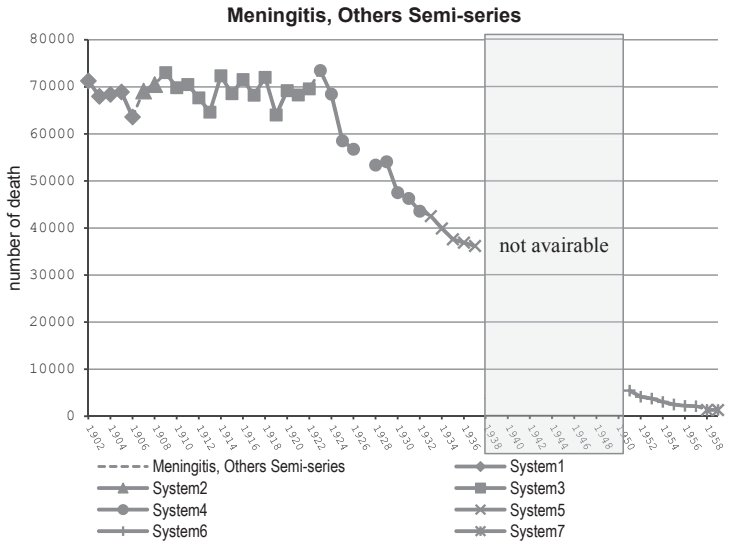

Figure 11. Composition of "Meningitis, Others Semi-series"

12. Cerebrovascular Diseases

"Congestion, Bleeding, and Softening of the Brain" in System I and II, "Bleeding, and Softening of the Brain" in System III, "Cerebral Hemorrhage and Malacia" in System IV, "Cerebral hemorrhage, Thrombosis and Embolism" in System V, and "Vascular lesions affecting central nervous system" in

[11] See Kiple ed. (1993), pp.875-880.

System VI and VII were integrated to “Cerebrovascular Diseases Semi-series”

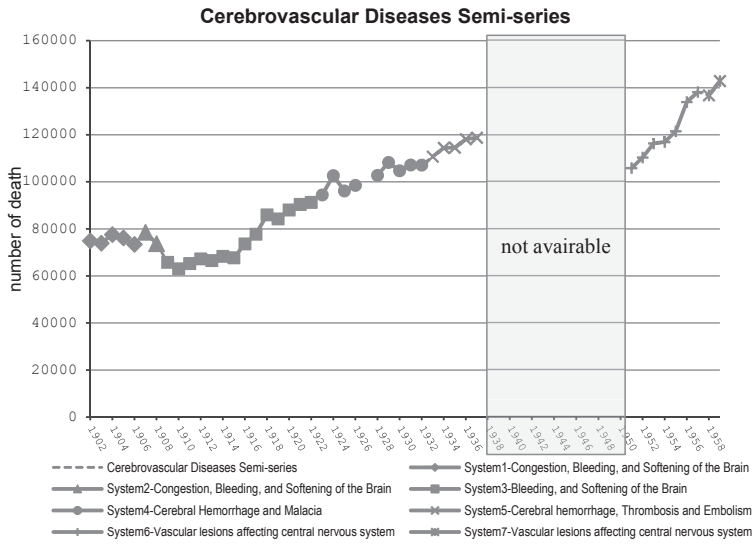

Figure 12. Composition of “Cerebrovascular Diseases Semi-series”

13. Bronchitis

Bronchitis was recorded as two categories, “Acute bronchitis” and “Chronic bronchitis”, in System I, II, III, and IV. These categories were unified as “Bronchitis” in System V and later systems.

Although “Acute bronchitis” and “Chronic bronchitis” indicated the strange transition that the value of both categories had reversed, the reason of this observation is unclear whether it was a fluctuation of the criteria or actual transition. Thus we selected the summation of both categories instead of each as “Bronchitis Semi-series”.

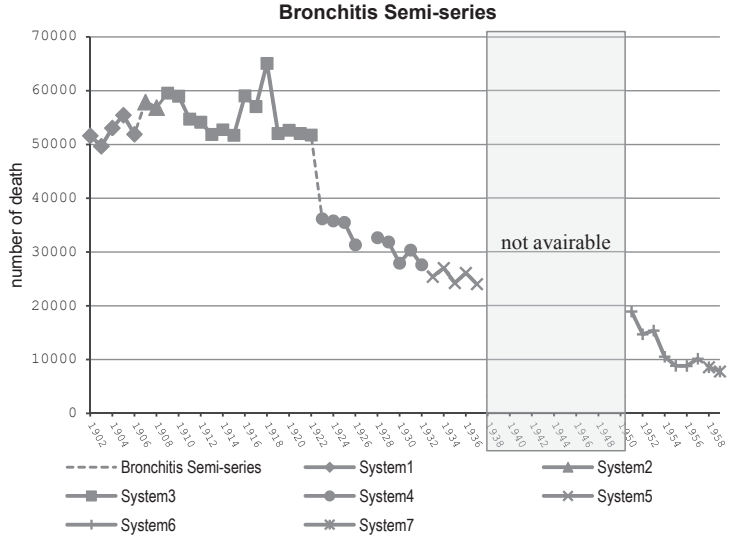

Figure 13. Composition of “Bronchitis Semi-series”

14. Beriberi

Beriberi was recorded from 1902 to 1957 continuously. In System VII, beriberi was omitted from the causes of death, therefore no death from beriberi was counted in 1958 and 1959. Since no change of category took place through the statistical period, all data were integrated to one series. However, we classified beriberi as “Beriberi Semi-series”, not series, because the consistency was suspicious so that the data from 1902 to 1937 fluctuated wildly.

Beriberi is a disease caused by dietary condition, especially lack of thiamin (vitamin B1). In Japan, this disease spread mainly in urbanized areas, associated with the polished-rice diet. Also, the soldiers of Japan Imperial Army and Navy suffered from beriberi; therefore to elucidate the cause of beriberi was the high-priority issue for the government. While the cause of beriberi was almost determined in middle of the 1920’s by contribution of the pioneering research of Umetaro Suzuki, the curative medicine was not established until the 1930’s.

Considering these historical facts, it is supposed that the fluctuation between 1926 and 1928 was caused by the development of diagnostics. Therefore, the decline trend after 1928 is more reliable than other fluctuation observed before 1926. In the circumstance of beriberi that has been mentioned above, the deaths from beriberi was one of remarkable indicator of living condition, especially dietary life of people. Higami and Tomobe (2013) suggested that the decline of the deaths from beriberi fairly related to the infant mortality rate and the changes of living conditions of young mothers, in their research regarding the infant mortality in Osaka City.

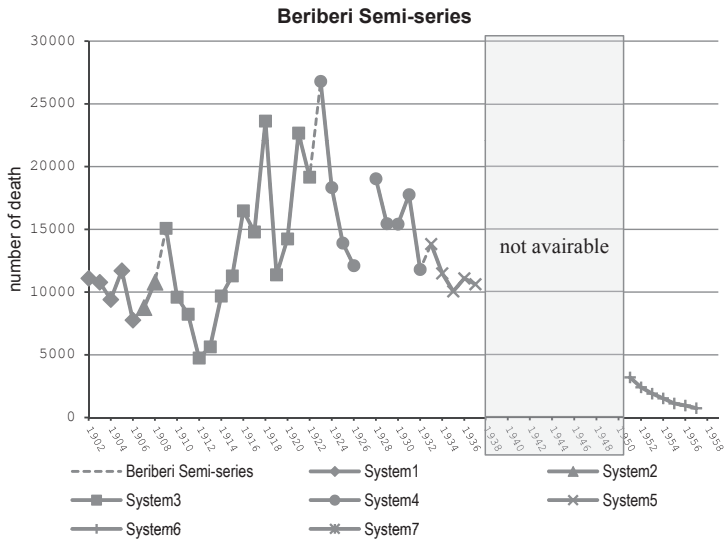

Figure 14. Composition of “Beriberi Semi-series”

15. Typhus

“Typhus fever” in System I, “Typhus” in System II, “Typhus” in System III, “Exanthematous Typhus” in System IV, and “Typhus” in System V was integrated to “Typhus Semi-series”. “Typhus and other rickettsial diseases” in System VI and VII which included “Tsutsugamishi and other mite-borne

typhus" also was joined to "Typhus Semi-series".

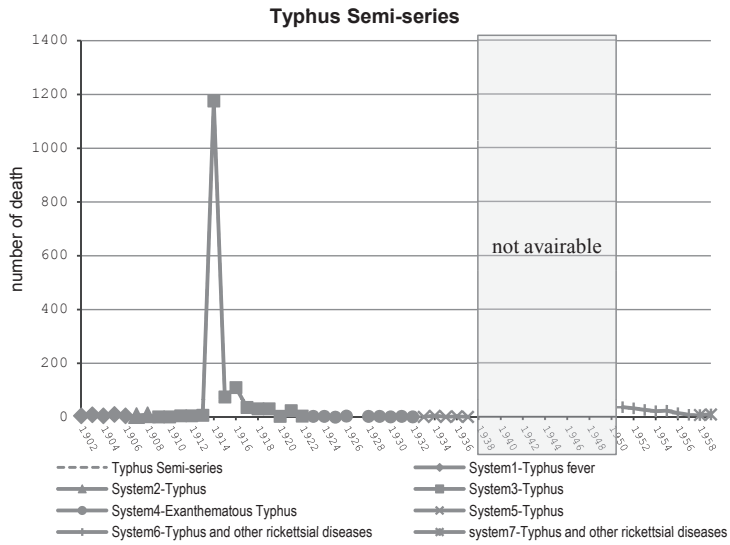

Figure 15. Composition of "Typhus Semi-series"

IV. Epidemiologic Transition and Causes-of-Death

The epidemiologic transition proposed by Omran (1971) is a useful framework for examination regarding relationship between diseases and population dynamics.

> "Conceptually, the theory of epidemiologic transition focuses on the complex change in patterns of health and disease and on the interactions between these patterns and their demographic, economic and glaciological determinants and consequences."[12]

As Omran has mentioned, the basic concept of epidemiologic transition is constructed from propositions as follows:

(1) The theory of epidemiologic transition begins with the major premise that mortality is a fundamental factor in population dynamics.

(2) During the transition, a long-term shift occurs in mortality and disease patterns whereby pandemics of infection are gradually displaced by degenerative and man-made diseases as the chief form of morbidity and primary cause of death.

(3) During the epidemiologic transition the most profound changes in health and disease patterns obtain among children and young women.

(4) The shifts in health and disease patterns that characterize the epidemiologic transition are closely associated with the demographic and socioeconomic transitions that constitute the modernization complex.

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[12] Omran (1971).

(5) Peculiar variations in the pattern, the pace, the determinants and the consequences of population change differentiate three basic models of the epidemiologic transition: the classical or western model, the accelerated model and the contemporary or delayed model.

Omran has sorted Japan as the "Accelerated Model" in the paper, according to the fact that the decreasing of Japanese mortality had progressed after WWII dramatically as follows; "the period taken for mortality to reach the 10 per 1,000 level was much shorter than that for the classical model". While his mention mainly focuses on the rapid decrease of mortality in the post-war period in Japan, this trend had already begun in the inter-war period also.

The time-series trend of Japanese mortality rate (crude death rate) in the pre-war period indicates two distinct peaks in 1918 and 1920. Needless to say, these peaks were caused by the pandemic influenza. (See Figure 16. Mortality rates form major causes-of-death, all Japan, 1902-1937) From 1918 to 1920, Pandemic influenza descended on Japan, and it brought extensive damage to everywhere in Japan.

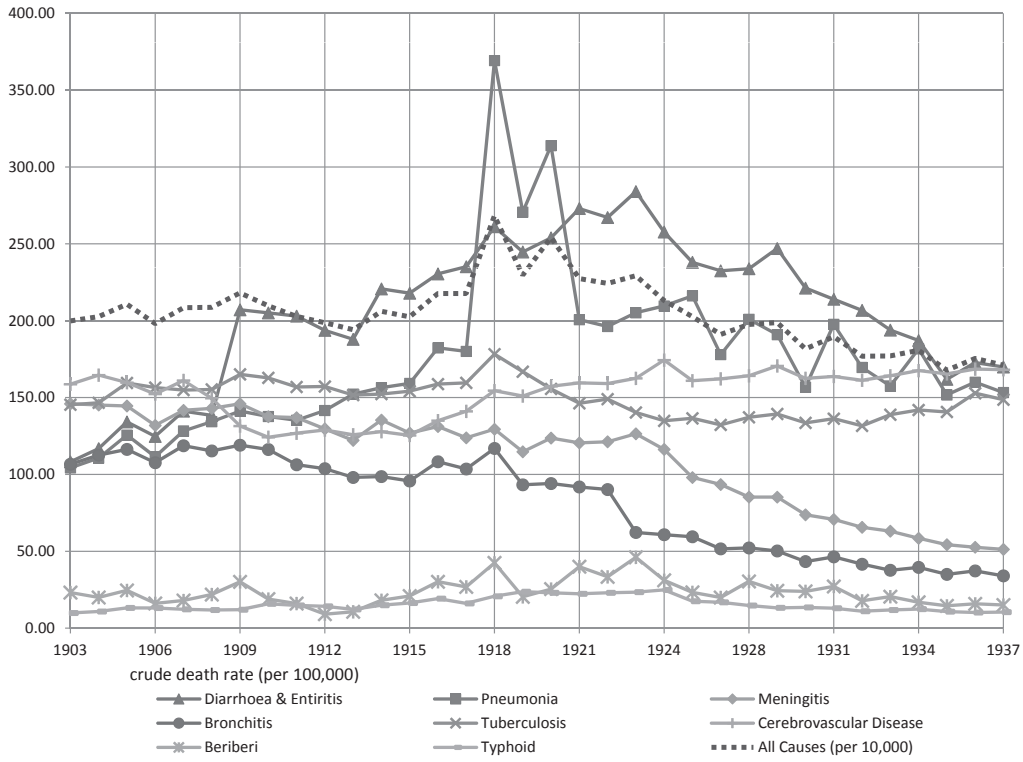

Figure 16. Mortality rates form major causes-of-death, all Japan, 1902-1937

Figure 16 shows crude death rates (per 100,000) of major causes-of-death from 1903 to 1937. The dark-dotted line indicates the total mortality rate (per 10,000) of all causes. In this period, more than forty percent of Japanese causes-of-death had been accounted by pneumonia, bronchitis, meningitis, cerebrovascular disease, diarrhoea & enteritis. Those major diseases had indicated almost same mortality rate in 1903; however, these causes of death showed different trends each other later.

Mortality rates of bronchitis and meningitis descended continuously. On the other hand, mortality rates of pneumonia, diarrhoea and enteritis rose until early the 1920's in contrast. Also, meningitis and tuberculosis indicated same mortality rate in 1903. Meningitis mortality descended continuously; on the other hand, tuberculosis mortality rose until 1918, and descended until 1924, then rose again during World War II. Obviously, the time-series trends of mortality rates were different with causes of death; therefore it is not easy to measure the contribution of each cause to the overall time-series change of mortality.

According to the statistical observations which have been mentioned above, it can be fairly assumed that the first epidemiological transition of Japan began in the inter-war period. The transition was not so drastic like the decline in the post-war period, but it suggests that the remarkable changes of nation's health have occurred in this period. During the inter-war period, the medical technology was in development phase; antibiotics had been invented but had not been diffused yet. Consequently, there were few diseases which have been controlled in Japan. Therefore, it is supposed that rather than medical technologies, the multiple impacts of various socio-economic factors, such as nutrition status, public hygiene, sanitary education, living environment, and labor conditions contributed to the epidemiologic transition. Moreover, the regional differences of socio-economic conditions might have influenced the transition process[13]. We believe that the research on the regional cause-of-death statistics will unveil the interrelations between epidemiologic transition and socio-economic changes of modern Japan. This is an open issue which should be considered in further discussion.

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[13] See Taeuber (1958), pp.284-309.

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