SOCIAL SCIENCE DILIMAN
14:2 July–December 2018

ARTICLE

Malaria and Japan's colonial frontier: Manchuria, 1900s–1940s

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26 – 48

ABSTRACT

This article examines the malaria problem among Chinese migrant laborers in Manchuria, particularly laborers on the South Manchuria Railway's mining sites, the Fushun Mines, during the first half of the twentieth century. Almost all of the malaria cases in Manchuria were caused by the parasite *Plasmodium vivax*, which rarely causes death but leads to debilitation and makes sufferers susceptible to other illnesses. Malaria epidemics in Manchuria during this period were the result of Japan's economic and military exploitation. The expansion of malaria mosquito habitats caused by large-scale constructions and development of mines and massive immigration for these industries led to these epidemics. Most of the malaria victims were Chinese laborers who worked for Japanese businesses and no less than two-thirds of these patients were reportedly from Fushun, where the Fushun Mines were located. The living and working conditions of the laborers made them vulnerable to various diseases, including malaria. As Japanese employers concentrated on the human-centered approach to malaria control general sanitary reforms were often ignored. After the promulgation of the Five-Year Industrial Development Plan of Manchukuo and the outbreak of the Second-Sino Japanese War, Japanese authorities' attitude to malaria among Chinese laborers changed dramatically. A steady supply of labor was essential to enable the production of more coal for the war-efforts as the Fushun Mines were designated a key industry for Japan's national defense. To achieve this manpower efficiency was crucial but malaria epidemics decreased the productivity of labor. As the coal shortage was considered a great obstacle for Japanese and Manchukuo industries, as well as for the conduct of the war, the malaria problem among Chinese laborers could no longer be ignored.

KEYWORDS

malaria, Japanese empire, Manchuria, Fushun Mines, Chinese migrant laborers

ISSN 1655-1524 Print
ISSN 2012-0796 Online

Introduction

During the nineteenth and twentieth century, malaria became a significant problem throughout much of the tropical world. Although it had long been present in many areas, it worsened as colonial regimes undertook major programs of agricultural and industrial development in the colonies, which produced ecological disruption and movement of laborers—sometimes across long distances. The rise in malaria affected both colonizers and colonized, although never uniformly. In the early nineteenth century, for example, malaria contributed to the heavy mortality that led to West Africa being dubbed "the White Man's Grave" (Curtin 2001), while later attempts to exploit the continent's vast mineral resources similarly exacted a high price from European colonists (1998, 109). Plantations and mines, however, also created conditions that exposed Africans to greater risk from this disease (Webb 2014, 20). While in India and other Asian colonies malaria was also a threat to Europeans it was far more the case for those who constituted the labor force (Arnold 1999).

Japan was forced to confront similar problems from the late nineteenth century on as it began to build an empire in the East. In Taiwan, malaria posed a significant obstacle to Japanese military and economic activities, as mortality was far higher for the Japanese in Taiwan than for the locals, at least until the 1890s (Lin and Liu 2010). In the early 1910s, malaria was still the chief cause of mortality among Japanese and Taiwanese with the exception of cholera and plague (Shimoda and Soda 1936). In Korea, the average morbidity from malaria among Japanese soldiers in the colony was higher than those of the military divisions in Japan in the 1920s (Gun'ibu 1926). The difficulties for malaria encountered in Manchuria, however, were of a different kind as Manchuria was not in a tropical location and malaria was not an indigenous disease, or at least not a significant one. Japanese colonization changed that as malaria became prevalent within the vicinity of agricultural and industrial sites as it increasingly sapped manpower on which the Japanese imperial and ultimately, wartime economy, depended.

The rise of malaria in Manchuria has not received significant attention from historians. Most of those who have written on the region's epidemiological history have largely focused on the Great Manchurian plague (1910–1911), even as this is understandable in view of the international attention it received and its subsequent impact on the development of public health in the region (Rogaski 2004; Summers 2012). Although plague broke out frequently in Manchuria after the epidemic, the threat from pneumonic disease diminished and its impact was less significant than malaria in terms of its effects on the Japanese imperial

economy, especially on Japan's war mobilization efforts. Historian Shen Jie has recognized this fact in general terms by showing how Manchukuo's policy of medical care was changed to one of preparing the workforce for wartime production after 1937, even as her account does not provide a detailed assessment of particular diseases (2003). Manchuria is mentioned briefly in Iijima Wataru's history of malaria and tropical medicine in the Japanese empire, but one does not get a sense of either the severity of the problem or of the measures taken to deal with it (2005).

This article brings malaria back into focus by examining the situation at the Fushun Mines, which was a core business of the South Manchuria Railway Company (SMRC). It was in such sites that malaria emerged as a new and significant problem. Almost all the cases were of the *Plasmodium vivax* variety, which tends to debilitate rather than kill, making sufferers susceptible to other illnesses. For these reasons, it was less of a threat to Japanese troops than the more deadly strains of malaria found in Taiwan even if it became a major concern in terms of labor efficiency, especially after the beginning of the Second Sino-Japanese War. Although malaria was neglected initially, it rapidly ascended the Japanese authorities' list of priorities because of the importance of the mines to Japan's war efforts. Unfortunately, there are no sources that directly articulate the views of the laborers, most of whom were unable to read or write. It is clear from Japanese records, nonetheless, that health conditions were an important concern among the laborers and that the company eventually felt compelled to act on them. The measures the company took were unique in the context of the Japanese empire, reflecting both the importance of the Manchurian economy and its products, which came to be used extensively in anti-malaria campaigns.

Sporadic malaria: Dairen and Tieling

In the first half of the twentieth century, two species of anopheles mosquito were reported in Manchuria. *Anopheles sinensis*, the most common species in East Asia, inhabited the whole region and *Anopheles maculipennis*, which was widespread in Europe, Central Asia and Siberia, was also found in northern Manchuria (Okada 1942, 103). Both species are now known to be vectors of malaria but prior to the Japanese occupation the disease was almost unknown in Manchuria. According to a Japanese medical report, malaria was rarely mentioned even in Chinese medical literature although it appears that Russian troops a few years before the war with Japan have recognized it during their occupation of Manchuria (Ōbito 1941).

During the first half of the Japanese occupation malaria remained negligible and was not a big concern for the authorities with the exception of two cases. In

the middle of the Russo-Japanese War (1904–1905), the Japanese army occupied Dairen, during which time the bombing of the city destroyed many roads and buildings. Sanitary facilities were also inadequate and the poor drainage system deposited stagnant water in many places (Perrins 2005). As a result, in 1905, 44 malaria patients from among the army's civilian employees were reported. It was thought that malaria parasites were brought by some of the employees, eight of which had been previously infected with malaria in Taiwan and Korea. In addition, employees' housing and its vicinity were insanitary; it had very little sun and poor ventilation. As part of anti-malaria measures, the army installed a ventilation system within these accommodations rather than undertake costly rebuilding. In keeping with Japan's preference for a human-centered approach to malaria control the army isolated the malaria patients and provided them with quinine. Soldiers and civilian employees had to take quinine prophylactically, too. A year later (1906), new malaria patients greatly decreased among the civilian employees (Shiga 1906).

Following the Japanese victory over Russia in 1905, control of the Liadong Peninsula was transferred to Japan. As a result of the Treaty of Portsmouth Japan also acquired the most southerly section of the branch of the China Far East Railway. A year later, the SMRC was established by the promulgation of a special law, which provided it with state protection. The company was entrusted with administrative responsibilities in the railway zones, including education, civil engineering, and public health. It is noteworthy that when Japan lost extra-territorial rights in Manchukuo in December 1937, the company continually supported Manchukuo's administrative affairs, particularly its medical services and public health system (Mantetsu 2005, 258).

The company made a strong effort to exert sanitary control and develop colonial medicine from the early days of its establishment. Goto Shimpei, the first president's reform strategy attests to these efforts (Summers 2012, 71). In April 1907, the company founded a board of health in the Kwāntung Leased Territories and the railway zone to monitor the health of Japanese workers and their families. As a semi-governmental company, however, it had to protect the Japanese settlers in those areas. The government planned to send a massive number of Japanese to Manchuria to further entrench Japan's influence but different environmental and climatic conditions as well as poor living conditions exposed the latter to a multitude of diseases and many of them abandoned the frontier (Kāntōshūcho 1935, 226–28). As a result the company was forced to deal with the epidemics and develop public health for Japan's national plan, as much as it also needed to show social superiority to justify its imperial expansion. As Japan's territorial expansion to different parts of Asia was made along with

its campaign to promote "civilization for the colonies" its export of modern medicine became the concrete manifestation of this propaganda (Liu 2008; Perrins 2009).

A hub of Japanese imperial expansion, Dairen experienced rapid urbanization and sanitary reform during this period. Large hospitals were established in the city, such as the Red Cross Hospital, the Kwantung government hospital, and the Dairen hospital. The spread of urbanization also reduced the number of new malaria patients among Japanese residents as it gradually removed the breeding habitats of mosquitoes. It is hard to estimate the malaria situation among Chinese residents, including migrant laborers, however, because only a few Chinese who were suffering from malaria visited the hospitals. Malaria patients, as well as the Japanese and Chinese who had been infected elsewhere also migrated into Dairen continually as the city developed to become a center of trade and transportation by sea and land (Kim 2016a).

In 1924, another malaria epidemic occurred at the Japanese stationary garrison in Tieling when 255 Japanese soldiers and 74 civilians within the vicinity of the garrison were infected with malaria (Hieda 1932, 425–26). Nishibori Shinjiro, director of the Dairen clinic of the Japanese Red Cross Hospital, noted that several soldiers from the 16th Kyoto Division and the 6th Kumamoto Division, which were located in relatively malarious areas, presumably brought the parasite with them to the garrison in Tieling (Nishibori 1932). In 1925, the Japanese garrison, the Japanese police, medical doctors of the SMRC hospital, members of the sanitary association, and the staff of the SMRC health department implemented a wide-range of anti-malaria measures using funds from the SMRC. To facilitate the implementation of these measures the company appointed Koizumi Makoto who was known not only for his research on tropical medicine but also for his long experience of anti-malaria work in Taiwan (SMRC 1927). As Iijima has pointed out, accumulated knowledge and skill pertaining to tropical medicine in Taiwan were transmitted widely throughout the Japanese empire, including Korea, the Kwantung Leased Territories, and Manchuria. Colonial authorities also adapted their knowledge of dealing with malaria to the local conditions in each of their respective areas (Iijima 2002).

Most malaria epidemics were unnatural products of the environment as these were caused by colonial governments' efforts to exploit the colonies. Serious outbreaks of the disease, in particular, were attributed to aggregations of labor such as large-scale construction works and plantations, which created suitable sites for malaria-bearing mosquitoes. Migrant laborers who were often viewed as mobile reservoirs of parasites because they sometimes brought malaria into non-malarial areas or from their workplaces to their hometowns and were attracted

to colonial development projects also aggravated the malaria problem. This is in addition to the agricultural and industrial development being undertaken in many areas in Taiwan and Korea under Japanese colonial rule that exacerbated malaria problems (Ku 2005; Kim 2016b).

Similar to European colonial powers the Japanese developed a strategy for dealing with malaria that differed substantially in each area reflecting both ecological differences and the different kinds of impact that malaria carried with it. In the early 1910s, for example, Taiwan's colonial government initiated forced anti-malaria measures and since then, the government's main focus in infectious disease control changed from the pneumonic plague to malaria. The Japanese emphasized a human-centered approach or the killing of parasites in carriers through anti-malaria drugs using Robert Koch's technique of mass drug administration of quinine (Rogaski 200, 258) rather than general environmental measures as with the British who instead promoted sanitary reforms in colonial urban areas (Ka 2009). Western powers, however, sometimes relied on pharmaceutical drugs in dealing with malaria but not as intensively as the Japanese. This is gleaned from the example of the British in India (Harrison 1994, 158–59).

Within the Japanese empire, the human-centered approach to malaria control was introduced selectively by targeting particular groups and areas where the Japanese resided or those vital to the exploitation of natural resources (Lin and Liu 2010). Some urban reforms and infrastructural improvements were also carried out in the main cities, such as Taipei, where malaria cases decreased beginning in the early 1900s onwards (Miyakawa 1944, 31). Other areas, however, were neglected and malaria remained in many of these places. In Taiwan, about 1.7 million people visited medical practitioners and free clinics for treatment of malaria in 1940 (Morishita 1942). In Korea, the most common form of malaria was *Plasmodium vivax*, which was less fatal than the *P. falciparum* parasite. As there was low mortality from malaria causes among Japanese settlers colonial authorities took a passive approach in dealing with it in contrast to other infectious diseases, such as cholera, typhoid, and dysentery, which Japanese settlers mostly suffered from. As a result, the Japanese concentrated its efforts almost solely on Japanese troops and civilians ignoring malaria among the Koreans even as deteriorating living conditions and food shortages under the war regime worsened the latter's situation (Kim 2016b).

In contrast with Taiwan and Korea, the Japanese undertook collective approaches to malaria in Tieling to protect Japanese stationed troops in the region. Makoto commanded these anti-malaria measures, which included: education in hygiene; blood tests and free prescriptions; removal of puddles; spraying of oil on anopheles breeding pools; and, other preventive measures against malaria-carrying mosquitoes. To complement vector control new sewerage systems were

also installed. A pond inside the city park was retained for aesthetic reasons but refurbished with a masonry retaining wall to prevent the breeding of mosquitoes. These measures seemed to have worked for only five new cases were reported from among the civilians in 1926 (SMRC 1927). Malaria, however, became prevalent in other areas, particularly in the industrial sites where the SMRC operated.

Resource development and malaria

The SMRC operated not only a railway service but also other businesses such as hotels, harbor works, farming, and mining, particularly coal and iron mines, which were crucial to support Japanese heavy industries. These businesses, however, caused significant environmental change that created excellent breeding sites for mosquitoes. The company also needed sufficient manpower and relied extensively on Chinese migrants for mineral extraction and manufacturing (SMRC 1932, 157–59). Most of these laborers were from Shantung and Hubei, where vivax malaria was prevalent and their influx not only increased the number of parasite carriers but also the chances of infection (Uwagawa 1983). These new conditions were conducive to the spread of malaria and were especially apparent in the industrial cities of Anshan and Fushun, where the malaria problem was more severe than in any other area in Manchuria. According to professors at Manshû Medical College, between 1925 and 1934, about three-quarters of malaria patients in Manchuria were reported to have come from Fushun (Kubo 1943).

The right to operate the Fushun Mines was acquired as a result of the Russo-Japanese War and by 1907, the SMRC started to mine coal in the area. Mined coal as fuel and binding agent to produce iron was supplied to diverse industries in Manchuria, such as the Anshan Steel Works (Chen 2011). Coal was also exported to Japan and its colonies. As a result, the SMRC began open-cast mining operation at two other places in the area beginning in 1915, apart from opening three other new pits. Five years later in 1912, the SMRC opened another open-cast mine in the area. As demand for coal continued to increase because of industrial expansion in Manchuria, Korea, and Japan, the SMRC began to develop a larger open-cast pit in 1924, and an existing settlement was removed to make way for it (Mantetsu Chōsakai 1933, 138).

The open-cast mining development, which entailed large-scale construction resulting to the ground becoming pitted where puddles formed and the destruction of the old settlement, malaria cases started to increase in Fushun. Bad drainage worsened the situation and anopheles mosquitoes thrived in the newly created paddy fields around the site (Okada 1942, 103). Agricultural exploitation that Japan engaged in also created similar problems in other colonies. In Taiwan, the expansion of paddy agriculture and crop irrigation systems increased breeding places for anopheles mosquitoes and the influx of agricultural workers introduced

new strains of malaria parasite (Iijima 2005, 42). In the 1920s, malaria patients among Koreans also increased due to the colonial government's economic policies, such as the construction of government-controlled salt farms and the reclamation of paddy fields with inadequate drainage systems (Kim 2016b). As in these two colonies the environmental changes in Fushun increased the suitable breeding places for mosquitoes and malaria patients in the city increased rapidly beginning in 1926 (Table 1).

Table 1: Malaria patients SMRC Fushun Hospital

	Nationality	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Total Number of Patients	Japanese	2,414	2,175	2,290	1,374	2,180	2,179	2,764	2,677	2,705	2,667
	Chinese	584	370	589	1,070	953	1,670	2,895	2,227	2,018	1,526
Number of Malaria Patients	Japanese	6	6	3	11	14	14	65	34	133	69
	Chinese	3	5	4	28	55	173	845	371	427	185
%	Japanese	0.2	0.3	0.1	0.8	0.6	0.6	2.4	1.2	4.9	2.6
	Chinese	0.5	1.4	0.7	2.6	5.8	10	28.5	17.0	21.2	12.2
Average of Japanese and Chinese patients	Total Number of Patients	2,998	2,545	2,779	2,444	3,133	3,849	5,559	4,854	4,723	4,193
	Malaria Patients	9	11	7	39	69	187	910	405	560	254
	*%	0.3	0.4	0.3	1.1	2.2	4.9	16.5	8.5	14	6

*Percentage of malaria cases from the total number of patients (Kudō 1932).

The number of Chinese patients in the Fushun hospital was greater than in other branch hospitals of the SMRC since these figures included some Chinese laborers at the Mines (Kudō 1932). The number of Chinese patients, however, was greatly underestimated because many Chinese relied on traditional or "superstitious" medicine and would sometimes ignore their symptoms of malaria (Hieda 1932). For Chinese residents in the railway zone, Western-style hospitals were too expensive and even Japanese laborers could not afford them (Perrins 2009). Japanese authorities, however, ignored these problems and instead blamed the high rates of disease on the "uncivilized customs" of the Chinese, such as sleeping in the open during summers (Uruno 1943, 81–2).

Chinese working conditions and their living quarters also exposed Chinese laborers to malaria. At the Fushun Mines, for instance, only the Japanese occupied the white-collar jobs while the Chinese were relegated to being mere coal diggers (Itō 1995). The chances of infection also increased as the number of laborers

grew; quite a few were already infected with malaria. When the Mines opened in 1907, there were only 787 laborers; in 1923, 20,582. Five years later, in 1928, it had 32,235 Chinese laborers (Ō 2015, 22). Since their accommodations were located within distance of mosquito habitats these Chinese laborers were often at risk of infection.

From 1926 on, the Fushun Mines implemented anti-malaria measures, such as spraying oil onto puddles and providing quinine to malaria patients. General sanitary reforms such as improvements in the drainage system, however, were not considered (Kitabatake, Yamamoto, and Murase 1934). As the mining sites in Fushun were being expanded and paddy fields around these areas were being continually reclaimed an ideal environment for mosquito breeding was induced. These factors limited the effectiveness of anti-malaria measures and thus, malaria became one of the most prevalent diseases among the laborers, especially in the summer (1934). Chinese laborers who were digging at the expanded open-cast mines, in particular, were more exposed to malaria than those in other sites. Such was the case that in 1933, the SMRC Sanitary Bureau entrusted anti-malaria measures to Kitabatake Eitarō, Yamamoto Yoshio, and Murase Wataru from the Manshū Medical College. These three professors implemented special anti-malaria measures at two mining sites, Shinton and Ryūhō, where malaria was most prevalent and investigated mosquitoes' breeding sites and other habitats, including flying distance from the sites (1934). Blood tests were also carried out and 4.3 per cent of Chinese laborers at these sites were identified as malaria parasite carriers. The professors provided the relatively new drug plasmoquine in combination with quinine to parasite carriers and malaria patients for seven days. Unlike quinine, plasmoquine was capable of killing the malaria parasite during its dormant stage in the liver, which allowed the drug to be used effectively for treatment as a prophylactic in combination with quinine (1934).

Beginning in 1934, cases of new malaria patients decreased but not for long because anti-malaria measures were not carried out regularly. Authorities at the Fushun Mines also only concentrated on a human-centered approach to malaria control and ignored general sanitary reform. In addition, contractual labor at the mines undermined malaria prevention. In 1934, about 38 per cent of laborers were employed for less than one year; 23.4 per cent for less than two years (Yun 2013, 324). As a result, it was difficult to kill malaria parasites in carriers. The continual expansion of paddy fields around the mines also meant that the spraying of oil on mosquito breeding sites was inadequate.

Almost all malaria cases among the laborers were caused by the parasite *Plasmodium vivax*, which, though rarely fatal, greatly diminished the labor force. Authorities at the Mines, nevertheless, were able to easily replace Chinese manpower because migrant laborers were in constant supply due to the ongoing

unrest in China. In China proper, many lives were devastated during the Warlord Era (1916–1928) and from 1927 on, as a result of the Civil War between forces loyal to the Kuomintang and Communist Party. Natural disasters, such as flooding and drought, also occurred frequently. Public health consequently deteriorated and many people became susceptible to infection. In 1932, malaria spread to many parts of China after an enormous flood and the social chaos that ensured exacerbated the malaria problem (O 1932). These conditions forced many Chinese to leave their war-torn towns and villages to find work in Manchuria and this constant influx of labor allowed the majority of these coal mines to maintain their levels of production (Ō 2015, 14–9). In 1934, coal production at the mines was 8,671,003 tons or 76 per cent of total coal production (9,007,090 tons) in Manchuria (Mantetsu Fushun Tankō 1937, 5–9). Disease, therefore, had no significant impact on coal production until 1936. This situation would change after the outbreak of the Second Sino-Japanese War. It was at this point that a more distinct and forceful approach to malaria control began to emerge.

The war regime after 1937

During the First World War (1914-1918), the Japanese Army realized that economic growth and increased productivity in industrialized warfare were necessary for victory. They recognized that securing iron and coal to produce weapons was a vital precondition for their success (Yamamuro 2002). In addition, during the 1920s, the growth of Chinese nationalism became an excuse for military expansion as the slump in the SMRC's business was advancing the Kwantung Army's status in Japanese political structures. In response, the Kwantung Army planned to acquire natural resources and create a great national defense system (Yamamoto 2002). As such, the Kwantung Army contrived what would later on become the Manchurian Incident on 18 September 1931. Within three months of the incident Japanese troops invaded Manchuria and, in 1932, the puppet state Manchukuo was established. The Kwantung Army took control of Manchukuo and the SMRC's business was transformed to meet its growing demands (Noguchi and Boyns 2013). In 1937, Japan went to war against China.

In the same year (1937), the Five-Year Industrial Development Plan of Manchukuo was promulgated to create a self-sufficient system based on heavy industry (Beasley 1987, 216). The plan stressed the need for the increased mining of coal, iron, and oil as well as manufacturing production. The Fushun Mines, primarily, were designated a key industry for national defense (Chen 2011). During the inter-war period (1919-1938), authorities at the Fushun Mines planned for the production of oil from shale and by the liquefaction of coal (*The Manchuria Daily News* 1940). Production of shale-oil was a response to the needs of the Japanese navy, which had already recognized the importance of oil and substitute fuels since the First World War (Yamamoto 2008). From December 1929 on, the

mines began to produce shale-oil and the SMRC later developed a new open-cast mining site, the Higashi open-cast, to produce more shale-oil and the site became a hotbed of malaria (Mantetsu Tokyo Bujunkai 2004, 46). In the late 1930s, Japan imported 92 per cent of its oil from foreign countries; 82 per cent of which was from the United States (US) (Iwama 2006). This situation was a big concern for Japan as it was already considering a war against the US. In view of this, the shale-oil industry in the Fushun Mines with coal liquefaction became of great importance to Japan economically and from the standpoint of its national defense (*The Manchuria Daily News* 1938, 329).

A steady supply of Chinese laborers was vital to sustain these activities. While the Mines improved employment terms beginning in 1938, living costs skyrocketed due to a severe lack of commodities under the war regime. Laborers were also forced to work longer hours to produce even more coal, accidents increasing as a result. As miners at the Fushun Mines dug deeper underground pockets of gas, which often caused explosions, were encountered (Ō 2015, 269). The deteriorating living standards and aggravated working conditions that resulted from these activities forced many laborers, particularly skilled ones, to leave the mines for other mining sites or factories in Manchuria. With reckless development of mining sites and difficulties in providing new facilities for mining the outflow of skilled laborers led to a decreased output of coal (Chen 2001).

To make matters worse, the poor working environment contributed to laborers' various diseases and bronchial ailments. Polluted wells were also a source of water-borne infections (Ji lin sheng she hui kexue yuan 1987, 406). Indeed, diseases became more prevalent in the Fengtian province overall. In 1939, cases of contagious diseases registered in Fengtian city reached the unprecedented number of 3,077 compared to 1,765 in 1938, making for a higher rate of infection than the 1911 pneumonic plague in Manchuria. This unusual increase was partly attributed to the increased Chinese and Korean labor population in the city (*The Manchuria Daily News* 1940). In fact, not only Chinese but also many Koreans fled to the city to escape the bad harvest which had been caused by drought, as well as general hardship in colonial Korea in 1939. The influx of migrant laborers was blamed for the deterioration of the urban environment and public health (Tanaka 2013).

Malaria cases also increased dramatically in Fengtian province from 1938 on (Table 2). According to a malaria report of the chief engineer of the provincial government, the increase was due to the following: increase in anopheles mosquitoes related to the expansion of paddy fields; development of the "concentration village system", which was intended to settle Koreans and Japanese in new agricultural areas; increase in malaria parasite carriers; and, the greater likelihood of new infections. These conditions arose as the Manchukuo government and the Kwantung Army recruited laborers systematically for the

Five-Year Development Plan. Large portions of the new malaria patients who constituted the core labor force were Chinese males (Ōbito 1941). In addition to new cases of malaria, there was an increase in chronic malaria patients due to improper treatment. Of the 1,032 Chinese respondents to the survey, 463 (44.9%) did not take any medicine when they were suffering from malaria; 338 (32.8%) took medicine only once (Ōbito 1941).

Table 2: Malaria cases Fengtian province

	1934	1935	1936	1937	1938	1939	Total
Cities	2,852	2,787	3,510	3,917	7,183	16,559	36,808
Rural areas	4,723	6,129	6,385	7,132	12,822	18,189	55,380
Total	7,575	8,916	9,895	11,049	20,005	34,748	92,188

Source: Ōbito 1941

Similarly, malaria cases increased rapidly among Chinese laborers and Japanese workers and their families at the Fushun Mines from 1938 on (Table 3). Laborers who were digging coal at the new open-cast Higashi mining site and Ryuho underground mining site, which was expanded in 1936, were particularly vulnerable. The mining sites provided an excellent environment for malaria-bearing mosquitoes. Whereas only 14 malaria cases were reported from the Ryuho mining site in 1937, this number increased to 465 in 1938; a year later, in 1937, 1,460 patients were reported. As the Japanese workers' housing accommodations were located near the two mining sites malaria cases among the Japanese also increased rapidly (Bujun Tankô Sômukyoku 1988, 84). In 1939, about 14 per cent of Japanese workers were infected with malaria. The following year (1940), the Mines implemented a blood check to identify parasite carriers among Japanese workers and their families. Of the 1,351 test subjects, 73 had malaria parasites (5.4%); the SMRC provided quinine to parasite carriers (86).

Table 3: Fushun Mines Japanese and Chinese malaria patients

	1937	1938	1939	1940 (Apr-Oct)
Japanese	105	377	998	2,626
	(5,299)	(6,678)	(7,394)	(8,383)
Chinese	483	2,505	8,686	5,696
	(44,338)	(57,723)	(71,436)	(68,180)
Total	588	2,882	9,684	8,322

N.B. Numbers in parentheses refer to the total number of workers.
Source: Bujun Tankō Sōmukyoku 1988.

Considering the increasing demand for coal for the war effort, malaria among Chinese laborers was a big concern for the Mines. In 1939 (Table 3), Chinese malaria patients rapidly increased to 8,686. In the same year, malaria was the second most prevalent disease (177.9 per 1,000 laborers) among Chinese laborers, after skin diseases (229.9 per 1,000 laborers). Malaria, however, was the biggest health problem in relation to labor efficiency for coal production (78). The company estimated that one laborer dug 0.5 ton of coal per day.

Workers who contracted malaria took 16 days of sick leave and during convalescent stage, after coming back to work, their efficiency was usually reduced by half for about a month (83). The estimated coal production loss due to malaria in 1940, was thus 200,000 tons (Abiko 1942). As the coal shortage was considered a great obstacle for Japanese and Manchukuo industries, as well as for the conduct of the war, the malaria problem among Chinese laborers was no longer a concern of the Fushun Mines alone (Tama 2001).

Anti-malaria measures

The shortage of anti-malaria drugs caused anxiety for the managers at the Fushun Mines. After the outbreak of the Second Sino-Japanese War, the Japanese government began to take strict control of foreign currency holdings and importation and exportation of commodities. As a result, it became difficult to import drugs and medicine, as well as raw materials to produce them (Kimura 1943). In addition, an unprecedented malaria epidemic occurred among Japanese soldiers who were fighting in China that led to a huge loss of military strength (Rikujō Jieitai Eisei Gakkō 1971, 27). Since an increased supply of anti-malaria drugs was needed for soldiers and veterans restrictions on the sale of quinine became the subject of discussion for the Japanese government in 1939 (*Osaka Asahi Shinbun* 1939). Eventually, the Japanese government started rationing drugs in May 1940, and issued a law to restrict exportation of medicine to China, Manchuria, Korea, Taiwan, and the Kwantung Leased Territories from December 1939 on (Chikamori 1941).

The increasing shortage of drugs and medicine including anti-malarial drugs in Manchuria affected the authorities at the Fushun Mines who stopped providing laborers with quinine, atebrine[1] and plasmoquine as prophylactics. The Fushun Mines authorities were thus forced to devise new ways to implement intensive anti-malaria measures. First, in 1940, the Mines joined the Anti-Malaria Committee of Fushun City working with the local community to carry out anti-malaria measures systematically. It also began to spray waste-oil, a by-product from the shale-oil plant on paddy fields and puddles to kill mosquito larvae. In addition, the Mines removed grasses, dried paddies and puddles, and intensified sanitary

operations around mining sites and Chinese accommodations. Education on anti-malaria prevention, such as the use of mosquito nets to ward off mosquitoes accompanied these activities (Bujun Tankō Sōmukyoku 1988, 86–7).

One significant initiative taken by the Mines was the invitation of a Japanese moxa practitioner to treat Chinese laborers. This practitioner had been teaching moxa at the central training center for the Japanese Youth Pioneering Brigades in Harbin since August 1940 (Tanaka 1941, 401–3). Traditional medicine had been officially abandoned in the early Meiji period and Western medicine soon came to dominate the field, as traditional medicine was considered unscientific and inappropriate in helping rebuild Japan into a modern nation-state. In the mid-1930s, however, several medical experts began to revive traditional medicine in earnest (Daijoji and Karchmer 2017). This development was linked to the revival of "Asianism" in the Japanese empire, an ideology that served to critique Western hegemony, emphasizing cultural solidarity between Japan and East Asian countries (Aydin 2008). There was also a practical reason for this revival as traditional medicine and its practitioners supplemented the shortage of Western-style medicine and medical personnel during the war (Kimura 1940). When the moxa practitioner met the President of SMRC, Ōmura Takuichi, in Fengtian in August 1940, Takuichi asked the practitioner to apply moxa to treat Chinese malaria patients at the Fushun Mines. The practitioner applied moxa with the assistance of 20 members of the Youth Brigades to 1,257 Chinese laborers beginning 26 August for a period of six days. Of the laborers, 861 were suffering from malaria. According to the report of the moxa practitioner, many patients were sedated during their malaria paroxysm as a result of the moxa application (Tanaka 1941, 405). Applying moxa to malaria seems to have been gradually accepted in Japan. According to the Allies' report on intercepted information broadcasts from Tokyo in early 1944:

> …a Chinese herbal doctor introduced to Japanese medical experts a remedy for malaria which was applied externally. This secret medicine is a powder compound obtained from a certain kind of insect well known in China and from medicine made from several types of plants. This compound was applied externally as a cauterizing agent to that part of the body[,] which is affected by malaria fever. (Military Intelligence Division 1944).

By the 1940s, the shortage of Western medicine worsened in Japan and the Japanese were forced to rely increasingly on traditional medicine. Some Japanese medical experts argued that invention of new medicines using local materials was a better idea, believing that while these materials had little therapeutic efficacy their use could make a big difference in the spiritual comfort of the patients (Kariyone 1944).

While the Fushun Mines were implementing intensive anti-malaria measures the SMRC made a huge effort to acquire anti-malaria drugs, which included not only quinine but also atebrine and plasmoquine. After the outbreak of the Second World War, it became extremely difficult for Japan to import the latter two medicines from Germany (Mitsui 1994, 166). Even so, authorities at the Mines were able to obtain a sufficient amount of these medicines from mid– to late 1940s. As a result, the Mines officials became less concerned with the shortage of anti-malaria drugs (Bujun Tankō Sōmukyoku 1988, 84). It is not clear how the Mines secured these drugs but it is likely that the Manchukuo government supplied these items. In early April 1940, the government sent a senior officer of the Home Ministry and representatives of the Association for Regulation and Importation of Drugs and Medical Supplies of Manchukuo to Tokyo to negotiate the importation of vital drugs with the Japanese government and quinine was one of the main subjects of the discussion. The delegates explained the importance of Manchukuo's industries in the war-effort and stressed the urgent need for the acquisition of these drugs for Manchukuo. Despite the increasing demand for drugs in Japan and in the battlefields in China, the Japanese government agreed to export almost all the drugs requested for Manchukuo, including 1,234 kilograms of quinine. By this act, the importance of the state in securing public health in its colonies becomes evident (Chikamori 1940). The Fushun Mines, thus, was able to obtain sufficient anti-malaria drugs for mass-drug administration (Bujun Tankō Sōmukyoku 1988, 87–9). That the Fushan Mines was able to acquire these drugs comparedto other areas also indicates the vital importance of the Mines to the wartime economy and the severity of the malaria problem that then existed in Manchuria.

As a result of these efforts, the number of Chinese patients at the Mines decreased by about 3,000 from the previous year; in contrast, the number of Japanese patients dramatically increased to 2,626 in October 1940 (Bujun Tankō Sōmukyoku 1988, 79). It could be that Japanese accommodations were located nearer the two mining sites where malaria was most prevalent so that in 1940, the district of the Japanese accommodation was reformed as a "model quarter" and received greater attention in terms of sanitation and vector control from the Japanese. In 1941, the malaria epidemic at the Mines subsided and malaria patients of both nationalities decreased substantially; the total number of Chinese patients decreased to one-fifth of the 1940 and Japanese patients dramatically decreased to only one-eleventh of the original (Abiko 1942).

There is no data relating to malaria in Fushun after 1941, so it is difficult to evaluate the malaria situation after that year; however, considering the circumstances surrounding the disease and the qualitative evidence on the malaria cases it could be assumed that the general health and sanitary situation deteriorated in Fushun. As wartime food shortages became acute and the intensity

of work load increased due to labor shortages and increased demand for coal production the miners' physical strength declined and they became even more susceptible to diseases. To make matters worse, it became incredibly difficult to secure a steady supply of medicines towards the end of the war. The occupation of Java in 1942, had temporarily mitigated the shortage of quinine in the Japanese empire as Java was the world's largest producer of cinchona, the source of quinine, at that time. Soon after the Japanese military lost command of the air and the sea in the Pacific it became very difficult to supply war-related commodities, including anti-malarial drugs, that resulted in the shortage for malarial drugs across the Japanese empire. (Ichikawa 1944). In Fushun this shortage worsened the laborers' health conditions. Chinese laborers at risk of starvation, for instance, had to work excessively even while suffering from many diseases (Ji lin sheng she hui kexue yuan 1987, 419; Takano 1944).

Conclusion

Despite the presence of two malaria-bearing mosquito species malaria presented few problems in Manchuria until the Japanese whose troops joining the Japanese garrisons in Dairen and Tieling initially brought malaria to Manchuria occupied the territory in 1905. Japanese colonial exploitation in the form of mining industries later created excellent breeding sites for malaria-bearing mosquitoes. The influx of Chinese migrant laborers also contributed not only to the increased number of parasite carriers but also the chances of the spread of malaria. These factors combined to increase malaria cases from the mid-1920s, particularly in mining sites operated by the SMRC. No less than two-thirds of these patients were reported from Fushun.

Initially, however, malaria was not a significant concern for the Mines because a sufficient number of Chinese laborers could easily be recruited to replace those who fell sick and the coal output also increased consistently. After the outbreak of the Second-Sino Japanese War, however, the Mines' attitude to malaria changed dramatically. A steady supply of labor was essential to enable the production of more coal for the war effort and the Fushun Mines was designated a key industry for Japan's national defense. From the late 1930s on, however, the number of malaria patients increased rapidly among Chinese laborers who were digging coal at newly developed mining sites and the disease became regarded as one of the main causes of the decreasing coal production. The Mines implemented comprehensive anti-malaria measures for the Chinese laborers starting in 1940, but struggled to acquire sufficient anti-malaria drugs while implementing other anti-malaria measures as the malaria-drug shortage was turning into a serious problem throughout the Japanese empire. Eventually the Mines was able to gain a sufficient supply of drugs and Chinese laborers were preferentially provided

with these in view of their importance to the war effort. While malaria patients among Chinese laborers decreased in 1940, Japanese malaria patients increased considerably.

This observation is important in the context of scholarship on colonial medicine and public health, especially on malaria. On the one hand, it illustrates how exploitative forms of economic intervention under a war regime had caused significant deterioration in environmental and health conditions, confirming the observations made in the general history works of Randall Packard and James Webb, as well as those of other scholars who have focused on malaria in specific regions (Packard 2007; Webb 2009). On the other hand, there are important differences on how the Japanese approached the malaria problem in Manchuria and these became evident at different points in time. First, the health of the laborers was neglected to an even greater extent than in some European colonies, some of which were beginning to take the problem of malaria more seriously, in one part for economic and the other for political reasons (Harrison 2011). Second, in Manchuria, Japanese authorities initially focused exclusively on the health of Japanese personnel and Japanese immigrants. From 1941 on, the Manchukuo government reorganized the Bureau of Public Health to strengthen anti-tuberculosis measures and improve Japanese immigrant farmers' public health (Shen 2003). Indeed, many middle-aged Japanese settlers who were the mainstays of the Japanese immigrant society were suffering from tuberculosis and respiratory diseases that different climatic conditions had aggravated (Toyota 1935, 23–4). Exceptionally, and temporarily, the demands of war led to a radical change in attitudes to the problem of malaria among Chinese laborers in Fushun. From a situation in which their health was regarded with indifference, the health of migrant laborers rapidly became a priority in order to ensure retention and productivity of labor. This pattern was unique in the context of the Japanese empire even as there was little hope for Chinese and Korean laborers in other areas. In the broader context of imperial medicine, however, the preferential treatment of laborers in key industries was by no means exceptional. As historian Nandini Bhattacharya notes, control of disease and the maintenance of hygiene and sanitation were sometimes given special attention in zones of economic importance (2012, 8).

The improvement in the malaria situation for laborers at Fushun, however, did not last long. Towards the end of the war, working conditions deteriorated and anti-malaria drugs became increasingly scarce in the Japanese empire, even among Japanese troops. The war regime weakened laborers and increased their risk of contracting diseases, especially malaria. This was the final phase of a problem that was entirely man-made—a consequence of war and imperialistic ambitions.

Acknowledgments

I would like to thank the Wellcome Trust for generously supporting my research with an Investigator Award in Medical Humanities (Grant No. 106874/Z/15/Z), "Invisible Crises, Neglected Histories: Malaria in Asia, c.1900–present". I am grateful to the editors and anonymous reviewers for their valuable insight and advice. I would also like to express my gratitude to Mark Harrison and Kevin Baird, University of Oxford, and Masatoshi Nakamura of the Japan International Cooperation Agency (JICA) for their constructive comments.

Note

[1] Scientists at Bayer synthesized atebrine in 1932. It was effective against falciparum malaria and had been used for malaria chemoprophylaxis (Meshnick and Dobson 2001).

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