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Japan’s venereal disease (VD):the effect of the morbidity
on indexes of infertility and fertility
in modern Japan: the case of Gunma prefecture, 1910s-20s

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A geographical and statistical analysis of “*Karyu-byo*”, Japan’s venereal disease (VD):
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Abstract

This paper analyzes the VD effect on fertility based on the village and town data in Gunma prefecture from 1910s to 1920s investigated by the bureau of public health and hygiene in the Ministry of Home Affairs (MHA). Gunma prefecture was the pioneer where the Japan’s licensed prostitute system was earliest abolished in 1893. Beside it, however, the private prostitute system called “*Kashi-zashiki*” prevailed into the whole area of Gunma prefecture by the Taisho period, ca.1910s. The prostitute system in the modern Japan encountered the socioeconomic change derived from both urbanization and factory industrialization, which was stimulated by the state policy and the problem of population increase happened in the north-eastern Japan since the late 19th century.

Keywords: Sexually Transmitted Disease; Syphilis; Infertility; Stillbirth; Miscarriage; Fertility

JEL classification: I15, N35, N55, N95, R12

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Introduction

During the recent decade, many social historians of medicine and gender have been fruitfully arguing in the global perspective the relationship between the treatment of venereal disease (VD) and the social perception of the patients especially since late nineteenth century¹. Usually, many of them were censured for women's engaging in the unwelcome occupation such as prostitution and men's immoral sexual behavior with prostitutes². Until now, the historical issue has been making sense both in the historian's world and the ordinary people's life as long as not only the traditional VD such as syphilis but the HIV is spreading to people widely and rapidly especially in the developing world.

Beside the historical and contemporary concern, there remains the important issue in the historical demography researchers have to resolve or explain. Recently, E. A. Wrigley, one of the worldly famous pioneers in the historical demography, gave us the important chance to think about why the marital fertility of early modern England and Wales had been kept moderate compared with other European countries³. On the basis of robust statistics of micro-demography by the family reconstitution, he explained the rise of marital fertility started from the middle nineteenth century in England and Wales by the decline of infertility, especially stillbirth which was partly but strongly got rid of by the rise of standard of living⁴. Although he hardly clarified the mechanism itself of making the fertility level moderate, his suggestion shed lights on the missing link between demography and physiology, which is becoming barely complicated at last.

The situation of Japan's historical demography looks like somewhat different. Originally, as you know, the data derived from Tokugawa Japan's 'parish register', *Shumon-Aratame-Cho*, is very delicate for the micro-analysis of fertility because most of infant death were missed there. Beside the deficiency, the interest of historians and demographers in Japan, so far, has been hardly directed to the interdisciplinary research area such as the collaboration of demography and epidemiology, physiology and medicine. Due to the few micro-analysis on Tokugawa 'estimated' fertility, the level of 'estimated' marital fertility was rather moderate, which ranged from 2.44 to 7.33 in TMFR, compared with that of the contemporary England and Wales⁵. In the Tokugawa period, the eastern Japan had rather lower

¹ For the case of the perception to the VD patients among urban poor in London, see Siena [2004].

² The Social History of Medicine organized the conference concerned to the topics. See, Davidson and Hall[2001], De Vries[2001], and Aisenberg[2001].

³ Wrigley[2004] gave us many analytical issues remained in the field of British historical demography. Especially, Wrigley[2004/1998] pinpointed the issue of infertility in England and Wales.

⁴ Wrigley, *ibid*.

⁵ See Tomobe[2001].

TMFR mainly due to the parity-specific fertility control while the rest of Japan had the similar shape of age-specific natural fertility schedule even with moderate level of TMFR⁶. It is the very question demographers/historians have to reply why the level of fertility was so moderate even in the area where the parity specific control had little been done. Demographers and historians have to inquiry not only the proximate determinants but the physiology of fertility based on the epidemiological statistics. As MAP1 shows, among many diseases suppressed fertility in Japan, “*Karyu-byo*”, the Japanese name of VD such as syphilis, gonorrhea and chancroid, was the most influential before the establishment of the prevention act for VD in 1927⁷.

Most recently, Kenichi Tomobe described the detail story of the spread of syphilis and the relationship between the arsenic compound and the disease happened around the end of Edo-period in the Osaka-area⁸. It is famous an arsphenamine, named Salvarsan developed by Dr. Sahachiro Hata and Dr. Paul Ehrlich, had partially effect on the treatment of the disease until the appearance of penicillin founded out by Dr. Alexander Fleming, 1928. Before the year, in Japan at least since the 18th century around Kyoto and Osaka medical doctors frequently utilized something arsenic at the case of syphilis treatment. Surprisingly, ordinary syphilis patients of the Edo period had been familiar with using something arsenic as a medicine against the disease.

[MAP 1]

Based on the aggregate data of physical examination for conscription in Gunma prefecture, especially the morbidity of VD at aged 20 during the Taisho period, this paper, first, investigates statistically the relationship between the morbidity of VD at aged 20 of male populations and some indices of fertility, infertility such as stillbirth, and infant mortality. The knowledge of the relationship certainly much contributes to the promotion of the physiological and epidemiological research on fertility and infertility both in the early modern and modern Japan. Second, through using the tools of historical GIS, this paper shows the diffusion mechanism of VD during the Taisho period in Gunma prefecture. Especially, it sheds lights on the interrelationship between the institutional change of Japan’s traditional prostitute system, the socioeconomic transition such as urbanization and factory industrialization, and the militarization.

1. Data and Sources

⁶ See Tomobe[forthcoming].

⁷ For example, Yamamoto[1983].

⁸ See Tomobe[2017].

It is well known among Japanese people VD such as syphilis, gonorrhea, and chancroid were distributed all over the country through the Japan's licensed prostitution from the Meiji period to the WWII⁹. The same situation can be extended to the Tokugawa period¹⁰. As we imagine that Tokugawa peasant men went to the area of licensed/private prostitute in the city and back to village with VD, probably many peasant women also infected with them. The infected pregnant women frequently led to stillbirth and spontaneous abortion. This resulted in the lower fertility of infected couples, and higher infant mortality. This paper analyzes the mechanism of VD effect on fertility based on the village and town data in Gunma prefecture around 1910s to 1920s investigated by the bureau of public health and hygiene in the Ministry of Home Affairs (MHA).

Gunma prefecture was the pioneer where the Japan's licensed prostitute system was earliest abolished in 1893. Beside it, however, the private prostitute system called "*Kashi-zashiki*" prevailed into the whole area of Gunma prefecture by the Taisho period, ca.1910s. The prostitute system in the modern Japan encountered the socioeconomic change derived from both urbanization and factory industrialization, which was stimulated by the state policy and the problem of population increase happened since the late 19th century. The Gunma prefecture already abolished the licensed prostitute had to react by herself to such a big transformation without the strong assistance from the Japan's national government. As a result, no matter whether public prostitute or private prostitute (*Kashizashiki* and *Ryoriten*), the VD in Gunma prefecture was diffused more widely and frequently at least during the Taisho period.

Within the overcrowded army camps, both the VD and the Sexually Transmitted Disease (STD) are the most dangerous chronicle disease once someone transmits them. In Japan's military history, the physical examination of conscription was compulsorily enforced to the entire applicants at aged 20 since the amendment of the conscription act in 1889. At the same time, the medical check of VD was also introduced there. Basically, applicants at the draft age had to be checked at the local conscription office where they were legally domiciled. But when they stayed outside, they could do just the physical check there. So, it is reasonable that most of applicants at the conscription examination were permanent resident around the local conscription office. The department of public health and hygiene at the MHA directed local officers to edit the local VD statistics at aged 20 investigated at the conscription exam and to report the current condition of local VD. Among them the village/town level documents edited by Otsukuma Takagi, an engineering officer of the MHA were the most valuable. Except the case of Gunma, there remained three prefectures (Saga, Kagoshima, and Tokushima) statistical researches on VD and trachoma, but which were based on not village/town but county (gun)

⁹ *ibid.*

¹⁰ See Kariya[1993].

level data at best.

The demographic data since the early Meiji period had also some difficulties as well as the Tokugawa era. As well known, the deficiency of infertility data such as stillbirth and infant death was evident until the enforcement of burial and graveyard act in 1884¹¹. After the year, the number of missing babies and fetal death had been smoothly diminishing. As for the period this paper researches, the reliability of stillbirth, infant mortality, moreover fertility was almost guaranteed. But what the biggest issue for the effect of VD on demographic indices during the Taisho period is Japan was just before the demographic transition especially concerning the infant mortality. This paper utilizes infant mortality rates based on village/town data in 1933, but regrettably the year was in the middle of the drastically declining process of infant mortality in Japan. Concerning stillbirth or fetal death, Gunma prefecture started declining since 1900s as well as the whole of Japan while it shows us the rate was rapidly increased in later 1940s and early 1950s¹². The reason is little sure here, but probably to some extent the enforcement of the Eugenic Protection Law contributed to it.

It is also little easy to collect village/town level demographic indices from 1910s to 1920s in Japan. Concerning to village/town level data, we can utilize the case of stillbirth and fertility in 1925 and 1933, and infant mortality just in 1933 while county level data of stillbirth and fertility are available from 1912 to 1924 every year in the Gunma Statistical Table. Among them, the data of village/town level infant mortality in 1933 came from the research conducted by the Imperial Gift Foundation Aiiku Association for Maternal-Child Health and Welfare, which jurisdiction was transmitted to the Ministry of Health and Welfare (MHW) and the new version of the demographic data was published in 1938 under the name of the editor of the Social Department in the MHW¹³.

3. Results

- 1) Relationship between the morbidity of VD, stillbirth, fertility, and infant mortality in the Taisho
Gunma: County-level statistical analysis

Diagram 1-6 shows the scattered plots of these variables on the county level. Due to the observation of the Diagrams, first, we can show the positive relationship between the morbidity rate of VD among aged 20 men and the stillbirth rate based on the county (gun) level data summed up village and town's data during the Taisho period, ca.1910s-1920s, which is no statistically significant. It means the county

¹¹ Takase[1991].

¹² see the Ministry of Health, Labor and Welfare provides us the digital data of fertility, fetal death and infant mortality and shows the time-series diagram of them on the Home page.

¹³ See Aiikukai[1934-36]

where adult men aged twenty were infected more frequently by VD had higher incidence of peasant women's stillbirth and miscarriage. Due to our speculation, peasant men infected at the prostitute houses came back to their original village, and transmitted the diseases to their wives¹⁴. The venereal diseases such as syphilis and gonorrhea, especially, resulted in the higher frequency of miscarriage, spontaneous abortion, and stillbirth.

[Diagram 1-6]

Second, it is very likely that the damage from the venereal diseases on growing embryo and fetus suppresses the peasant couples' fertility. We cannot know in detail from historical documents about the mechanism by which peasant couples kept their fertility lower. What we have to remember here was that Taisho Japan, ca. 1920, had much higher percentage of childless couples for 5 years who didn't practice intentional birth control at all compared with the contemporary historical Europe¹⁵. Dr. Louis Henri, one of founders of modern demography in France, was very surprised to hear the fact but he could not find the mechanism at last. The higher rate of morbidity of VD made a great contribution to the lower level of fertility in Japan, and one of the causes is, probably, the distribution of VD, especially syphilis and gonorrhea in Japan. It also lasted from the Tokugawa era. Diagram1-6 show the relationship between the morbidity of VD at aged 20 and the ratio of number of birth to 100 people in Gunma. The latter is the proxy of fertility. We can see the negative relationship between them, which is statistically significant at almost cases in Table 1.

[Table 1]

Last, we discuss the relationship between morbidity of venereal diseases and infant mortality rate. At the case of modern Japan, we have no village/town level data of infant mortality until 1933 when the Imperial Gift Foundation *Aiiku* Association for Maternal-Child Health and Welfare, *Onshi-zaidan Boshi Aiiku-kai*, investigated and gathered the data of infant mortality, stillbirth, and fertility from every village and town in Japan. It shows the positive relationship between the cumulative morbidity rate of venereal diseases from 1912 to 1924 and the infant mortality in 1933, but which is not statistically significant.

2) Relationship between the morbidity of VD, stillbirth, fertility, and infant mortality in the Taisho Gunma: village/town-level statistical analysis

This section shows the result of the statistical analysis based on village/town level data of both the

¹⁴ Kariya[1993].

¹⁵ See Okazaki[1951]

morbidity of VD and demography. In Gunma prefecture, the public licensed prostitute system had been abolished earliest in Meiji Japan. Soon later, the private prostitute house, *Kashizashiki* or *Ryoriten*, however, was introduced there¹⁶. Especially, after the year when the act for restaurant and rental room was made in 1912, the private prostitute was divided into the two types, *Koshu-Ryoriten* and *Otsushu Ryoriten (OR)*. The former refers the higher rank of restaurant where the *geisha* served alcoholic beverages and the latter the lower rank of restaurant where ladies except *geisha* served them and became a prostitute with higher probability there. Inevitably, the latter became more popular among the male people in the Taisho Gunma. MAP2&3 shows the distribution of OR and the corresponded morbidity of VD and the various demographic indexes such as fertility and stillbirth.

[MAP 2&3]

Therefore, first, the village/town where *OR* was located is controlled in the regression as dummy variable, and second, the number of *OR* in the specified village/town is taken as one explanatory variable there. The results in Panel A in Table 2 show both of β s, standardized partial regression coefficient, of fertility and stillbirth in 1933 are statistically significant at lower p -value¹⁷. In this paper the reason why the stillbirth data in 1933 fits better than that of 1924 is little resolved¹⁸. Because the size of stillbirth is originally rather small compared with that of birth or infant death, the fitting of the regression is becoming somewhat unstable. There is also the possibility that the effect of establishing the *OR* system put into in 1912 made to some extent an accumulative contribution to the stillbirth rate by 1933.

[Table 2]

Second, the direct effect of the *OR* system in Gunma is presented at the Panel B in Table2. As the prostitute index is taken into the regression as a dummy variable, the village/town where OR located has the positive correlation to the morbidity of VD with statistical significance. The location of *OR* was also very closely related to the location of place where population density was higher and there were traditional inns inherited from the Tokugawa era along the main road. Concerning these factors, the next section in this paper is analysing them. Anyway, the *OR* system in the Taisho Gunma was the most effective and important institution by which VD was distributed into there.

3) The geographical distribution of morbidity of VD and the relationship to the demographic indices in the Taisho Gunma: village/town level analysis

¹⁶ See Yamamoto[1983] and Takagi[1925/1997-200].

¹⁷ The value of β means the elasticity of the explanatory variable to the dependent one.

¹⁸ The same result is coming from the regression analysis both in the case of Kagoshima and Saga prefecture.

In this section, we measure the effect of VD on demographic indices by shedding lights on the geographical distribution in Gunma prefecture. In general, VD was mostly transmitted by prostitutes. Since the Tokugawa period, prostitutes in Japan usually did their business at inns along the main road and in amusement places such as specific prostitute towns and hot spring spots¹⁹. After the year Gunma prefecture abolished the licensed prostitute system in 1893, they gathered to the special purpose Japanese restaurant, *Ryori-ten*, scattered through the whole of the prefecture. The venereal diseases, VD, were distributed through them to rural areas and other prefectures. In the paper, the effect of the development of railroad is not considered because around 1920s it had no strong effects on the capacity of transportation, especially human migration in Gunma prefecture.

Map4&5 show the relationship between the geographical distribution of morbidity of VD and the points of hot spring and the routes of main roads, *Nakasendo* and *Mikunikaido* in Gunma prefecture during the Taisho period, which still continued to be since the Tokugawa era. In Maps, the difference of color/color graduation depends on the extent of morbidity rate of VD by village and town used in the above analysis. We can evidently see the close relationship between the road routes, hot-spring points and the morbidity rate of VD. It means many prostitutes gathered in some amazing spots such as hot spring and inns along the main roads.

[Map4&5&6]

Map4&5 also show the geographical distribution of inn along the main roads and the distribution of morbidity of VD in Gunma prefecture. There were two main roads, *Nakasendo* and *Mikuni-kaido*, routed in Gunma prefecture in the Taisho period. The *Nakasendo*, one of five main roads since the Tokugawa period, pulled much more people than the *Mikuni-kaido*, and then many inns and specific prostitute houses gathered along it. The VD were also scattered more densely through the *Nakasendo* than the *Mikuni-kaido*. The result of the regression analysis at Panel C in Table 2 also presents there is the negative correlation between the distance from *Nakasendo* and village/town with statistical significance. Beside the transportation routes, needless to say, the location of the Japanese restaurant, *Ryori-ten*, made a great contribution of the geographical distribution of VD in the Taisho Gunma. But above mentioned, there is no doubt the location of OR was closely related to the condition how many people gathered or currently resident there. MAP6 also confirms the positive correlation ship between the morbidity of VD and the population density in the Taisho Gunma. This consideration leads us to the hypothesis that there was very close correlation between human migration, the location of OR, and the geographical distribution of VD in the Taisho Gunma.

¹⁹ Kariya[1993].

4). The geographical distribution of morbidity of VD and the human migration in the Taisho Gunma: village/town level analysis .

Because VD are one kind of STD, human migration has the decisive effect on the distribution of them. The years, 1910s to 1920s, this paper covers was in the middle of the stage of socio-economic great transformation such as urbanization and factory industrialization in Japan. Accordance with the process, certainly the size and frequency of human migration was becoming much bigger and higher in the Taisho Gunma. What distinguished the traditional market economy of the Tokugawa period with the modern one with the factory industrialization was that the traditional economy and society in the Tokugawa period was mainly stimulated not by the goods movement but the human movement. The socio-economic situation of the Taisho Gunma, if anything, was similar to that of the Tokugawa era rather than that of factory industrialization. MAP7 clearly presents the positive correlation between the human migration rates, net migration and gross migration, and the population density.

[MAP7]

Panel D in Table 2 presents the positive effect of gross and net migration on the distribution of morbidity of VD, in which the β of the net was bigger than that of the gross migration. In general, VD is distributed more frequently in the places which are densely populated and voluminously migrated while VD in the Taisho Gunma had the tendency that the patient brought into the village from outside. Next, Table 3 shows the results of regression analysis for the effect of migration and OR on the VD morbidity. The one case of regression calculates the effect of OR as one dummy variable while the other treat the number of OR in village/town as explanatory variable. Concerning the type of migration, Table 3 also handles both the case of gross migration and net one. Except the two cases of OR as dummy variable, we can get the statistically robust values of β . This result teaches us each OR functions very well as a transmitted center of VD in the Taisho Gunma. Although Gunma prefecture abolished the public licensed system of prostitute earliest in the Meiji Japan, many private prostitute houses, OR, carried out the function of distribution of VD there at least during the Taisho period.

[Table 3]

Concluding Remarks

1: The interest of historians and demographers in Japan, so far, has been hardly directed to the interdisciplinary research area such as the collaboration of demography and epidemiology, physiology

and medicine. Due to the few micro-analysis on Tokugawa 'estimated' fertility, the level of 'estimated' marital fertility was rather moderate compared with that of the contemporary England and Wales. In the Tokugawa period, the eastern Japan had rather lower TMFR mainly due to the parity-specific fertility control while the rest of Japan had the similar shape of age-specific natural fertility schedule even with moderate level of TMFR. It is the question demographers/historians have to reply why the level of fertility was so moderate even in the area where the parity specific control had little been done. Demographers and historians have to inquiry the physiology of fertility based on the epidemiological statistics. Among many diseases suppressed fertility in Japan, "*Karyu-byo*", the Japanese name of VD such as syphilis, gonorrhea and chancroid, was the most influential before the establishment of the prevention act for VD in 1927.

2: This paper analyzes the mechanism of VD effect on fertility based on the village and town data in Gunma prefecture around 1910s to 1920s investigated by the bureau of public health and hygiene in the Ministry of Home Affairs (MHA). Gunma prefecture was the pioneer where the Japan's licensed prostitute system was earliest abolished in 1893. Beside it, however, the private prostitute system called "*Kashi-zashiki*" prevailed into the whole area of Gunma prefecture by the Taisho period, ca.1910s. The prostitute system in the modern Japan encountered the socioeconomic change derived from both urbanization and factory industrialization, which was stimulated by the state policy and the problem of population increase happened since the late 19th century. The Gunma prefecture already abolished the licensed prostitute had to react by herself to such a big transformation without the strong assistance from the Japan's national government. As a result, no matter whether public prostitute or private prostitute (*Kashizashiki* and *Ryoriten*), the VD in Gunma prefecture was diffused more widely and frequently during the Taisho period.

3: The demographic data since the early Meiji period had also some difficulties as well as the Tokugawa era. As well known, the deficiency of infertility data such as stillbirth and infant death was evident until the enforcement of burial and graveyard act in 1884. After the year, the number of missing babies and fetal death had been smoothly diminishing. As for the period this paper covers, the reliability of stillbirth, infant mortality, moreover fertility was almost guaranteed. This paper utilizes infant mortality rates based on village/town data in 1933, but regrettably the year was in the middle of the drastically declining process of infant mortality in Japan. Concerning stillbirth or fetal death, Gunma prefecture started declining since 1900s as well as the rest of Japan while it shows us the rate was rapidly increased in later 1940s and early 1950s. The reason is little sure here, but probably to some extent the enforcement of the Eugenic Protection Law contributed to it.

4: As for the relationship between the morbidity of VD, stillbirth, fertility, and infant mortality based on the Gunma county-level data, first, we can show the positive relationship between the morbidity rate of VD among aged 20 men and the stillbirth rate, which is no statistically significant. Second, Diagram1-6 show the relationship between the morbidity of VD at aged 20 and the ratio of number of

birth to 100 people in Gunma. The latter is the proxy of fertility. We can see the negative relationship between them, which is statistically significant at almost cases in Table 1.

5: Concerning to the relationship between the morbidity of VD, stillbirth, fertility, and infant mortality in the Taisho Gunma based on the village/town-level data, first, the village/town where *OR* was located is controlled as a dummy variable in the regression, and second, the number of *OR* in the specified village/town is taken as one explanatory variable there. The results in Panel A in Table 2 show both of β s, standardized partial regression coefficients, of fertility and stillbirth in 1933 are statistically significant at lower *p*-value. Second, the direct effect of the *OR* system in Gunma is presented at the Panel B in Table2. As the prostitute index is taken into the regression as a dummy variable, the village/town where *OR* located has the positive correlation to the morbidity of VD with statistical significance.

6: As for the GIS of *Karyu-byo*, Map4&5 show the positive correlation between the geographical distribution of morbidity of VD and the place points of hot spring and the routes of main roads, *Nakasendo* and *Mikunikaido* in the Taisho Gunma, which still continued to be since the Tokugawa era. The *Nakasendo*, one of five main roads since the Tokugawa period, pulled much more people than the *Mikuni-kaido*, and then many inns and specific prostitute houses gathered along it. The VD were also scattered more densely through the *Nakasendo* than the *Mikuni-kaido*. The result of the regression analysis at Panel C in Table 2 also presents there is the negative correlation between the distance from *Nakasendo* and village/town with statistical significance. Beside the transportation routes, needless to say, the location of the Japanese restaurant, *Ryori-ten*, made a great contribution of the geographical distribution of VD in the Taisho Gunma.

7: Concerning to the geographical distribution of morbidity of VD and the human migration in the Taisho Gunma, Because VD are one kind of STD, human migration has the decisive effect on the distribution of them. Panel D in Table 2 presents the positive effect of gross and net migration on the distribution of morbidity of VD, in which the β of the net was bigger than that of the gross migration. In general, VD is distributed more frequently in the places which are densely populated and voluminously migrated while VD in the Taisho Gunma had the tendency that the patient brought into the village from outside. Next, Table 3 shows the results of regression analysis for the effect of migration and *OR* on the VD morbidity. The one case of regression calculates the effect of *OR* as one dummy variable while the other treat the number of *OR* in village/town as explanatory variable. Concerning the type of migration, Table 3 also handles both the case of gross migration and net one. Except the two cases of *OR* as dummy variable, we can get the statistically robust values of β . This result teaches us each *OR* functions very well as a transmitted center of VD in the Taisho Gunma.

Reference

A. Statistics (in Japanese)

Aiikukai [1934-36].

Gunshiku choson betsu shussan, shusse, shizan, oyobi nyuji shibo tokei. [Statistics of live birth, still birth and infant mortality in each county, city, town and village in Japan]. Tokyo, Aiikukai.

Gunma[1912-25].

Gunma prefecture statistics, the part of population, police and hygiene.

Takagi, Otsukuma. [1925].

Karyu-byo yobo nikansuru hokoku.[The report of the prevention of Japan's venereal disease]. Tokyo, Maimusho.

B. Secondary works

Aisenberg, A. [2001].

“Syphilis and prostitution: a regulatory couplet in nineteenth-century France”, in Davidson,R. and Hall,L.A., eds., *Sex, Sin and Suffering: venereal disease and European society since 1870*, London, Routledge, pp.15-28.

Belsey, Mark A.[1979].

“Biological factors other than nutrition and lactation which may influence natural fertility :additional notes with particular reference to Sub-Saharan Africa”, in Leridon, H. and Menken, J., eds., *Natural Fertility*, Liege, Belgium, Ordina Editions, pp.253-272.

Bongaarts, P. [1983].

Fertility, biology, and behavior: an analysis of the proximate determinants, N.Y., Academic Press.

Chun-Lin Kuo, Hanashima, M. and Tomobe K.[2004].

“Design of visualization for historical statistic database”, paper presented for the Annual conference of the Pacific Neighborhood Consortium (PNC) 2004, 17-22nd October, Academia Sinica, Taipei, Taiwan.

Davidson,R. and Hall,L.A.[2001].

“Introduction”, in Davidson,R. and Hall,L.A., eds., *Sex, Sin and Suffering: venereal disease and European society since 1870*, London, Routledge, pp.1-14.

DeLuca, M.A. and Leslie, P.W.[1996].

“Variations in risk of pregnancy loss”, in Cecil, R. ed., *the anthropology of pregnancy loss: comparative studies in miscarriage, stillbirth and neonatal death*, Oxford, Berg, pp.113-130.

De Vries, P.[2001].

“ ‘The shadow of contagion’: gender, syphilis and the regulation of prostitution in the Netherlands, 1870-1914”, in Davidson,R. and Hall,L.A., eds., *Sex, Sin and Suffering: venereal disease and European society since 1870*, London, Routledge, pp.44-60.

Hanashima, M. and Tomobe, K.[2005].

“The effect of morbidity of venereal disease on infant mortality, stillbirth, and fertility in modern Japan: the case of Gunma prefecture, 1910s-1920s”, paper presented for the 4th Symposium on Digital Earth, 29-30th March, Roppongi Hills, Tokyo, Japan

Henri, Louis [1961].

“Some data on natural fertility”, *Eugenics Quarterly*, vol.8, pp.81-91.

Kariya, Haruo[1993].

Edo no Seibyō [Venereal Diseases in Edo]. Tokyo, Sanichi Shobo.

Okazaki, Ayanori [1951].

“Nokosha no shussannryoku nikansuru tokeiteki kansatsu” [The statistical observation on peasant fertility], *Jinko Mondai Kenkyū* [Journal of Population Issue], no.7, pp. 1-18.

Savage, O.M.N.[1996].

“Children of the rope’ and other aspects of pregnancy loss in Cameroon”, in Cecil, R. ed., *The anthropology of pregnancy loss: comparative studies in miscarriage, stillbirth and neonatal death*, Oxford, Berg, pp.95-112.

Siena, K.P.[2004].

Venereal disease, hospitals and the urban poor, Rochester, N.Y. University of Rochester press.

Takase, Masato. [1991].

“1890-1920nen no wagakuni no jinkodotai to jinkosetai” [The nature of vital statistics and static statistics in Japan from 1890 to 1920]. *Jinkogaku Kenkyū*[Journal of Demography in Japan], no.14,pp.1-34.

Tomobe,K.[2017].

“Kinsei/Kindai Nippon no Karyubyō(Baidoku) shiryūzann shusseiryoku no ingakankei wo megutte” [Survey and speculation on the causal relationship between Karyubyō, Syphilis, stillbirth, miscarriage and fertility in early modern and modern Japan]. *Kindai Nippon Kenkyū* [Modern Japanese Studies], 34, pp.1-38.

Tomobe, K.[2005].

“The geographical and statistical analysis of “karyu-byō”, venereal disease(VD), and the effect of the morbidity on infant mortality, stillbirth and fertility in modern Japan: the case of Gunma prefecture, 1910s-20s”, paper presented for the Osaka University Seminar of Economic and Business History, 15th July, 2005, the Graduate School of

- Economics, Osaka University, Osaka, Japan.
- Tomobe, K. [2001].
 "The level of fertility of Tokugawa and Meiji Japan", in Liu,T., et al., eds., *Asian Population History*, Oxford, Oxford University Press, 2001, pp.138-51.
- Tomobe, K.[forthcoming].
 "Coale-Trussell indices, breast-feeding and infanticide in Tokugawa Japan", in James Lee and Osamu Saito, eds., *Abortion, Infanticide, and Neglect in Population History*, Oxford, Oxford University Press.
- Whitaker, E.D.[2000].
Measuring mamma's milk, Ann Arbor, University of Michigan Press.
- Wrigley, E.A.[2004/1998]
 "Explaining the rise in fertility in England in the 'long' eighteenth century", in *idem.*, *Poverty, progress, and population*, Cambridge, Cambridge University Press, pp.317-350.Originally it was published in the *Economic History Review*, 51, 1998, pp.435-64.
 ----- [2004].
 "Demographic retrospective", in *idem.*, *Poverty, progress, and population*, Cambridge, Cambridge University Press, pp.394-440.
- Wrigley, E.A., Davies, R.S., Oeppen, J., and Schofield, R.S.[1997].
English population history from family reconstitution 1580-1837. Cambridge, Cambridge University Press.
- Yamamoto, Shun'ichi [1983].
Nippon Kosho shi [The History of public prostitute in Japan]. Tokyo, Chuohokisha.

Table 1
Simple Regression Analysis for the morbidity of VD and Demographic indices
: by county(gun) in Gunma prefecture, 1912 to 1925

X = VD(each year)	β	t	P	R ²	n
A. Fertility (Y)					
1912 – 1913	-0.4723	1.6945	0.1210	0.1454	12
1913 – 1914	-0.3629	1.2314	0.2463	0.0448	12
1914 – 1915	-0.3523	1.1906	0.2613	0.0366	12
1915 – 1916	-0.7184	3.2659	0.0085	0.4677	12
1916 – 1917	-0.8970	6.4174	0.0001	0.7851	12
1917 – 1918	-0.7388	3.4672	0.0060	0.5005	12
1918 – 1919	-0.8551	5.2163	0.0004	0.7044	12
1919 – 1920	-0.6986	3.0878	0.0115	0.4369	12
1920 – 1921	-0.5843	2.3882	0.0360	0.2816	12
1921 – 1922	-0.3754	1.3435	0.2062	0.0629	12
1922 – 1923	-0.3869	1.3915	0.1916	0.0724	12
1923 – 1924	-0.7371	3.6173	0.0040	0.5018	12
1924 – 1925	-0.1866	0.6300	0.5416	0.0348	12
B. Stillbirth (Y)					
1912 – 1913	-0.2990	0.9910	0.3451	0.0894	12
1913 – 1914	-0.2652	0.8697	0.4048	0.0703	12
1914 – 1915	0.3835	1.3130	0.2185	0.1471	12
1915 – 1916	0.3300	1.1055	0.2948	0.1089	12
1916 – 1917	-0.2615	0.8568	0.4116	0.0684	12
1917 – 1918	0.1247	0.3975	0.6994	0.0156	12
1918 – 1919	-0.2626	0.8604	0.4097	0.0689	12
1919 – 1920	-0.2890	0.9547	0.3622	0.0835	12
1920 – 1921	-0.0856	0.2851	0.7809	0.0073	12
1921 – 1922	0.2751	0.9489	0.3630	0.0757	12
1922 – 1923	0.1230	0.4110	0.6890	0.0151	12
1923 – 1924	-0.1404	0.4704	0.6472	0.0197	12
1924 – 1925	0.0007	0.0022	0.9983	0.0000	12

Note) VD: morbidity of VD at aged 20, Fertility = N of birth / 1000 persons,

Stillbirth = N of stillbirth / N of birth

Source) Demography: *Gunma Ken Tokei Sho* (Gunma Prefecture Statistics), 1912–1925.

Morbidity of D.V.: Takagi[1925], Appendix, Table34, pp.402–410.

Table 2
Simple Regression Analysis for the morbidity of VD and Demographic/other indices
: by village/town in Gunma prefecture, 1912 to 1925

X = VD (1912–1924)	β	t	P	R ²	n
A. Demographic Indices					
1. Fertility: 1912–24, OR located					
	-0.3840	3.4298	0.001	0.147	70
2. Stillbirth: 1924, OR located					
	0.1354	1.1269	0.2637	0.0183	70
3. Stillbirth: 1933, OR located					
	0.2527	2.1533	0.001	0.0320	70
B. Prostitute Index (Dummy)					
(1: village/town OR located, 0: No OR located)					
	0.1790	2.5860	0.0003	0.0638	204
C. Transportation Index (km, distance from <i>Nakasendo</i>)					
	-0.2535	3.6497	0.0003	0.0642	196
D. Migration Indices					
1. Gross Migration: 1913–21					
	0.4310	6.9864	0.0000	0.1857	216
2. Net Migration: 1913–21					
	0.5051	8.6004	0.0000	0.2551	216

Note) VD: morbidity of VD at aged 20, Fertility = N of birth / 1000 persons, Stillbirth = N of stillbirth / N of birth, OR: *Otsushu Ryoriter*(prostitute house), Gross Migration = (in + out)/ current resident population, Net Migration = in/out

Source) Morbidity of D.V. and Prostitution index: Takagi[1925], Appendix, Table34, pp.402–410.

Demography and Migration indices: *Gunma Ken Tokei Sho* (Gunma Prefecture Statistics), 1912–1925.,

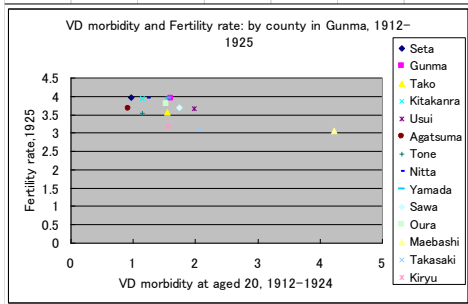
Table 3
Regression Analysis of the morbidity of VD and indices of Migration and Prostitute
: by village/town in Gunma prefecture, 1912 to 1925

	β	t	P	R ²	n
Y: V.D. morbidity rate (1912–1924)					
X 1: Gross Migration	0.3877	5.8190	0.000	0.2198	218
X 2: N. of OR	0.1457	2.1872	0.0298		
X 1: Gross Migration	0.4413	6.9444	0.000	0.2033	218
X 2: OR(Dummy)	0.2284	0.4780	0.6332		
Y: V.D. morbidity rate (1912–1924)					
X 1: Net Migration	0.2011	2.8100	0.0054	0.1289	218
X 2: N. of OR	0.2194	3.0651	0.0025		
X 1: Net Migration	0.2812	4.0499	0.0001	0.0937	218
X 2: OR(Dummy)	0.0568	0.8171	0.4148		

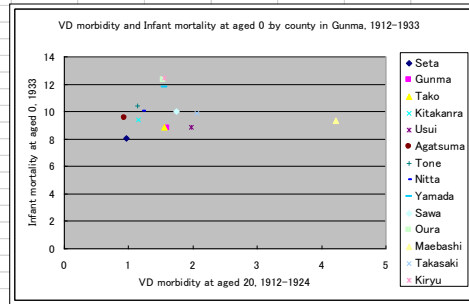
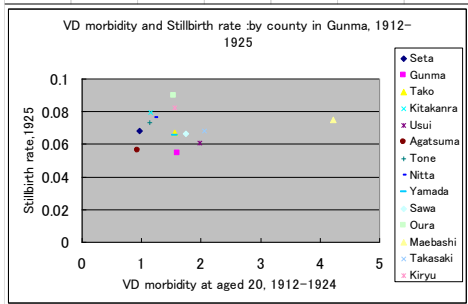
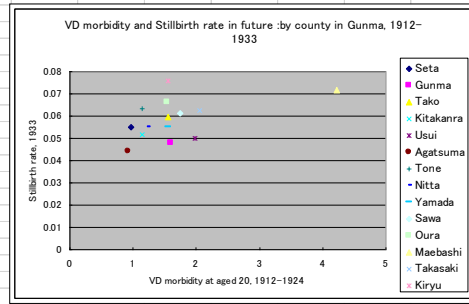
Note) VD: morbidity of VD at aged 20, OR: *Otsushu Ryoriten*(prostitute house), OR(Dummy);
 1= OR located; 0 = No OR located, Gross Migration = (in + out)/current resident population, Net
 Migration = in/out

Source) Morbidity of D.V. and Prostitution index: Takagi[1925], Appendix, Table34, pp.402–410.
 Migration indices: *Gunma Ken Tokei Sho* (Gunma Prefecture Statistics), 1912–1925.,

Scattered Diagram 1.



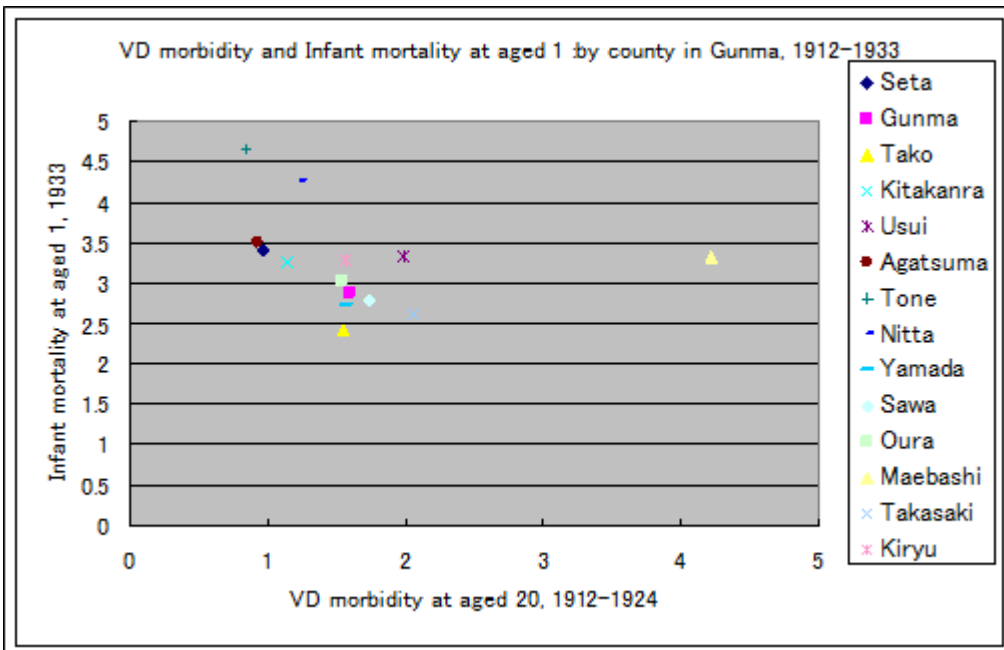
Scattered Diagram 2.



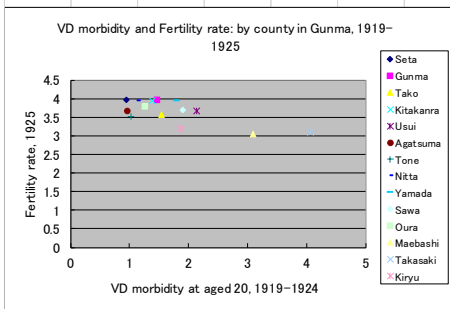
Source) Gunma Prefecture Statistics[1912-24], Cabinet Statistics[1925]

Source) Gunma Prefecture Statistics[1912-24], Aikukai Statistics[1934-6]

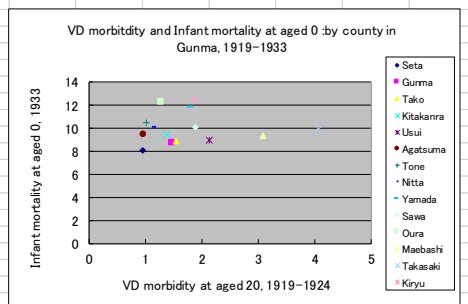
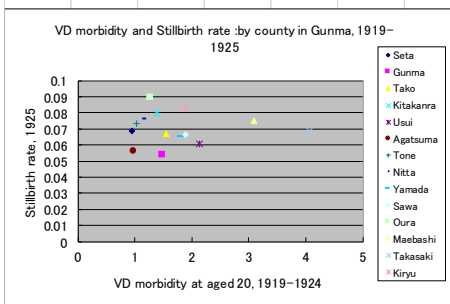
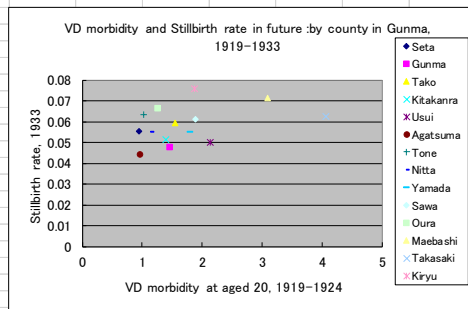
Scattered Diagram 3



Scattered Diagram 4



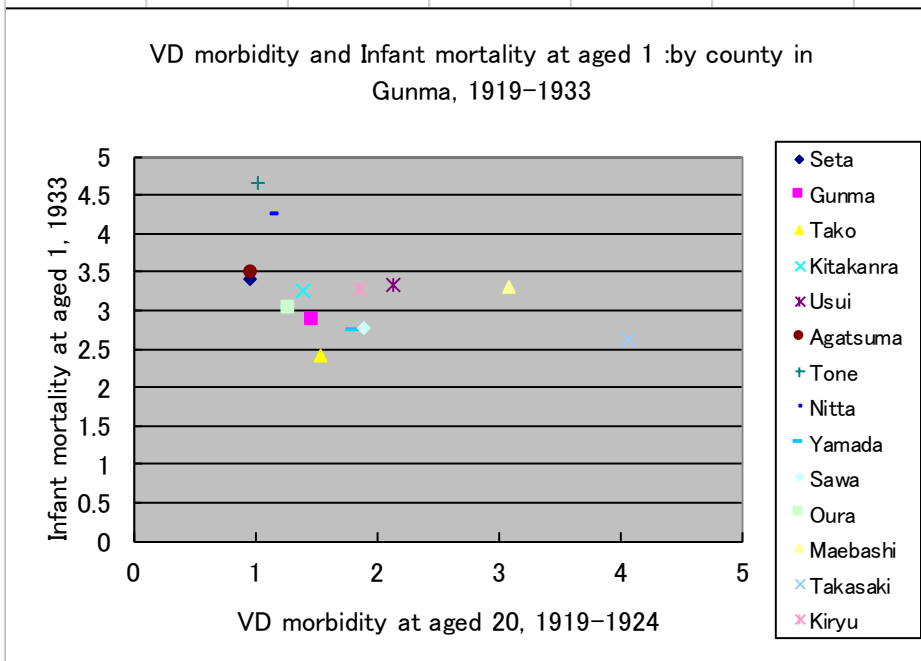
Scattered Diagram 5



Source) Gunma Prefecture Statistics[1912-24], Cabinet Statistics[1925]

Source) Gunma Prefecture Statistics[1912-24], Aikukai Statistics[1934-6]

Scattered Diagram 6

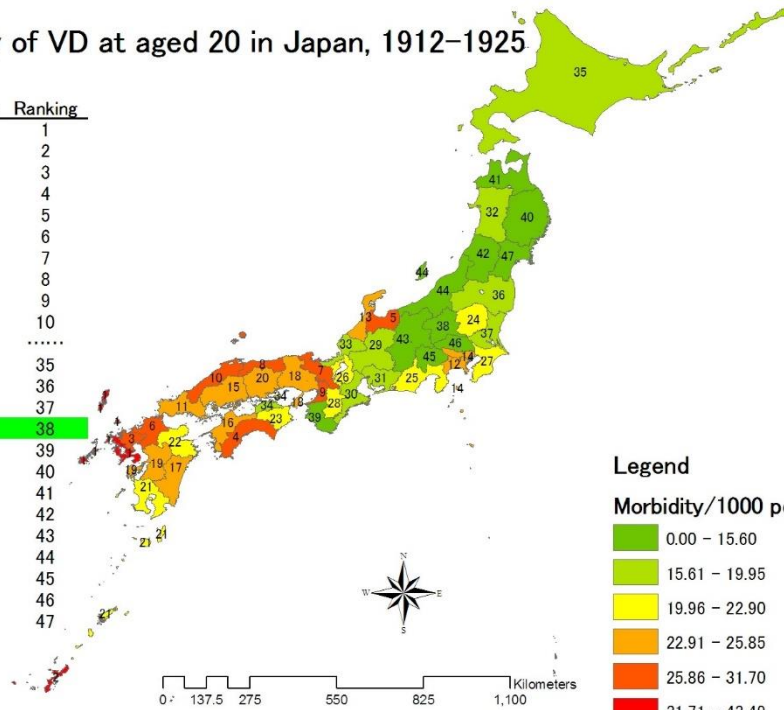


Source) Gunma Prefecture Statistics[1912-24], Aikukai Statistics[1934-6]

MAP1

The morbidity of VD at aged 20 in Japan, 1912–1925

Pref	Morbidity	Ranking
Nagasaki	43.49	1
Okinawa	36.96	2
Saga	31.70	3
Kochi	31.45	4
Toyama	29.94	5
Fukuoka	29.86	6
Kyoto	28.50	7
Totori	28.00	8
Osaka	27.09	9
Shimane	27.06	10
.....
Hokaido	17.93	35
Fukushima	17.86	36
Ibaraki	17.22	37
Gunma	15.60	38
Wakayama	15.27	39
Iwate	14.92	40
Aomori	14.84	41
Yamakata	14.63	42
Nagano	14.58	43
Niigata	14.33	44
Yamanashi	13.09	45
Saitama	12.64	46
Miyagi	12.22	47

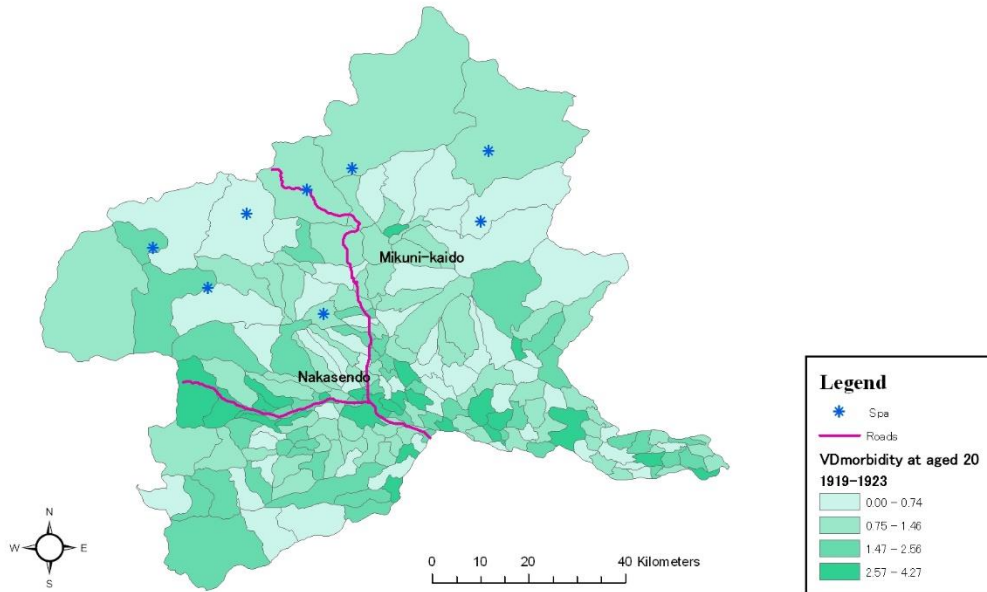


Legend

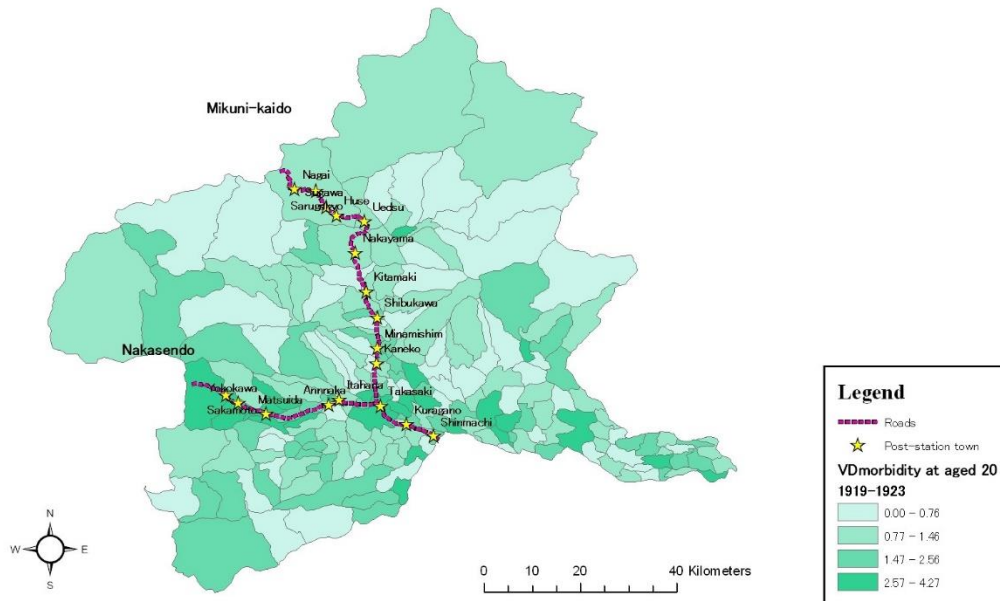
Morbidity/1000 persons

- 0.00 – 15.60
- 15.61 – 19.95
- 19.96 – 22.90
- 22.91 – 25.85
- 25.86 – 31.70
- 31.71 – 43.49

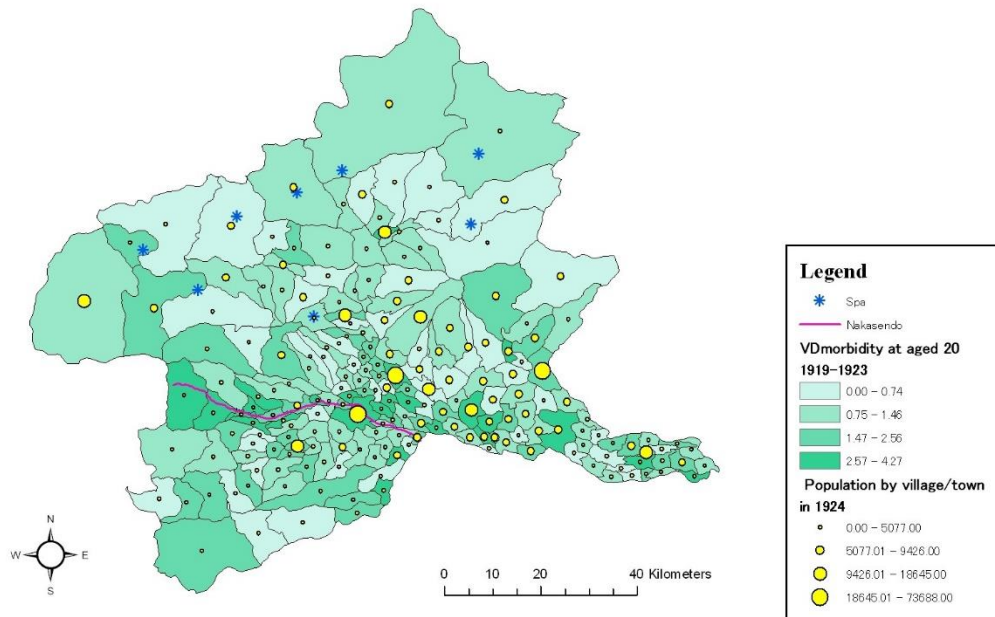
MAP4. Main roads, Spa and the VD morbidity rate at aged 20 :by village/town in Gunma Prefecture,Taisho period



MAP5 Main roads , post-station towns and the VD morbidity rate at aged 20 : by village/town in Gunma Prefecture, Taisho period



MAP6. The VD morbidity rate at aged 20 and the distribution of population : by village/town in Gunma Prefecture, Taisho period



MAP7 The morbidity of VD and indices of Migration by village/town in Gumma Prefecture, Taisho period (1912-1925)

