# Disease and Mortality in the History of Taiwan

Ts'ui-jung Liu and Shi-yung Liu*

This paper was first delivered at Conference on Asian Population History, held at the Institute of Economics, Acaemia Sinica, January 4-8, 1996. The revised version was included in *Asian Population History* edided by Ts'ui-jung Liu, James Lee, David Sven Reher, Osamu Saito and Wang Feng (Oxford: Oxford University Press, 2001), Chapter 12, pp. 248-269. (Chinese characters are added in this text.)

This paper aims to provide a survey of historical records related to disease and mortality in Taiwan up to the 1920s, a decade that marks an important period of transition in the social history of Taiwan. During this decade, plague was no longer threatening and malaria control was well in progress (Chen SX, 1979: 127). Almost no systematic statistics are available related to disease and mortality in Taiwan prior to the twentieth century. Despite this defection of data, we will try to piece together what we have found in order to present a sketch on which further studies may be based. We will first discuss endemic and epidemic diseases with qualitative materials and then present statistics available in the early twentieth century. To avoid misinterpretation, we will use traditional terms on most occasions except when a modern medical terminology is already identified in the literature.

## 1. Qualitative data of endemic disease

Taiwan, an island with sub-tropical climate, was gradually opened up from the seventeenth century by the immigrants from mainland China. Its unhealthy endemic environment was once a source of fear, however, throughout the eighteenth century the population in Taiwan increased rapidly mainly due to immigration (Liu TJ, 1995: 296-340). In the historical records of Taiwan, terms most frequently used to refer to illnesses stemming from maladjustment to local environment were z*hang* 瘴 (miasma), z*hangqi* 瘴氣 (pestilential vapors) and z*hangli* 瘴癘 (an epidemic arising from miasma). These terms are identified as malaria by modern medical doctors and historians (Du, 1959: 489-492; Chen, 1992: 160-169; Leung, 1993: 355; Hsiao, 1993:105-109; Chang, 1994: 1-7). In some records, terms such as *nue* 瘧, *nueji* 瘧疾, and *nueli* 瘧痢(癘) are also found. A term parallel to zhang that was commonly used in south china , nue was used in the area north of the Yangzi river (Hsiao, 1993:105). *Nueji*, an ancient term that exists in the *Book of Rites*, is malaria in modern Chinese (Chen, 1981: 28).[1]

---

* The authors are respectively, a Research Fellow at Institute of Economics and then at Institute of Taiwan History (Preparatory Office), Academia Sinica; a Ph.D. Candidate at Department of History, University of Pittsburg and then a Research Assistant at Institute of Taiwan History (Preparatory Office), Academia Sinica. We would like to thank conference participants for their helpful comments and Iijima and Zurbrigg for providing their articles after the conference.

[1] For a discussion of miassmas in the West, see Cipolla, 1992: 4-5. Folk medicine in southeast Asia classified malaria either as a disease of hot or cold, or both, see donn, 1969: 53, 86, 89. For traditional Chinese theories concerning causes of malaria see Miyasita, 1979: 92-94; Hsiao, 1993: 106-111.

Malaria was a major endemic disease and the cause of most deaths in Taiwan by 1916 (Maruyama, 1957: 47; Chen, 1979: 138). In addition to records about *zhang* and *nue*, we will also take into consideration those related to *shuitu pufu* 水土不服, which means falling ill because of maladjustment to a new place. These three terms are often mentioned together to refer to illnesses stemming from the local environment. We will first look into historical documents to see how people described this disease and suffered from it.

The earliest record of malaria in Taiwan was perhaps kept by the Dutch when they ruled Taiwan during 1622-1661. It is known that some Dutch missionaries died from malaria (Du, 1959: 490). In 1653, a letter dated October 24 from the Council of Formosa said:

> During this year, a considerable number of persons, both of old and young, have died of ague and measles in the southern region, as well as in the northern villages. Those diseases still prevail, so that many rice-fields have been left uncultivated, and we fear the consequence will be that the Formosans will have much to suffer this year from hunger and privation (Campbell, 1903: 290).

This prevalent of diseases, including malaria, caused a decrease in the population in the Pingdong plain. In 1650, there were12,247 people in 15 villages, but in 1655, there were only 9,145 in 10 villages (Li, 1994: 114, 128).

In 1661 Zhebg Chenggong 鄭成功 (Koxinga) led his army to take over Taiwan from Dutch rule. Shortly after their landing, 70-80 per cent of Zheng's force had fallen ill and many soldiers died due to ‘maladjustment to the climate’ (TW120: 55). Shi Lang 施琅, who later led the Qing army to conquer Taiwan in 1683, suggested in a memorial that Zheng had at most a force of 24,000 persons, of which 5,000-6,000 had died of illness and wounds (TW105: 592; TW140: 398; TW128: 766).

In the late seventeenth and the early eighteenth centuries, Chinese officials dispatched by the Qing government to Taiwan were well aware of the island's unhealthy climate. The fear was especially great for the areas of far south and far north. For example, during 1684-1716, of the 12 Xiadanshui subdistrict deputy magistrate下淡水巡檢 whose office was located at Donhgang 東港 near the south tip of the island, 8 died of illness during their incumbencies (TW124: 49-50). At other official posts, however, similar phenomena were not found. In northern Taiwan, it was not until 1710 that 7 military stations with a quota of 120 soldiers were established to the north of Dajia 大甲 river (TW141: 115-116, 118). Most solders stationed there died of illness. Ruan Caiwen 阮蔡文, who was appointed lieutenant-colonel of northern route in 1713, went to inspect these stations in 1715 and got z*hangqi*. Although he left Taiwan after his term of office, he died on the way to his new appointment (TW128: 796-797).

A very vivid record was kept by Yu Yonghe 郁永河 who came to Taiwan in 1697 on a mission to obtain sulfur from a mine located near today’s Taipei. Officials and friends in the prefectural city (today's Tainan) warned him that the climate of Keelung and Tamsui (the northernmost part of Taiwan) was extremely bad; people going there usually fell ill and died. These warnings, however, could not stop him from going. Equipped with pills and medicines, he realized the horrors when nine out of ten among his fifty-five servants fell ill within a few days after arriving at Tamsui in late June. Moreover, one of his colleagues suffered from dangerous diarrhea (*li* 痢) after

being rescued from a shipwreck. Although he did not give a name for the disease prevalent among the servants, he assumed that it was due to z*hangli* and noted that patients 'groaned and shivered' around him. Because the medicine at hand was not sufficient, he had all the patients shipped back to Tainan and was informed later that more than half of them died. In August, twelve new servants arrived and they all fell ill in a few days as before. He added that although over the past ten years he had been taken ginseng to help strengthen his body, he was still quite exhausted (TW44: 16-17, 26, 38, 40).

Other personal experiences are also revealing. For example, Sun Yuanheng 孫元衡, a subprefect of Taiwan during 1705-1708, recorded his experience in poems. In one written after recovering from an illness in autumn 1705, he stated: 'Where the wind rises from the mountains, the pestilential clouds (z*hangyun* 瘴雲) are deep.' In another, when he had fallen ill written in 1708, he described himself wrapping up in bedclothes and putting on a fur garment in his room to enjoy the sunset. He also mentioned that black mosquitoes buzzed annoyingly around. Although Sun certainly had no idea about whether or not these mosquitoes were of the genus *Anopheles*, it is quite clear that with the symptom of chills, he had suffered from malaria. When he completed his term in Taiwan and returned to the mainland, he wrote a poem on the shore of Amoy to express his relief. This poem says that once he set his feet on the ground of Middle-land again, he felt like a frightened bird escaping from a dangerous net (TW10: 12, 77, 81).

The 1717 gazetteer of Zhulo 諸羅 classified the illness of z*hang* into two categories. It says:

> Both South and North Danshui are districts of z*hang*. The z*hang* of South Danshui makes one to have cold and fever, to wail and go crazy. When treated properly and carefully, it can still be cured. The Z*hang* of North Danshui makes one become lean with darkish and yellowish appearance, and the spleen has trouble with digestion and swells. ...It is mostly incurable (TW141: 292-293).[2]

Of course, this distinction of two kinds of z*hang* cannot be compared directly with classification and etiology of malaria in modern medicine (Dunn, 1993: 855-856). The above passage, however, expresses a general view held in eighteenth-century Taiwan. Many documents repeated that z*hang* was endemic in the far south and far north and was more severe in the latter (e.g., TW4: 14; TW216: 23). Throughout the nineteenth century, however, people who talked about the climate of Taiwan and its relation to z*hang* believed that as settlements expanded, z*hang* would gradually disappear with human management (Liu, 1995: 314, 337-338).

When the Gemalan 噶瑪蘭 area (in northeastern Taiwan) was opened up in the early nineteenth century, it was regarded as a place where z*hangli* broke out frequently (TW160: 63). The subdistrict deputy magistrate, Hu Gui 胡桂, who took charge of measuring newly reclaimed land during 1810-1812, unfortunately died of z*hang* in 1812 (TW92: 71-72, 88). Yao Ying 姚瑩, who served as magistrate of Taiwan county in 1819, subprefect of Gemalan in 1821-1831, and circuit intendant of Taiwan in 1838-1843, knew the area very well. He suggested in 1841 that time time

[2] The South and North Danshui were applied by people at that time to two areas along the two rivers, the one in southern and the other in northern Taiwan. From here on, the transcribed form Danshui is used to refer to the northern district in which the twon Tamsui was situated.

had not been ripe for opening up the area to the east of the mountains. One of his reasons was that officials appointed to this area must be able to endure pestilential vapors (he used the term *yenzhang* 煙瘴, literally, smoky miasma; TW83: 49). He himself once fell ill in Taiwan and composed a poem saying that he would like to have a fur garment in the summer (TW83: 195). It is noteworthy that Yao once got malaria (*nue*) in autumn 1814 when he was in Conghua 從化, Guangdong (TW83: 238). In 1832 when he was magistrate of Wujin 武進, Jiangsu, he periodically suffered from malarial fever (*hanre* 寒熱, literally, chill and fever; TW83: 205; for *hanre* as a name of malaria, see Chen, 1981: 234). It seems that malaria became a chronic disease for Yao until he died in 1853 in Yongzhou 永州, Hunan (TW83: 258).

It may be noted by passing here that Yao Ying was not the only official who had an experience of malaria before coming to Taiwan. Xu Zonggan 徐宗幹, circuit intendant of Taiwan in 1848-1854, had suffered from malaria in autumn 1845 when he was in Tongzhou 通州, Jiangsu, mourning his mother‘s death (TW93: 27). He did not mentioned, however, that he ahd suffered from malaria in Taiwan. Hu Chuan 胡傳 (father of Dr. Hu Shih 胡適), came to Taiwan on a mission to inspect all military stations of the island in 1892 and became magistrate of Taitung until 1895. He caught malaria in 1877 at Lingshui 陵水, Hainan Island (TW71: 266). He reported that he suffered from *hanre* now and then during his six-month travels around Taiwan and his three servants all died. Moreover, he observed that a large number of soldiers became addicted to opium for they thought that it could help relieve attackes o malaria (TW71: 60-61, 67, 103, 128, 167, 188-189, 199, 207).

In 1874, a Japanese military expedition to Taiwan marked a new phase of opening up the eastern part of the island. The Japanese government used the pretext of punishing the Taiwan aborigines over some fifty-four Ryukyu prople who were killed at Mudanshe 牡丹社 after they were rescued from a shipwreck, in 1871 (TW39: 1-2). The Japanese army set up their camps at Langqiao 琅嶠 area near the southern tip of the island. In June 1874, Chinese officials began to report the illness among the Japanese army (TW39: 89-90). The newspaper *Shenbao* 申報 also reported that there was a danger for malaria (*nueji*) breaking out in Taiwan. The Japanese army was suffering from the heat and many soldiers fell ill; fifty had died since the campaign began (TW247: 119-120, 139). The only English account on this event stated: ‘[T]he sudden outbreak of fever, in July, which rapidly prostrated a large proportion of the soldiers, and from which hardly an individual connected with the expedition escaped. … some humdreds of the troops died. (House, 1875: 215).” According to Chinese official reports dated from aughst 28 to November 21, Japanese ships crried more than 2,000 sick soldiers and 230 corpses back to Japan (TW39: 117, 126, 136, 147, 151-152). A report on this campaign by Yoda Gakukai 依田學海 states that from summer to winter, of the 4,500 Japanese soldiers sent to Taiwan, 12 died in combat and 550 died from *zhangqi* (TW308: 86). Dr. Maruyama contends that the Japanese army suffered from an outbreak of malaria (Maruyama, 1957: 48). Two recent studies both cited detailed data kept by the Japanese army surgeon, Ochiai Taizo 落合泰藏 (Katz, 1995: 16, 41; Fan, 1994: 12). The data shows that 489 of the 547 deaths from various diseases were due to epidemics, mostly related to malaria. Thus, 12 percent of the deaths among the Japanese army were induced by diseases.

In response to the Japanese expedition, the Qing government dispatched 13 battalions of the Huai 淮 army, with a total number of 6,500 soldiers, to assist in the

defense of Taiwan (TW38: 51). At the same time, the Qing government also decided to exploit the area lying east of the Central Mountain Range. This policy involved opening up roads and pacifying aborigines in the mountains. After the issue was settled with Japan, the Huai army was sent back to the mainland. Once the issue was settled with Japan, the Huai army was sent back to the mainland. On July 26, 1875, the *Shenbao* reported that four battalions of the Huai army returning from Taiwan arrived in Shanghai with about 1,400-1,500 soldiers. The survivals said they they had stationed near the aboriginal area of Fengshan 鳳山 for about one year; they were unused to the place and many had fallen ill or had boils on their skin (TW247: 539).

The gazetteer of Luzhou 廬州 (a district in Anhui province where the Huai army originated) contains an essay on this campaign. It says that z*hangli* broke out in autumn of 1874 and lasted until next spring, when some 700 officers and soldiers died. Altogether. four commanders died of illness at their camps; more than 100 officers and 2,000 soldiers died of illness and in fighting (TW213: 99-102). The 13 battalions dispatched to Taiwan were all sent back to the mainland by August 30, 1875 (TW29: 70; TW120: 203). If 2,104 persons are taken as the total number of lost among the Huai army sent to Taiwan, the mortality rate can be calculated as 32 per cent.

Another estimate may be gathered from reports of Tang Dingkuei 唐定奎, the commander, about the deaths of the Huai army from summer of 1874 to August 9, 1875. Altogether, 75 officers and 1,501 soldiers died of z*hangli*, 31 soldiers died in combat and 13 died from wound (TW29: 10, 25-26, 67, 69). Thus, the total number that died from the disease was 1,576, or about 24 per cent of the Huai army.

Luo Dachun 羅大春, circuit intendant of Taiwan from August 1874 to August 1875, reported tht the Huai army had suffered a lot from illness in Taiwan. In one battalion, only 27 soldiers had not fallen ill (TW308: 55). Moreover, an essay by Fang Junyi 方濬頤 says that during the campaign of opening up the mountains, onlu a few dosen of the Huai army died fighting the aborigines (TW308: 71). In other words, just as in the case of Japanese army, malaria rather than battle was the main cause of death among the Huai army. The Huai army had a much higher mortality rate, however. An editorial in *Shenpao* commented on this fact and suggested that the difference lay in whether or not the sick soldiers were sent back once they had fallen ill. It urged that more symoathey should be given to soldiers in compaigns (TW247: 547).

At the same time, in the process of opening up the mountains, many people died of illness due to maladjustment to the place. For instance, during 1987-1985, 14 officers who died in opening up the road in Taitung. Of them, 8 died of z*hang*, 2 died of *yi* (epidemic, see below), 3 died of *ji* (any ailment), and 1 died of fighting the aborigines. Moreover, 13 officers died of illness (not being specified as z*hang*) during 1876-1892 and 2 died of z*hang* in 1893 (TW81: 71-76).

Although little is known concerning the illness of unknown soldiers, some details about the sickness of officials are available. Here we give a few examples. When Yuan Wento 袁聞柝 was stationed at Beinan 卑南 (today's Taitung) to take charge of opening up a road, he suffered from a severe attack of z*hang* in January 1875. He was sent back to Tainan for medical treatment and was able to return to his duty in April (TW81: 76-77). Luo Dachun reported that he got *nueli* when he was at Xincheng 新城 (in today's Hualien county) in February 1875; his illness became worse with symptoms such as pains between his ribs and spitting of blood. He thus asked for a leave of absence for two months. After three months, however, his illness became all

the more severe. With doctor's suggestion of taking a long time of rest, he was allowed to resign from his position (TW247: 541, 555; TW120: 203). Wu Zancheng 吳贊誠, acting governor of Fukien, got z*hangli* in eastern Taiwan during the summer of 1877. Aftertreatment from the doctor, he did not recover his former energy. In the next year, he went to Qilai 岐萊 (in today's Huanlien county) and got symptoms of pains in his right arm and back as well as vertigoes. At the doctor's suggestion, he was permitted to return to Fuzhou, but he died of illness soon at his home (TW247: 817-818, 833; TW276: 166). Wang Kaitai 王凱泰, governor of Fujian, died on November 20, 1875, only twelve days after returning from Taiwan to Fuzhou. He died unavoidably, mainly because he had suffered from z*hangli* and *jiaoqi* (beriberi) while in Taiwan (TW247: 571, 577). Liu Mingchuan 劉銘傳, who came to Taiwan in 1884 to defend against the French intrusion and became the first governor of Taiwan during 1885-1891, gave details about his illnesses in several memorials. Finally, he was permitted to resign. He reiterated in his memorial to thank the throne that he ahd entered the mountains several times; unexpectedly, he got the illness of *zhang* and it became chronic for him (TW27: 107-120; TW276: 218).

The perilous z*hangli* also attacked the Chinese and the French forces sent to Taiwan during the Sino-French War in 1884-1885. The Chinese sources provide no numbers of soldiers that died of disease on either side (TW192: 338; TW204: 70, 75; TW253: 46, 156; Chen, 1992: 168). The French called this strange malady 'fievre des bois' that showed symptoms of headache, vomit, fever, and chill (Garnot trans. By Li, 1960: 3, 38). However, malaria was not the only killer during this campaign. We will discuss the epidemic that broke out during this campaign in the next section.

Malaria as a fearful killer was also witnessed by Dr. George Mackay (1844-1901) who came to Taiwan in 1872 and served as a missionary and a doctor until 1895. He described malarial fever as 'man's deadliest foe', and said:

> Because of it disease and death work terrible havoc among the inhabitants. Almost every form of disease is directly traced to this one source. Seldom do three months elapse without one or more members of every household being laid low. In the hot season the natives are suddenly attacked, and in many cases succumb in a few hours (Mackay, 1896: 43).

In addition to various names given by foreigners for this disease, local people called it 'Tamshui fever' (Mackay, 1896: 313). This local name accords with the impression of North Danshui as a country of z*hang* since the seventeenth century. Moreover, just as Chinese term z*hang* suggested that this disease was caused by pestilential or poisonous vapors, Mackay did not know its real cause, either. He said: 'Its real cause, no doubt, is malarial poison generated by the decomposing of organic matter, and its intensity depends on the constitution, climate, and surroundings of the sufferer' (Mackay, 1896: 313). Herecommended lemon juice, quinine, and other medicines for the treatment of this disease. He also noted the prevalence: 'It is not an uncommon thing in Formosa to find half of the inhabitants of a town prostrated by malarial fever at once. I have seen households of twenty or thirty with not one able to do any work' (Mackay, 1896: 314).[3]

[3] For the value of westerners' reports on disease in late nineteenth-century China, see J. Shepherd's chapter in this volume; also see Dai, 1995: 158-174.

The above stories, episodic as they are, demonstrate that from the seventeenth century on an endemic disease and fearful killer in Taiwan may be identified as malaria. Here it may be relevant to mention a custom related to this disease. The most remarkable custom related was betel-nut chewing as mentioned by many local gazetteers (TW65: 199-200; TW66: 251-252; TW92: 6; TW121: 608; TW141: 145, 203; TW160: 198). Betel-nut were presented as gifts for preventing attacked of *zhang*. It is notable that Chen Wenda 陳文達, the compiler of the 1720 gazetteer of Taiwan county, criticized this custom as prqactically useless and wasteful (TW103: 58). Wang Bichang 王必昌, the compiler of the county's additional gazetteer in 1752, echoed this opinion (TW113: 403). Moreover, Zhu Shijie 朱仕玠 observed around 1765 that the habit of chewing betel-nuts could cost 60-70 or even 100 cash a day per person and made one's teeth black and poor or disintegrate (TW3: 71). Dr. Mackey also had a vivid account about betel-nut chewing and his dentistry in Tamsui in the late nineteenth century (Mackay, 1896: 314-316).

In some cases, the term z*hang* is not necessarily referred to malaria. For example, in 1705, Sun Yuanheng used the term *xiangzhang* 香瘴 (literally, fragrant miasma) in his poem. A footnote he gave says, 'the mountain around is covered with thick Judas-tree (*gui* 桂, *Ceridiphyllum japonicum*), the people can easily fall ill when they come in contact with fragrant flowers; and this also is z*hang* (TW10: 13).' It seems that Sun used *zhang* in this case to refer to some kind of allergy rather than malaria. For another example, in 1879, the *Shenbao* published an essay on *yanzhang* (smoky miasma) in northern Taiwan based on the experience of soldiers returning from Taiwan. This essay says that the soldiers had symptoms of erosion in the mouth, red eruption on the skin, loss of voice, and feeling dizziness; and they looked rather exhausted. According to the soldiers, seven or eight out of the ten had fallen ill and four or five out of the ten had died. This essay continues to suggest that *yanzhang* was similar to *liyi* (epidemic), which entered into human body through the month and the nose. It also recommemded some treatments for which the effectiveness we still have to find out (TW247: 971-973). With the above four symptoms, however, we may gather that *yanzhang* was not necessarily identical with malaria, but some sort of viral or bacteria disease.

## 2. Qualitative data of epidemic disease

A standard term for epidemic disease in Chinese records is *yi* 疫 *or y-li* 疫癘 *(liyi* 癘疫*)*, and a great (severe) epidemic is specified as *dayi* 大疫. Although *yi* can not be easily identified to a specific disease, it undoubtedly means epidemic in the sense that at the same time, 'every one is suffering from the same illness' (MacPherson, 1995: 769). In the local gazetteers, events of *yi* are usually recorded under a category of 'calamity and potent' (*zaixiang* 災祥) along with famine, flood, drought, earthquake, typhoon and the like. The events of *yi* and *dayi* recorded under this category in Taiwan's local gazetteers are listed in Table 1.

With this list of 13 events, the first question we may raise is incompleteness of the record, for it is doubtful that no epidemic was recorded in the eighteenth century. It is not clear what the standard is for recording a *yi* under the category of calamity. If compilers of the local gazetteers followed the same standard, then, the mutness of the record could mean some events were left out for not meeting this standard. Here we give a few examples.

Table 1 Events of epidemic recorded in Taiwan's local gazetteers

| Year | Loction | Event | Source |
|---|---|---|---|
| 1681 | Taiwan Fu | *yi* | TW65: 217; TW66: 277; TW121: 655; TW74: 471; TW105: 553 |
| | Taiwan Xian | *yi* | TW113: 544 |
| | Fengshan Xian | *yi* | TW124: 157; TW146: 269 |
| 1820 | Danshui Ting | *yi*, autumn | TW172: 349 |
| | Miaoli Xian | *yi*, autumn | TW159: 129 |
| 1856 | Penghu Ting | *dayi* | TW164: 373 |
| 1857 | Penghu Tin | *yi* | TW164: 373 |
| 1864 | Jiayi Xian | *yi* | TW58: 48 |
| 1866 | Danshui Ting | *Dayi*, summer | TW172: 350 |
| | Miaoli Xian | *Dayi*, summer | TW159: 130 |
| 1868 | Penghu Ting | *Dayi*, autumn | TW164: 374 |
| 1874 | Miaoli Xian | *yi*, autumn | TW159: 130 |
| 1883 | Miaoli Xian | *yi*, summer | TW159: 130 |
| 1884 | Penghu Ting | *Dayi*, summer | TW164: 378 |
| 1885 | Penghu Ting | *Dayi*, summer | TW164: 378 |
| 1889 | Miaoli Xian | *Dayi*, winter | TW159: 130 |
| | Miaoli Xian | *yi*, summer | TW159: 130 |

The 1837 gazetteer of Gamalan does not indlude *yi* under the category of calamity, but does contain an essay by Xieh Jinluan 謝金鑾 saying that a *yi* had occurred in 1803. Instead of mentioning any victim, Xieh states that 20,000 males and females contributed money to beseech blessing from God (TW92: 162). Another document exaggerated this event as a *dayi*, and the number of males and females as 60,000 (TW30: 9). The 1871 gazetteer of Danshui Ting mentioned that Sanguancu 三官祠 temple was built by the villagers after a *yi* broke out in 1803 (TW172: 152). The 1840 gazetteer of Gamalan includes an essay by Yao Ying describing a *yi* that occurred after a great typhoon attacked the area on the night of July 3, 1821. Yao distributed medicine and thus the *yi* was stopped (TW160: 382; TW7: 84; TW83: 23).

Despite the data of Table 1 being incomplete, we can still discuss to some extent the epidemic in the history of Taiwan. The epidemic of 1681 broke out in southern Taiwan. It took a heavy toll among followers of Zheng Chenggong and was possibly related to the fall of his regime two years later (TW105: 577). Except for this event, others in the list all occurred in the nineteenth century, especially in the second half. Moreover, most epidemics broke out in two areas. The one was Danshui Ting in the north, with Miaoli Xian as a part of the subprefecture before being setting up as a county in 1889. The other was Penghu Ting, on the small islands known as Pescadres situated off the southeast coast of Taiwan. The accessibility of these two areas by sea may explain somewhat the spatial concentration, if some epidemic had international connectons.

The 1820 epidemic in Danshui Ting may be identified as cholera during its first pandemic as suggested by a recent study (MacPherson, 1995: Table 1, 750, Map 1, 770). The record is, however, too poor to say more about it. We only know that Zheng Chonghe 鄭崇和, an emigrant from Kimmen 金門 and a wealthy resident of the subprefectural city (today's Hsinchu), distributed medicine and saved a number of lives during this epidemic (TW172: 270).

The 1856 epidemic in Penghu Ting caused ‘several thousands’ to die. Here, we may give some figures for a rough calculation. Penghu Ting had a population of 59,128 in 1828 and 67,540 in 1892. In the two administrative units, Dongxiao 東西澳 and Kuibiao 奎壁澳, two villages were most severely attacked by the 1856 epidemic. Their population was 16,041 in 1892 (TW164: 79, 86-87, 373). Assuming that from 1828 to 1892, the population grew at 0.2 per cent per annum, then the two most affected areas might have had 14,926 people in 1856. Moreover, we may assume that ‘several thousands’ meant 3,000-5,000 and calculate that 20-33 per cent of the population died of this epidemic. Just as in the case of 1820 epidemic in Danshui Ting, the gazetteer says that Li Guangdu 李光度, a merchant quild's accountant, distributed medicine during this great epidemic (TW164: 250). The 1857 event was a continuation of that occurred in the previous year.

The 1864 epidemic was recorded only for Damaonanbao 打貓南堡, a village north of the county city of Chiayi. This epidemic broke out after the rebellion of Dai Chaochun 戴潮春 and many people died. It might have attacked only a limited area as the same source did not mention that other villages in the county were aft\ected.

In the 1866 great epidemic of Danshui Ting, Zhang Zhengduan 張正端, a resident of Mengjia 艋舺 (in today's Taipei city), distributed medicine to save lives (TW172: 139, 451). The 1868 great epidemic in Penghu Ting was most severe at Lintouao 林投澳 and Kuibiao. In both cases, however, the numbers of victims were unknown. The information of deaths was also not available in the last six events listed in Table 1.

It may be noted by passing that a strange epidemic occurred in Penghu in winter 1873. According to the gazetteer, most of the people of the subprefecture were attacked by this disease bur very few died of it. They had pains over their bodies and they felt powerless in their hands and feet even after one or two months. This disease has been identified as dengue according to symptoms described by the gazetteer (Li *et al*., 1972, 3: 274).

As for seasonality of epidemics listed in Table 1, five occurred in summer (1866, 1883, 1884, 1885, and 1890), three in autumn (1820, 1968, and 1874), and one in winter (1889). The rest in 1681, 1856, 1857, and 1864 were unknown.

In addition toan epidemic recorded under the category of calamity, the term *yi* was also used in various documents to refer to common illness that occurred among the aborigines and during military campaigns.

Regarding epidemic (*yi*) that occurred among the aborigines, the 1717 gazetteer of Zhulo containd a story about Douliumen 斗六門. An old tribal head was murdered by his tribe members for they had bitter complaint about endless deer-hunting. The blood of the head dripped on grasses that turned all red, while the tribe members died of an epidemic (*yi*) without exception (TW141: 290-291; TW3: 90). Around 1721, Lan Dingyuan 藍鼎元 noted the aboriginal villages situated east of the mountains. Nine villages had existed in 1695, since then one had disappeared due to *yi* (TW12: 90). In 1873, Ding Shaoyi 丁紹儀 noted that *yi* was one of the reasons for the aborigines to move or die off (TW2: 70). The 1894 enquiries in Taitung reported that the aborigines usually moved the entire tribe whenever there was an epidemic (TW81: 52). Some records also said that the aborigines were most afraid of smallpox (*dou* 痘) (TW61: 188-189; TW159: 123). A well-known story is of the pioneer developer of Gamalan area, Wu Sha 吳沙, who saved the lives of aborigines during a smallpox epidemic in 1796 (TW7: 70; TW160: 372). A study on smallpox infection among the aborigines suggests that this disease was found mainly around the Ali mountain and Ilan (Wen

ZH, 1992: 87-89). In 1877, it was proposed to set up medical bureaus and to hire vaccinators to help vaccination among the aborigines (TW276: 9). In 1892, Hu Chuan reported that there was one medical bureau at Xinkaiyuan 新開園 (TW71: 21). However, details about the function of these medical b ureaus still have to be found. Although details about the function of these medical bureaux still have to be found.

Several examples of epidemics during military campaigns are also found in the history of Taiwan. In 1721, during the campaign against the revolt of Zu Yigui 朱一貴, an epidemic (*liyi*) broke out and numerous officers and soldiers died (TW14: 21). Similarly, in August 1787, during the campaign against rebellious Lin Shuangwen 林爽文, 50-60 per cent of the Qing army coming from the mainland fell ill (TW156: 371). It was reported that Lan Yuanmei 藍元枚, a commander stationed at Lugang 鹿港 (in central Taiwan), died of dysentery on September 29 and soldiers died of illness everyday in November (TW102: 617). Due to the fact that even soldiers from south China were apt to fall ill in Taiwan, the Qianlong Emperor thus decided not to send his army from Beijing (TW102: 622-623). These two events show that epidemics did occur in the eighteenth century, altghough they were not mentioned under the category of calamity in local gazetteers. Again, in autumn 1863 many soldiers died of epidemic during the campaign against rebel Dai Chaochun (TW8: 15).

In the 1874 campaign mentioned above, the outbreak of malaria had turned into an epidemic as noted in some sources (TW308: 71, 74; TW110: 21). During the Sino-French War in 1884-1885, in addition to malaria, The French soldiers also died of an epidemic with symptoms of cholera. According to the account of Garnot, a lieutenant in the French navy, the French landed at Keelung on October 1, 1884. The French force consisted of 53 officers and 1,800 soldiers and they were soon infected by cholera epidemnic. From October 11, 1884 to January 20, 1885 altogether 82 died of the epidemic and the number of soldiers still effective was less than 1,000. In feburary 1885, the African detachment that was so far not infected by the epidemic started to lose its soldiers. The joint foreign detachment was also seriously attacked with 91 infected and 31 dead by February 19 (Garnot trans. by Li, 1960: 20-23, 38, 47, 49, 60, 71, 77). The French soldiers also suffered from skin disease (TW 253: 271). Moreover, the French admiral Courbet had fallen ill due to dysentery starting late April and his illness gradually became more complicated and he died on June 11, 1885 in Penghu (Garnot trans. by Li, 1960: 116; TW192: 35, 444; Zenfg and Jin, 1986: 245).

Although the term 'cholera' was not mentioned in most Chinese records we have seen so far, there is revealing evidence. The epidemics broke out in winter instead of in summer. One report said that it was *zhang* but added that heavy diarrhea occurred when *zhang* started. Other reports said what prevailed in Keelung was *wenyi* 瘟疫 (plague); and that of the 3,300 French soldiers stationed there, only about 2,000 were still able to fight (TW253: 158, 294, 370, 373). Similarly, the Chinese force also suffered from *yili* and there were deaths every day; no more than 3,000 could still be engaged in combat (TW120: 213; TW277: 75). Thus, we see different terms were used in recording this epidemic. Moreover, it seems that this epidemic attacked not only the armies and not just in northern Taiwan. Liu Mingchuan reported in one memorial that *yili* prevailed in Tainan before spreading to northern Taiwan (TW27: 140). A brief history of Maogangwei 茅港尾, a town north of Tainan, stated that during the time of Sino-French War, cholera (*huoluan* 霍亂) and malarial epidemic plague (*wennuezheng* 瘟瘧症) prevailed. These diseases, of which the residents either died or fled, attacked first the village, then the surrounding area and then the town

(TW216: 136).

Finally, it is well known that in 1895 when the Japanese took over Taiwan, their troops encountered resistances from the local people, but they suffered even more form disease. One record said that the Japanese army arrived Changhwa in august and some 200 soldiers fell ill suddenly upon arrival. An epidemic (*yizheng* 疫症) broke out in a few days and many Japanese died, among them Major-General Yamane and other officers (TW120: 256-257). Lames Davidson, who served as a war correspondent with the Japanese army and later the United States consul for Taiwan, gave us an eyewitness account:

> At all events, an outbreak of fever spread throughout the army like wild-fire. From the highest officer to the lowest coolie, all were incapacitated. Only the very serious cases were taken to the field hospital; yet within the first few days these numbered 824, of whom 82 died. Of the hospital crops of one chief and five doctors, three were incapacitated, thus leaving but two to look after the numerous invalids. Sixteen out of forty-one trained medical assistants were struck down, and four died (Davidson, 1903: 339-340).

On the whole, from the date of Japanese landing on May 26 to December 15, only 164 Japanese were killed in battle and 515 wounded. However, 31,636 were taken ill, of which 4,642 died, 21,748 were sent to Japan for treatment, and 5,246 were hospitalized in Taiwan (Davidson, 1903, 364; Barclay, 1954: 136, gives round numbers). Although the size the Japanese force is unknown, we may calculate that the mortality of those who had fallen ill was 14.7 per cent. It was this campaign that urged the Japanese colonial authorities to give a high priority to public health policy that helped to reduce risks of death in Taiwan since the 1930s (Barclay, 1954: 133-171; Xie, 1989; Fan, 1994). We will not repeat the details here.

We should note that according to the Qing statute, a *Yangjiyuan* 養濟院 (Institute for Nourishment and Relief of the Poor) was set up in the three counties in Taiwan as early as 1684. A *Pujitang* 普濟堂 (Hall for General Relief) was established in the prefectural city (Tainan) in 1746 (TW121: 113-114). In addition, a *Liuyangju* 留養局 (Bureau for Retaining and Nourishment) was set up in Changhwa in 1764 (TW156: 62). These agencies aimed mainly at the relief of the poor, but the but the *Yangjiyuan* set up in Changhua in 1736 was restricted to retain patients of leprosy (TW121: 823-824; TW156: 61-62). Moreover, Liu Mingchuan set up an official medical bureau and hospital in Taipei when he was the governor of Taiwan (Chen, 1992: 12). These establishments represented official efforts in taking care of the poor and the sick and more details should be found about their functions in Taiwan.

As for efforts of private people, we have mentioned above some individuals who distributed medicines during epidemics. It is noteworthy that in 1869, Mingshantang 明善堂, a philanthropic society in Zhuqian 竹塹 (today's Hsinchu), set up a rule to distribute pills and medicines from the fifth to the seventh month (about June to August) to help prevent the summer epidemic (TW145: 192). These public and private efforts may be considered as positive or formal actions taken by the people in dealing with epidemic diseases. On the contrary, people might have sought healing from withery. They also practiced the custom of *wangjiao* 王醮, a rite for driving away the sprit of epidemic (TW103: 60-61; TW121: 498-499; TW141: 147-148, 150-151). These folk customs were certainly not peculiar in Taiwan (Katz 1990).

## 3. Some statistics

In this section, we will briefly discuss health conditions and causes of death among Taiwanese in the early twentieth century with available statistics.

The health conditions in Taiwan during the 1920s can be gathered from the results of health examinations conducted from 1921 to 1929 at 32 localities in the eight administrative divisions. At the outset, it should be noted that the sample can be considered as a good representative of the population. As shown in Table 2, the age structure and mean age of he people taking he health examinaations re very close to those of the Taiwanese population in the 1925 census; the *t* values of test statistic confirm that the sample is identical with the population.

Table 2. Age structure and mobidity of Taiwanese (1921-1929)

| Age | Total Population (1925) | | | People investigated | | | Morbidity | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total (%) | Male (%) | Female (%) | Total (%) | Male (%) | Female (%) | Total (%) | Male (%) | Female (%) |
| 0-4 | 12.08 | 11.86 | 12.31 | 14.44 | 14.64 | 14.24 | 31.62 | 32.31 | 30.91 |
| 5-9 | 13.11 | 13.06 | 13.16 | 12.60 | 12.95 | 12.25 | 40.80 | 44.50 | 36.91 |
| 10-14 | 11.83 | 11.88 | 11.76 | 12.15 | 12.46 | 11.85 | 39.04 | 46.31 | 31.42 |
| 15-19 | 10.96 | 11.08 | 10.84 | 10.00 | 10.02 | 9.99 | 34.36 | 45.55 | 23.18 |
| 20-24 | 9.45 | 9.78 | 9.09 | 8.72 | 8.85 | 8.59 | 32.05 | 39.64 | 24.26 |
| 25-29 | 8.15 | 8.45 | 7.82 | 7.34 | 7.65 | 7.04 | 33.22 | 40.12 | 26.10 |
| 30-34 | 6.65 | 7.05 | 6.23 | 6.59 | 6.98 | 6.21 | 26.62 | 43.10 | 29.32 |
| 35-39 | 5.96 | 6.36 | 5.54 | 6.43 | 6.52 | 6.33 | 36.07 | 41.28 | 30.71 |
| 40-44 | 5.69 | 5.94 | 5.42 | 5.85 | 5.95 | 5.75 | 38.24 | 44.39 | 31.90 |
| 45-49 | 4.83 | 4.83 | 4.84 | 5.15 | 5.03 | 5.27 | 37.30 | 38.60 | 36.06 |
| 50-54 | 3.98 | 3.83 | 4.14 | 3.84 | 3.57 | 4.11 | 37.48 | 41.15 | 34.30 |
| 55-59 | 2.72 | 2.46 | 3.00 | 2.60 | 2.16 | 3.03 | 35.45 | 36.63 | 34.62 |
| 60-64 | 1.74 | 1.48 | 2.02 | 1.81 | 1.51 | 2.10 | 31.90 | 33.05 | 31.07 |
| 65-69 | 1.32 | 1.00 | 1.66 | 1.21 | 0.90 | 1.51 | 30.75 | 27.95 | 32.42 |
| 70-74 | 0.83 | 0.56 | 1.12 | 0.75 | 0.51 | 0.98 | 29.00 | 32.83 | 26.96 |
| 75-79 | 0.45 | 0.27 | 0.65 | 0.36 | 0.23 | 0.48 | 28.47 | 31.03 | 27.27 |
| 80-84 | 0.18 | 0.09 | 0.27 | 0.11 | 0.05 | 0.17 | 29.07 | 19.05 | 32.31 |
| 85+ | 0.07 | 0.03 | 0.11 | 0.04 | 0.02 | 0.07 | 29.41 | 28.57 | 29.63 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 35.70 | 40.95 | 30.46 |
| Mean age* | 24.95 | 24.45 | 25.49 | 24.45 | 23.65 | 25.24 | | | |
| N | **3,993,408** | **2,053,669** | **1,940,739** | **77,011** | **38,450** | **38,561** | **27,494** | **15,747** | **11,747*** |

*the results of the difference-of-means test show that the t value for the total is -5.5415E-05, for the male is -0.000s202, and for the female is -4.05674E-05; with 17 degrees of freedon and 0.05 level fo4r two-tailed test, $-.2.11 < t < 2.110$.

Source: total population, TJTY, 1946: 104-105, Table 58.1; people ionvestigated and in illness, Eisei, 1931: 8-9.

From Table 2, we can see that the mortality of the male was higher than that of the female at most age groups, except for the age group 65-69 and age 80 and above. All together, 77,011 Taiwanese had health examinations, of which 27,494 were found to be ill; thus, the morbidity was 35.7 per cent. When trachoma, cavity and parasites

were included, almost all those examined were sick. The results of health examinations conducted at 71 villages in Japan during the same period showed that of the 138,461 persons examined, only 38,821 were found to be ill. Not including trachoma, cavity, and parasites, the morbidity was 28.04 per cent (Eisei, 1931, 5).

Geographically speaking, of the eight administrative districts at the time, the highest morbidity was 96.2 per cent in Taizhongzhou 臺中州 (in central Taiwan). Next to this was 65.5 per cent in Taidongting 臺東廳 Ting. The third in the rank was 42.0 per cent in Tainanzhou 臺南州 (in the south). The fourth was 21.4 per cent in Xinzhuzhou 新竹州 (between the north and the central). The fifth was 16.5 per cent in Gaoxiongzhou 高雄州 (in the southwest). The last three in he rank were 7.1 per cent in Taibeizhou 臺北州 (in the north and northeast), 6.1 per cent in Penghuting 澎湖廳 (off shore islands), and 2.3 per cent in Hualiangangting 花蓮港廳 (in central east). The low morbidity in Huanliangangting was because the investigations were taken when malaria was not in the season (Eisei, 1931: 7).

The findings were recorded in 195 entries and grouped into 12 categories. The morbility calculated with the grouping showed that 21 per cent of the people having health examinations had suffered from general constitutional diseases, such as splenomegaly, anaemia, goiters, nutritional diseases, weak constitutions, rheumatism, hyperliposis, etc. Next to this category was 4.4 per cent of the people suffering from epidemic, endemic, and infectious diseases, such as malaria, measles, pulmonary tuberculosis, syphilis, gonorrhea, etc. the third category was skin and subcutaneous diseases that counted for 3.5 per cent. Other categories counting for more than one per cent were diseases related to the respiratory system (2.3 per cent), nervous and sensory system (1.8 per cent), digestive system (1.5 per cent), and blood circulation (1 per cent). As for diseases related to physique and system of locomotion, urinary and reproduction organs, outer causes, deformity, they all counted for less than one per cent (Eisei, 1931: 10, 40-49).

Regarding specific diseases, splenomegaly, malaria, anemia, erythema, and acute bronchitis were the top five in that order. Of the 27,494 persons ill, nearly half (45.1 per cent) had splenomegaly. About one tenth (9.5 per cent) had malaria. In addition, 8.5 per cent had anemia, 4.2 per cent had erythema, and 3.6 per cent had acute bronchitis. It was found that splenomegaly was closely related to malaria in Taiwan as in other malarial districts (Chang, 1994: 6; Zurbrigg, 1994: 132). Those who had splenomegaly were mostly carriers of *Plasmodium* as they had suffered from malaria before. The anaemia sufferers were mostly found in Taizhongzhou (2,312 of the 2,349) and the cause was possibly related to parasites and to malaria (Eisei, 1931: 19-28).

In Tainanzhou, among those who were ill, the rate of splenomegaly was 78.8 per cent, and malaria, 14.7 per cent; both above the average. The rate of malaria in Taizhongzhou (10.4 per cent) and Gaoxiongzhou (11.8 per cent0 were also above the average. In Taidongting, the rate of splenomegaly (59.7 per cent) was above the average. As the two diseases were closely related, the districts bhaving a rate above the average councould be taken as the area where malaria was still prevalent in the 1920s (Eisei, 1931: 17, 24, 27-28). It is also notable that Taibeizhou, which covered the North Danshui area and used to be a notorious malaria country, now had a rate of 8.9 per cent, slightly below the average. This may show that the malaria control program applied to this district since 1910 had already produced some effects (Taihoku, 1919: 536-538; Zeng and Jin, 1986: 209-211).

Japanese colonial authorities started conducting a malaria control program in 1906

at a camphor collection site at Jiaxianpu 甲仙埔 (in Gaoxiongzhou). After carrying out experiments at 20 localities, regulations were set up in 1913 to enforce the control over the island (Taiwan Sotokufu, 1932). These regulations were applied to selected localities: 55 in 1916, 58 in 1918, 74 in 1919, and 208 in 1932 (Li *et al*., 1972: 4:298; Fan, 1994: 126-148).

We should note that Japanese colonial authroities always enforced the malaria control policy as a solution to social problems. This is quite different from their Western counterparts who had struggled with whether to treat malaria more as a social problem or as an entomological one (Evans, 1989: 40-59). The malaria control units routinely collected data on the prevalence of the disease. This is certainly an important contribution, but there is little evidence of epidemiological studies of malaria by the Japanese. Members of the Institute of Tropical Medicine, the most important institution in charge of medical studies in colonial Taiwan, carried out entomological studies, but these were largely taxonomic rather than biological or epidemiological (Note 1946, RF601I: 4-5).

This anti-malaria programme, like other policies of anti-contagious diseases during the colonial period, was evidently aimed at the conservation of manpower with the least possible expense and effort. Also, it was aimed at suppression of malaria rather than at prevention of transmission through mosquito control (Watson and Chow; 1946: RF601I, 6-8). Nevertheless, the malaria control policy was still effective from the standpoint of the Japanese government as seen in the declining rate of malaria. The eradication of malaria in Taiwan was to wait until 1965 (Weishengshu, 1993). Since documents related to malaria control in Taiwan are quite rich, further studies are required to explore its implications from a comparative perspective.

The same investigations also found that the swelling of the thyroid gland (produced some findings about parasites. On the average, 78.3 per cent of the 77, 011 persons examined had parasites. This rate was about the same as 78.2 per cent found in Japan (Eisei 1931, 55-56). As for the type of parasites carried by these people, 54.4 per cent had helminth (round intestinal worm); 29.3 per cent had flagellate; 14.4 per cent had hookworm; this pattern was quite similar to that found among the Japanese; the percentages were 50.3, 29.8, and 16.7 respectively (Eisei 1931, 65).

The same investigations also found that the swelling of thyroid glend (goiter) was a peculiar disease in Taiwan; it ranked sixth among 195 items (Eisei, 1931: 41). Of the 27,494 persons ill, 961 (or 3.5 per cent) had suffered from a goiter and 906 were female. This disease was noted in records as early as around 1860 (TW36: 18). It was mostly found along hillside areas due to special local geographical conditions. It is notable, however, that this disease caused no one to die up to 1931 according to statistics (TJTY, 1946: Table 91).

As for the causes of death, statistics are available for 79 entries during 1906-1942 (TJTY, 1946: Table 91). Here, the major causes of death among Taiwanese (not including the Japanese residing in Taiwan) are selected and percentages are calculated for a discussion of the situation during 1906-1929.

The results show that the cause of death for most Taiwanese was malaria up to 1911 and again in 1915-1916. During 1906-1916, malaria took about 10 per cent of the death roll. Its share declined during 1917-1929, but still counted for more than 5 per cent up to 1927. After 1916, as malaria control was in progress, pneumonia became the leading cause of death. In 1929, pneumonia accounted fo 21 per cent of the deaths and ranked top. Since pneumponia was the major cause of death among Taiwanese children (see below). The decrease of its share did not take place until the

decline in child mortality after 1935 (Chen, 1979: 141-142). In addition, tuberculosis of respiratory organs made up 6.7 per cent and ranked third. Bronchitis was 5.5 per cent and ranked fourth. When diseases related to respiratory system are taken together, they actually had the largest share of deaths throughout the period under study. Next to respiratory diseases were the digestive ones, such as diarrhea and enteritis, stomach and duodenum ulcers. In 1929, these diseases had a share of 18.44 per e\cent. In other words, the large share ofr deaths related to respiratory and digestive diseases indicated a situation before the health transition (Chen, 1979: 133-140).

It is notable that 'albuminuria and convulsions' as a cause of death had a quite high percentage up to around 1920. I took about 9 per cent of death toll and ranked only next to malaria during 1906-1909. It still counted for more than 5 per cent before 1915 (the statistics for this item are not available after 1923 due to reclassification). It is neglected, however, in studies dealing with mortality in Taiwan (e.g., Chen, 1979). This item included convulsions and eclampsia not due to conception and delivery, while other causes related tro childbirth required further study in order to find out their implications.

Epidemic diseases (including plague, typhoid, paratyphoid, typhus, dysentery, smallpox, diphtheria, scarlet fever, and other contagious and parasitic diseases not individually named) made up a comparatively small proportion of death among Taiwanese. In most years, these diseases accounted for less than 3 per cent. Plague, the disease caused by *Yersinia pestis*, was most notable. It was first formally reported in Taiwan in 1896 and was the major epidemic before 1910, but it was almost eradicated after 1916. Japanese colonial authorities set up quarantines and adopted measures to control the spread of plague. Remarkable measures were the deep burial of corpse, burning down houses of the victims, and catching rats (Li *et al*., 1972: 3: 212-214; Fan, 1994: 102-126).

Another series of statistics related to epidemic diseases are available for 1897-1942 (TJTY, 1946: Table 490). This latter series show that there was no death caused by plague after 1917. The figures in this latter series are also somewhat larger and this difference is due to the fact that Japanese and foreigners were also included. In any case, it is notable that epidemics took around 5 per cent of the total deaths during 1919-1922 mainly from outbreaks of cholera, typhoid, smallpox, and epidemic cerebrospinal meaningitis (cf. TJTY, 1946: Table 490). Compared with ordinary diseases, epidemics are better documented in Taiwan as in China, Japan, and Southeast Asia (Owen, 1987: 6-7). Some studies with comparative perspective had been doen recently (Fisher, 1995; Iijima, 1991, 1995; Liu, 1994; MacPherson, 1995), dn we should not repeat the details here.

Some American doctors from Rockfeler foundation have considered that the Japanese policies of anti-epidemic and endemic diseases as a social relief programme may have been unsound from a public health point of view (Watson and Chow, 1946: RF601I, 8). However, the reduction in morbility did prove that Japanese policies were successful and efficient. Moreover, the success of Japanese policies may also lead us to rethink a more comprehensive understanding that should integrate the epidemiological treatment and social relief into the control of epidemic and endemic diseases. It may also be meaningful for a future study to compare the case of Japanese Taiwan with that of British India (Harrison, 1994).

Finally, senility, apoplexy, and nephritis are selected to show the cause of death relating to old age. During 1906-1929, senility caused 3 or 4 per cent of the deaths. Apoplexy was 1.5 per cent. Both remained quite stable. The percentage of nephritis,

however, showed an increasing trend; it increased from less than 1 to 4 per cent. The low percentage of these items reflected again the situation before the health transition.

As for Taiwanese children below age 5, the statistics of 208,644 deaths in 1916-1921 are available in 33 entries. The top ten causes in order were as follows: pneumonia (15.5 per cent), stomach disease (11.2 per cent), deformity (10.9 per cent), infant eclampsia (7.3 per cent), malaria (5.9 per cent), acute bronchitis (5.7 per cent), diarrhea and eneriis (5.4 per cent), other epidemic and endemic diseases (4.1 per cent), other respiratory diseases (3.84 per cent), and meningitis (3.78 per cent). Im addition , measles made up 1.99 per cent and ranked thirteenth (Eisei, 1928: 2-3).

In short, despite the plague eradication and malaria control under progress, Taiwan remained a society before an era of health transition up to the 1920s. A majority of the people still died of disease related to the respiratory and digestive systems. Moreover, morbidity of skin and parasitic diseases was still quite remarkable. These diseases could have been prevented if sanitary conditions had been improved and cured if modern medicine had been provided.

## Concluding remark

This paper is a preliminary study on disease and death in the history of Taiwan prior to the era of health transition. With qualitative data gathered from various historical records, we have tried to provide a sketch of endemic and epidemic diseases suffered by the people of Taiwan since the seventeenth century. With some statistics available in the early twentieth century, we have tried to capture the health conditions of the Taiwanese and trace major causes of death. We have also touched upon some methods for preventing diseases, superstitious custom or effective medicine, social enforcement or epidemiological treatment, that have been adopted in Taiwan during the past few hundred years. Further studies are no doubt required for all these aspects and for details of specific diseases and their social, cultural and historical implications.

## Reference

Barclay, G.W. (1954), *Colonial Development and Population in Taiwan*, Princeton University Press, Princeton.

Campbell, Rev. Wm. (1903; 1987), *Formosa Under the Dutch: Described from Contemporary Records*, reprinted, Southern Materials Center, Taipei.

Chang, P.Y. 張朋園 (1994), 'Pinquiong yu jibing: Yun-Gui diqu de zhangli 貧窮與疾病:雲貴地區的瘴癘 [Poverty and disease: zhangli in the Yun-Gui region]', Paper presented at the Conference on the one hundred anniversary of Dr. Sun Yat-sen's Revolutionary Party, November 19-23, Taipei.

Chen, B.X. 陳邦賢 (1981), *Zhongguo yixue shi* 中國醫學史 [A history of medicine in China], Shang-wu, Taipei.

Chen, J.K. 陳君愷 (1992), *Rizhi shiqi Ta-wan yisheng shehui tiwei zhi yajiu* 日治時期臺灣醫生社會地位之研究 [A study on the social status of Taiwanese doctor under Japanese rules], Monograph series No.22, Institute of History, National Taiwan Normal University, Taipei.

Chen, S.K. 陳勝崑 (1992), *Zhongguo jibing shi* 中國疾病史 [A history of disease in China], Jujing, Taipei.

Chen, S.X. 陳紹馨 (1979), *Taiwan de renkou bienqian yu shehui bianqian* 臺灣的人

口變遷與社會變遷 [Population change and social change in Taiwan], Lienjing, Taipei.
Cipolla, C. M. trans. by E. Potter (1992), Miasmas and diaseas; Public Health and the Environment in the Pre-industrial Age, Yale University Press, New Haven.
Dai, W.F. 戴文鋒 (1995), '*Haiguan yibao* yu Qingmo Taiwan kaigang diqu de jibing 《海關醫報》與清末臺灣開港地區的疾病 [The medical Reports and the disease in the treaty port areas in Taiwan in late Qing]', *Thought and Words*, 33.2: 157-213.
Davidson, J.W. (1903; 1988), *The Island of Formosa, Past and Present*, Southern Materials Center, Taipei.
Donn, V.H. (1969), *Bisayan Filipino and Malayan Humoral Pathologies: Folk Medicine and Ethnohistroy in southeast Asia*. Data paper, no. 76, Southeast Asia Program, Department of Asian Studie, cornell University, Ithaca, New York.
Du, C. M. 杜聰明 (1959), *Zhongxi yixue shilue* 中西醫學史略 [A short history of Chinese and Western Medicine], published by the author, Taipei.
Dunn, F.L. (1993), 'Malaria', in Kenneth F. Kiple (ed.), *The Cambridge World History of Human Disease*, Cambridge University Press, New York, 855-862.
Eisei 臺灣總督府警務局衛生課 (1928): *Eisei chosa sho, no.8* 衛生調查書(基本調查の八[*Report on the health examination, no.8*], The Health Department of the Police Bureau under the Taiwan Sotokufu, Taipei.
Eisei 臺灣總督府警務局衛生課 (1931): *Eisei chosa sho, no.10* 衛生調查書第十輯 [*Report on the health examination, no.10*], The Health Department of the Police Bureau under the Taiwan Sotokufu, Taipei.
Evans, H. (1989), 'European Malaria Policy in the 1920s and 1930s--The Epidemiology of Minutiae,' *ISIS*, 80: 40-59.
Fan, Y.Q. 范燕秋 (1994), 'Riju qianqi Taiwan zhi gonggong weisheng: yi fangyi wei zhongxin zhi yanjiu (1895-1920) 日據前期臺灣之公共衛生:以防疫為中心之研究(1895-1920) [Public Health in Taiwan during the early period of Japanese rule: a study on epidemic prevention during 1895-1920],' MA thesis, Institute of History, National Taiwan Normal University, Taipei.
Fisher, C.T. 費克光 (1995), 'Zhongguo lishishang de hsuyi 中國歷史上的鼠疫 [Plague in Chinese history], in T. J. Liu and M. Elvin (eds.), *Jijian sozhi: Zhongguo huanjingshi lunwenji* 積漸所至：中國環境史論文集 [Sediments of Time: Environment and society in Chinese History], institute of Economics, Academia Sinica, Taipei, pp. 673-745.
Garnot, E. (1894), *L' Expédition française de Formose, 1884-1885*, trans. by Li, L.W. 黎烈文 (1960), *Fajun qin Tai shimo* 法軍侵臺始末, Taipei, The Bank of Taiwan.
Harrison, M. (1994), *Public health in British India: Anglo-Indian preventive medicine 1859-1914*, Cambridge, Cambridge University Press.
House, E.H. (1875; 1984), *The Japanese Expedition to Formosa*, Tokyo; reprinted, Dali Publishing Co., Taipei.
Hsiao, F. 蕭璠 (1993), 'Han Song jian wenxian sojian gudai zhongguo manfang dili huanjing yu difanping kiqi yingxiang 漢宋間文獻所見古代中國南方地理環境與地方病及其影響 [The physical environment and endemic disease in ancient south China and their impact on human activities as views from the documents of Han through /song times]', Bulletin of the Institute of History and Philology, Academia sinica, 63.1: 167-171.

Iijima, W. 飯島渉 (1991), 'Kindai To-Ajia ni okeru pesuto no ryuko nit suite – 1894 nen Guangdong oyobi Hong Kong, 1902-13 nen Yokohama, 1910-11 nen Manshu 近代東アジアにおけるペストの流行について ー 1894年廣東香港、1902-13年横濱、1910-11年「滿洲」[On plague epidemics in modern East Asia; Guangdong and Hong Kong in 1894, Yokohama in 1902-13, Manchuria in 1910-11]', *Shicho* 史潮, new 29: 24-39.

Iijima, W. 飯島渉 (1995), 'Korera ryuko to To-Ajia no boeki shisutemu – Hong Kong, Shanghai, Yokohama, 1919 コレラ流行と東アジア防疫システム ー 香港•上海•横濱，1919年 [Cholera epidemic and the system of epidemic prevention in East Asia]', in The Joint Editorial committee (ed.), Yokohama to Shanghai: kindai toshi keiseishi hihaku kenkyu [Yokohama and shanghai: comparative studies on the history of formation of modern cities], Yokoyama Historical Archieves, Tokyo, pp. 463-490.

Katz, P. (1990), *Plague Festivals in Chekiang in Late Imperial China*, Ph.D. thesis, Princeton University.

Katz, P. (1995), 'Germs of Disaster - The Impact of Epidemics on Japanese Military Campaigns in Taiwan'. Paper presented at Conference on Family, Demography and Social Reproduction organized by International Commission on Historical Demography, September 2, Montreal.

Leung, A. K.C. (1993), 'Diseases of the Premodern Period in China', in Kiple (ed.), *The Cambridge World History of Human Diseases*, 354-362.

Li, K.M. 李國銘 (1994), 'Shiqi shiji zhongyeh Pingdong pingyuan de cunluo yu jishi 十七世紀中葉屏東平原的村落與記事 [Villages and recorded events of Pingtung plain during the mid-seventeenth century], *Taiwan Historical Research*, 1.2, 109-130.

Li, T.Y. 李騰嶽 et al (1972), *Taiwansheng tongzhi* 臺灣省通志 [The gazetteer of Taiwan province], section on public health, 5 vols., The Historical Research Commission of Taiwan Province, Taichung.

Liu, S.Y. (1994), 'The Tiger Out of the Enclosure: Cholera in Colonial Taiwan (1895-1945)', Manuscript.

Liu, T.J. 劉翠溶 (1995), 'Hanren tuoken yu juluo zhi xingcheng: Taiwan huanjing bianqian zhi qishi 漢人拓墾與聚落之形成: 臺灣環境變遷之起始 [Han immigration and the Settlement of Taiwan: the onset of environmental change]', in Ts'ui-jung Liu and Mark Elvin (eds.), *Jijian sozhi: Zhongguo huanjingshi lunwenji* 積漸所至：中國環境史論文集 [Sediments of Time: Environment and society in Chinese History], The Institute of Economics, Academia Sinica, Taipei, pp. 295-347.

Mackay, G.L. (1896;1991), *From Far Formosa: The Island, its People and Missions*, SMC Publishing INC, Taipei.

MacPherson, K. 程愷禮 (1995), 'Huoluan zai Zhongguo (1820-1930): chuanranbing guojihua de yimian 霍亂在中國 (1820-1930)：傳染病國際化的一面 [Cholera in China, 1820-1930: An Aspect of the internationalization of Infectious Disease]' in Ts'ui-jung Liu and Mark Elvin (eds.), *Jijian sozhi: Zhongguo huanjingshi lunwenji* 積漸所至：中國環境史論文集 [Sediments of Time: Environment and society in Chinese History], The Institute of Economics, Academia Sinica, Taipei, pp. 747-795.

Mackay, G.L. (1896;1991), *From Far Formosa: The Island, its People and* Missions,

reprinted, Southern Material Center, Taipei.
Maruyama Y. 丸山芳登 (1957), *Nihon-ryo jidai ni tsukawashita Taiwan no iji eisei gyoseki* 日本領時代に遣した台灣の醫事衛生業績 [Taiwan's medical health achievements bestowed during the Japanese ruling period], publish by the Author, Yokohama.
Miyasita, S. (1979), 'Malaria (*yao*) in Chinese Medicine during the Chin and Yuan Periods', *Act Asiatica*, 36: 90-112.
Note (1946), Archive of the Rockefeller Foundation, RF601I China-malaria, RG1, series 601 China, box 44, folder 359.
Owen, N.G. (ed.) (1987), *Death and Disease in Southeast Asia: Explorations in Social, Medical and Demographic History*, Oxford University Press, Singapore.
Taihoku 臺北廳 (1919): *Taihoku choshi* 臺北廳志 [Gazetteer of Taipei district], Taipei.
Taiwan Sotokufu (1932), *Mararia boatsu shi* マラリア防遏誌 [A record of malaria prevention], Taipei.
TJTY 臺灣省行政長官公署統計室 (1946): *Taiwan sheng wushiyinianlai tongji tiyao* 臺灣省五十一年來統計提要 [Taiwan Province: Statistical Summary of the Past 51 Years], Taiwan Provincial Statistical Office, Taipei.
TW: *Taiwan wenxian congkan* 臺灣文獻叢刊 [Taiwan historical documents series], 1957-1972. The Bank of Taiwan, Taipei. Individual works cited are listed below with the number in he series. Year of the first edition or time of the work is in parentheses. ,
TW2, Ding, S.Y. 丁紹儀 (1873) *Dongying Shilue*東瀛識略 [A brief note on the eastern sea].
TW3, Zhu S.J. 朱仕玠 (1765), *Xiaoliuqiu manzhi* 小琉球漫誌 [Notes on *Xiaoliuqiu*, i.e., Taiwan].
TW4, Huang, S.J. 黃叔璥 (1736), *Taihai shicha lu* 臺海使槎錄 [A record of rafting over the sea to Taiwan].
TW7, Yao, Y. 姚瑩 (1829), *Dongcha jilue* 東槎紀略 [A brief note on rafting to the east].
TW8, Lin, H. 林豪 (1870), *Tongying jishi* 東瀛紀事 [Notes on the eastern sea].
TW10, Sun, Y.H. 孫元衡 (1705-8), *Chikanji* 赤嵌集 [Collected poems written in Taiwan].
TW12, Lan, T.Y. 藍鼎元 (1722), *Dongzhengji* 東征集 [On eastern expedition].
TW14, Lan, T.Y. 藍鼎元 (1721-4), *Ping Tai jilue* 平臺紀略 [On pacifying Taiwan].
TW27, Liu, M.C. 劉銘傳 (1906), *Liu Zhuangshugong zouyi* 劉壯肅公奏議 [Memorials of the author].
TW29, Shen, B.Z. 沈葆楨 (1892), *Fujian Taiwan zouzhe* 福建臺灣奏摺 [Memorials related to Fukien and Taiwan].
TW30, Tang, Z.G. 唐贊袞 (1891), *Taiyang jianwen lu* 臺陽見聞錄 [On experiences in Taiwan].
TW36, Wu, Z.G. 吳子光 (1860s), *Taiwan jishi* 臺灣紀事 [Notes on Taiwan].
TW38, *Tongzhi jiaxu Ri bing qin Tai shimo* 同治甲戌日兵侵臺始末 (1874), [Details of Japanese intrusion to Taiwan].
TW39, Wang, Y.Z. 王元墀 (1874), *Jiaxu gongdu chaochun* 甲戌公牘鈔存 [Copies of official documents in the year jiaxu].
TW44, Yu, Y.H. 郁永河 (1697), *Pihai jiyou* 裨海紀遊 [Travel over a small sea].

TW58, *Jiayi guannei caifangce* 嘉義管內采訪冊 (1897-1901), [The record of inquiry in jurisdiction of Chiayi county].
TW61, Zheng, P.Y. 鄭鵬雲 *et al*. (1898), *Xinzhu xianzhi chugao* 新竹縣志初稿 [Draft gazetteer of Hsinchu county].
TW65, Gao, G.Q. 高拱乾 (1694), *Taiwan fuzhi* 臺灣府志 [The gazetteer of Taiwan prefecture].
TW66, Zhou Y.W. 周元文 (1712), *Chongxiu Taiwan fuzhi* 重修臺灣府志 [The revised gazetteer of Taiwan prefecture; 1712].
TW71, Hu, C. 胡傳 (1892-5), *Taiwan riji yu linqi* 臺灣日記與稟啟 [Diary and ewports in Taiwan].
TW74, Liu, L.B. 劉良璧 (1741), *Chongxiu Fujian Taiwan fuzhi* 重修福建臺灣府志 [The revised gazetteer of Taiwan prefecture, Fujian province].
TW81, *Taidongzhou caifangce* 臺東州采訪冊 (1894), [The record of inquiry in Taitung district].
TW83, Yao, Y. 姚瑩 (1867), *Zhongfutang xuanji* 中復堂選集 [Selections of the author's works].
TW87, Xu, Z.G. 徐宗幹 (1862), *Siweixinzhai wenbian* 斯未信齋文編 [Collected essays of the author].
TW92, Ke, P.Y. 柯培元 (1837), *Gemalan zhilue* 噶瑪蘭志略 [A short gazetteer of Gemalan].
TT102, *Qinding pingding Taiwan jilue* 欽定平定臺灣紀略 [A record on pacifying Taiwan by imperial order].
TW103, Chen, W.D. 陳文達 (1720), *Taiwan xianzhi* 臺灣縣志 [The gazetteer of Taiwan county].
TW105, Fan, X. 范咸 (1747), *Chongxiu Taiwan fuzhi* 重修臺灣府志 [The revised gazetteer of Taiwan prefecture].
TW110, *Taiwan haifengdang* 臺灣海防檔 (1865-99), [Archive of maritime defense in Taiwan].
TW113, Wang, B.C. 王必昌 (1752), *Chongxiu Taiwan xianzhi* 重修臺灣縣志 [Revised gazetteer of Taiwan county].
TW120, Chen, Y. 陳衍 (1922), *Taiwan tongji* 臺灣通紀 [A chronology of Taiwan].
TW121, Yu, W.Y. 余文儀 (1774). *Xuxiu Taiwan fuzhi* 續修臺灣府志 [The additional gazetteer of Taiwan prefecture].
TW124, Chen, W.D. 陳文達 (1720), *Fengshan xianzhi* 鳳山縣志 [The gazetteer of Fengshan county].
TW128, Lien, H. 連橫 (1918), *Taiwan tongshi* 臺灣通史 [A general history of Taiwan].
TW140, Xie, J.L. 謝金鑾 (1807), *Xuxiu Taiwan xianzhi* 續修臺灣縣 [The additional gazetteer of Taiwan county].
TW141, Chen, M.L. 陳夢林 (1717), *Zhulo xianzhi* 諸羅縣志 [The gazetteer of Zhulo county].
TW145, *Xinzhu xian caifangce* 新竹縣采訪冊 (1894), [The record of inquires in Hsinchu county].
TW146, Wang, Y.Z. 王瑛曾 (1764), *Chongxiu Fengshan xianzhi* 重修鳳山縣志 [The revised gazetteer of Fengshan county].
TW156, Zhou, X. 周璽 (1832), Zhanghua *xianshi* 彰化縣志 [The gazetteer of

Changhua county].
TW159, Shen, M.Y. 沈茂蔭 (1894), *Miaoli xianzhi* 苗栗縣志 [The gazetteer of Miaoli county].
TW160, Chen, S.J. 陳淑均 (1840), *Gemalan tingzhi* 噶瑪蘭廳志 [The gazetteer of Gemalan sub-prefecture].
TW164, Lin, H. 林豪 (1892), *Penghu tingzhi* 澎湖廳志 [The gazetteer of Penghu sub-prefecture].
TW172, Chen, P.G. 陳培桂 (1871), *Danshui tingzhi* 淡水廳志 [the gazetteer of Danshui sub-prefecture].
TW192, *Fajun qin Tai dang* 法軍侵臺檔 (1883-5), [Archieves of French intrusion to Taiwan].
TW204, *Fajun qin Tai dangan bubian* 法軍侵臺檔案補編 (1883-1885)[ Archieves of French intrusion to Taiwan: a supplement].
TW213, *Haibing dashiji* 海濱大事記 [Important events along the coast; essays by various authors].
TW216, *Taiwan yudi huichao* 臺灣輿地彙鈔 [A collection of historical geographical records in Taiwan by various authors].
TW247, *Qingji Shenbao Taiwan jishi jilu* 清季申報臺灣紀事輯錄 (1872-87) [A collection of reports related to Taiwan by the shenbao in late Qing].
TW253, *Shubao Fabing qin Tai jishi canji* 述報法兵侵臺紀事殘輯 (1884-85) [Remanence from the *Shubao* on the account of French intrusion upon Taiwan.
TW276, *Liu Mingchuan fu Tai qianhou dangan* 劉銘傳撫臺前後檔案 (1876-95) [Arvhieve of Taiwan before and after Liu Mingchuan serving as governor of Taiwan].
TW277, Zhu, S.P. 朱壽朋, *Guangxuchao tonghualu xuanji* 光緒朝東華續錄選輯 (1875-1908) [Selections from the *Tonghualu* in the Guangxu reign].
TW308, Lo, D.C. 羅大春 (1874-5), *Taiwan haifang bing kaishan riji* 臺灣海防並開山日記 [Diary on defense and opening up the mountains in Taiwan].
Watson, R.B. and Chow, C.Y. (1946), 'Notes on Malaria in Taiwan.' Archive of the Rockfeller Foundation, RF601I China-malaria, RG1, series 601 China, box 44, folder 359.
Weishengshu [Department of Health, the Executive Yuan] (1993), *Taiwan punue jishi* [An authentic record of eradicating malaria in Taiwan], Taipei.
Wen, Z.H. 溫振華 (1992), 'Taiwan tuzhu tienhua chuanbo chutan 臺灣土著天花傳播初探 [A preliminary study on smallpox infection among the Taiwan aborigines]', in Liao Yun-fan *et al*., *Chen Shengkun yishi jinian ji* [Essays in memory of Dr. Chen Shengkun], Jujing, Taipei.
Xie, Z.J. 謝振榮 (1989), 'Riben zhimin zhuyi xia Taiwan weisheng shengce zhi yanjiu 日本殖民主義下臺灣衛生政策之研究 [A study o health policy in Taiwan under Japanese colonialism]', M.a. thesis, Wenhua University, Taipei.
Zeng, Y.Z. 曾友正 and Jin, Y.L. 金永麗 (1986), *Riju qianqi Taiwan beibu shizheng jishi: weisheng pian dashiji* 日據前期臺灣北部施政紀實:衛生篇大事記 [Records of Japanese administrative activities in north Taiwan in he early colonial period: major events of public health], Taipei Municipal Historical research Commission, Taipei.
Zurbrigg, S. (1994), 'Rethinking the "Human Factor" in Malaria Mortality: the Case of Punjab, 1868-1940', *Parassitologia*, 36: 121-135.