

Batavia in Crisis: Disease Outbreaks and Public Health Responses in the 20th Century

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Abstract

This study investigates the health crisis that gripped Batavia during the early 20th century, characterized by recurrent disease outbreaks. The development of the outbreak was influenced, among other by the unhealthy lifestyle of the population, the lack of knowledge regarding handling existing outbreaks, as well as climate and weather factors in the Batavia region which supported the spread of the disease. By examining the interplay of socio-economic conditions, public health practices, and environmental factors, this research seeks to elucidate the factors contributing to these epidemics. Employing a historical methodology, the study analyzes primary and secondary sources to reconstruct the city's health landscape. Findings reveal that Batavia's inadequate public health infrastructure, coupled with poor living conditions, exacerbated the spread of diseases. The city's government struggled to implement effective control measures, leading to significant mortality rates. However, the introduction of mass vaccination programs in the 1910s and 1920s marked a turning point, demonstrating the potential of public health interventions in mitigating disease outbreaks. This research underscores the importance of robust public health systems in preventing and responding to epidemics, a lesson that remains relevant today.

Keyword: Public Health, Mitigating Outbreaks, Colonial Policy; Health Crisis.

Introduction

In the course of the Dutch colonial government, the aspect of public social welfare was considered one of aspects that the colonial government did not pay the attention to, especially the health condition at that time. Since the first arrival of The Dutch East India Company (VOC) as one of the big trade unions that built their own empire and trade monopoly in the Dutch East Indies, the economic aspect became their only main goal in the colony land. Choosing Batavia as the central government either for VOC or colonial government did not make the state of social welfare service at that time considered better than the other district in Dutch East Indie. Besides, the geographical conditions of Batavia where the tropical climate became a threat against the emergence of various kinds of health problems that happened at that period of time which as the outbreak of infectious disease that spread in the community in Batavia turns out to be on of the consequences that had to be perceived by

the Dutch colonial government as the result of the lack on their investment to help improve the health aspect (Boomgard 1993, 24).

The colonial government found it difficult to overcome the health problem in Batavia, which began with the emergence of various types of epidemic disease outbreaks and turned out to be the major problem experienced by the people of Batavia, whether indigenous occupants, Europeans, or Chinese people. The epidemic diseases mentioned, such as malaria, cholera, and typhoid fever (typhus), increased the number of deaths in the community. Another factor that contributed to the disease outbreak that occurred at the time was the extremely high fatality rate for those who were infected due to a lack of knowledge to handle it properly to overcome the infectious of the disease as mentioned, other than that the lack of qualified health facilities to support the medical problems that were found in Batavia added to the colonial government's difficulty in overcoming the

spread of infectious disease that effected Batavia (Nitisastro 2010, 102).

Aside from the previously mentioned factors, environmental matters and climate in Batavia allegedly became a contributing factor to the deployment of deadly diseases found in the community, urban ecological damage caused by either nature or human error had an impact on the growth of various types of the deadly diseases in Batavia. As an example, the urban ecological damage caused by nature at the time was a volcanic earthquake that occurred on January 4th and 5th, 1699, causing volcanic eruptions accompanied by heavy ash rain. The result of that event was damage to the Ciliwung river, which was settled and full of volcanic mud. The result of that event was deathly dysentery and cholera disease that afflicted the people of Batavia (Gooszen 1999). Not only that, but the environmental issues that caused the emergence of deathly disease in the region of Batavia were still present around 1732, at the same time as the change of both season and weather in Batavia, which had a serious impact on the emergence of malaria endemic, which took hundreds to thousands of victims, mostly Europeans, particularly Dutch people (Damarastri 2002, 11).

To Europeans who stay and live in In Batavia, the incident became increasingly dreadful, with many people dying mysteriously without any symptoms. It was very common during this time period to find someone who had not finished their dinner the night before and was declared dead the next day. It was caused by the fact that most people claimed to be healthy at the time, as they did not experience shivering, fever, dysentery, or water swelling. The existence of environmental problems and a fairly extreme weather climate in Batavia was enough to make Europeans who live or come for the first time in the tropical area find it difficult to adapt, so when it comes to the transition season, their immune system is not as good as Chinese or local people who can adjust themselves to nature and the environmental problems that exist in Batavia. (Shahab 2010, 87).

In addition to climate and environmental issues, the Batavian way of life contributes to the emergence of various types of disease outbreaks. The existence of canals, specific rivers, was used as

a dumping ground for all types of garbage by the Batavian, resulting in the deposition of waste along the banks of these canals. According to Lohanda (2007), the people of Batavia also use the rivers and canals as a place to defecate, one of the reasons the community uses the river as a toilet is simply because, in the past time, the houses in Batavia did not have special sewers or bathrooms that functioned to dispose of human excreta so that all kinds of human excreta were accommodated in a certain place and at 9 pm they had to throw the excreta to the nearest river or canal which located in Batavia. In that period of time, this was known as *negenueursbloemen* (nine o'clock flower), even this bad habit had been going on in Batavian society since 1630 (Lohanda 2007, 66).

The Batavian society's unhealthy lifestyle and lack of concern for the environment resulted in severe environmental pollution. The rate of contamination of soil contaminated by sewage from Batavia residents had very negative effects, such as the possibility of spreading harmful germs and bacteria. Furthermore, this situation made it difficult to predict the type of disease or epidemic that the community would experience, as it was caused by all types of waste flowing through the length of the rivers or canals that were supposed to be the source of clean water for most of Batavia's residents at the time. This condition was exacerbated by Batavia's geographical conditions, which primarily consisted of swamps, rice fields, and unmaintained fishing ponds (Figure 1). The ditch was not working properly due to the residents' habit of planting on the ditch's edge, resulting in dirty water sludge, which changed the function of the existing ditch at the time, which originally functioned as water infiltration, into one that effectively spread the disease that infected the people of Batavia (Gorkom 1913, 22).

As the twentieth century began, the reforms carried out by the Dutch colonial government in the medical field began to be seen, as evidenced by the formation of a government organization to improve public welfare in the health sector, *Dienst Der Volksgezondheid* (Department of Health Service). The government health institution supervises several medical service institutions, such as *Hyginische Geneeskundige Diensten*, that were established to control the epidemics and infectious

diseases that occurred in Batavia. The purpose of establishing these institutions is to record medical statistics, which includes birth registration, death registration, and death registration based on the cause of the disease. Second, fighting infectious disease includes epidemiological mortgages whose duties include isolation investigations, immunization, quarantine, decontamination, health propaganda, and specializing in dealing with infectious disease outbreaks such as smallpox and malaria. Third, the food inspection, in which the Department of Medical and Hygiene Services must ensure that the stock of milk and food that will be distributed to the community remains available in the market and of high quality. Fourth, the Laboratory, which is regarded as one of the most important instruments used by the Department of Health and Hygiene Services, must perform its epidemiological function by conducting an assessment of one of the most important sources of life necessities consumed by the community, such as drinking water and food that people consume every day (Loghem 1933, 97).



Figure 1. Fishing Pond Covered with Algae Plant and to be a Habitat for Malaria Mosquito Larvae
Source: Tropische Gezondheidsleer 1933.

There are few references in the historiography of the history of health in Indonesia to the handling of epidemics that occurred, particularly in the Batavia area. Bahaudin (2006) wrote a book titled "From Javanese Mantri to Doctors: Study of Colonial Government Policy in Handling Smallpox Disease in XIX-XX Century Java" that is quite relevant and related to this research. This article has become the primary source for writing historiographical histories of health, demonstrating how dangerous the smallpox epidemic was in Java at the time. However, because

the scope of the research was so broad and the discussion was solely focused on the spread of the smallpox epidemic, other researchers from various regions were able to discuss disease outbreaks that had occurred, as well as the condition of health facilities and the handling of disease outbreaks intended for the general public.

Study from Pols (2018) reports that British and Dutch medical professionals had long acknowledged Batavia's reputation for poor health. However, they attributed this more to the lifestyle choices of Dutch residents than to the tropical climate. When Dutch doctors discussed the possibility of Europeans settling permanently in the East Indies in the 1840s, many emphasized the importance of personal conduct and good judgment in adapting to the tropical environment. These doctors optimistically believed that such measures could overcome the challenges posed by the climate.

Ward (2014) research paper Rabies in the Dutch East Indies a Century Ago – A Spatio-temporal Case Study in Disease Emergence" discusses the emergence of rabies in the Dutch East Indies at the beginning of the 20th century. This research uses a spatio-temporal approach to analyze spread of rabies, identifying factors that influence the emergence and spread of this disease in geographic and temporal contexts. Ward explores various aspects of rabies epidemiology, including interactions between humans and animals, dog population dynamics, and public health responses to outbreaks. This research reveals how environmental change, urbanization, and human and animal mobility contribute to the spread of rabies. Apart from that, Ward also discusses disease control efforts carried out by the colonial government, including vaccination programs and regulation of the dog population. By examining historical data and combining it with spatial analysis, this research provides how diseases can emerge and spread in specific contexts.

Based on previous research regarding the epidemic and endemic spread of disease in Batavia, this article reviews different problem points. The main cause of various disease outbreaks in Batavia could not be separated from the tropical climate and hot weather in Batavia, as well as the lack of health facilities at that time.

Aside from the description given above, the interesting ideas and problems have emerged that will be discussed in this article, including (1) epidemics and endemics of infectious diseases in Batavia and their management (2) Batavia's natural and environmental conditions in the twentieth century.

Method

This study employs a historical methodology comprising four stages: heuristic, criticism, interpretation, and historiography. Primary sources, including archival materials from the National Archives of the Republic of Indonesia (ANRI) and contemporaneous records from the Department of Colonial Public Health Services, were collected alongside secondary data from relevant health history literature. Data analysis followed to extract objective findings, culminating in historical narrative construction. Reports from Van Gorkom's "Ongenzod Batavia" serves as a primary reference, offering a comprehensive overview of Batavia's socio-economic and health conditions during the early 20th century. The book highlights the prevalence of disease outbreaks, influenced by poor living conditions, inadequate healthcare knowledge, and the tropical climate. Meanwhile, report from Dr. Van Loghem's "Klimaat & Ziekte" (1916) contributes to the study by examining the relationship between climate and disease. As a climatologist and epidemiologist, Van Loghem's research on the impact of environmental factors on disease spread in tropical regions provides valuable context. In addition, Dr. H.C. Nijland's report on hygiene and health in the Dutch East Indies offers practical insights into the challenges of maintaining health in a tropical environment. Nijland's focus on personal and environmental hygiene aligns with the study's exploration of public health practices in Batavia.

Tropical Climate and its Effects on Health

The emergence of various epidemics and infectious disease outbreaks in Batavia cannot be separated from several supporting factors, which include the natural environment, public health behavior, and

community welfare facilities. This type of situation is exacerbated by a lack of public awareness about the possibility of tropical diseases striking the community at any time.

At the beginning of the 19th century, the colonial government had actually carried out various kinds of scientific research to find a connection and communion between the influence of weather and climate in Batavia and the emergence of epidemics of infectious diseases at that time (Pols 2018). However, many of these studies have yet to yield a result, as an example, the plague cycle that occurs in Batavia at each turn of the month appears very strange and unprecedented to scientific researchers. How is it possible that new epidemics appear every month and strike Batavia residents, killing hundreds or even thousands (Loghem 1916, 8).

The effort put into this research only paid off at the end of the nineteenth century, when many European doctors traveled to the Dutch East Indies to investigate disease outbreaks that were prevalent at the time. As the results came in, new conclusions were drawn about the emergence of various types of epidemics in Batavia due to the region's tropical climate weather. According to the study's findings, the tropical climate had more reactions to human organ tissues such as skin, lungs, and liver. For example, the function of the lungs is to purify the blood from excess carbon and combine it with oxygen, but different things tend to happen to Batavia residents who live in tropical climates. When compared to other people outside of Batavia, their lungs work harder. Because of the hot weather in Batavia, a person's lungs did not function properly. Because of the small amount of oxygen successfully inhaled by the lungs, the lung function did not run optimally in this case. This event was exacerbated by the contamination of the air in Batavia by various types of smoke and pollution, combined with the lifestyle issues of people who do not pay attention to their lung health by smoking, while smoking opium made the community more vulnerable to the emergence of various types of epidemic outbreaks. was present at the time.

In a study conducted by doctor D. Ouwehand, decarbonization that occurred in some Batavian people at the time had entered the

category phase of a very bad condition, and oxygen poverty that occurred in tropical climates became a differentiating factor with temperate regions in Europe. Not only did it harm the lungs more severely, but decarbonization can also harm other organs such as the liver. According to Ouwehand, when the lung function fails to bind oxygen optimally, there is an increase in blood flow to the liver; however, the increase in the blood does not reach the liver completely, resulting in bile deposition. In a number of cases, the failure mechanism of liver and lung function can be regarded as the root cause of why the Batavian people are so vulnerable to infectious disease outbreaks; on the other hand, this condition is regarded as a natural investment, as other epidemics of disease that can attach to the human digestive tract, such as cholera and dysentery, became easier to spread (Loghem 1916, 11).

In addition to having a direct impact on human health, the climate in Batavia, which alternates between dry and rainy seasons, has also contributed to the spread of the current infectious epidemic. The rate of rainfall that occurred between August and the end of December was ideal for the spread of infectious diseases to infect people at that time, and the continuous rain frequently caused flooding as a routine environmental event experienced by Batavia residents. In fact, the presence of this annual disaster is followed by the spread of infectious diseases such as cholera, malaria, and typhus, all of which cause a large number of casualties in the community. For example, the great flood that hit Batavia in 1932 not only killed many people but also resurrected the cholera epidemic because the rivers that were supposed to be a source of clean water for the people to drink were polluted with various types of household waste and the carcasses of livestock that were swept away by the flood (Coban 1976, 114).

Because of this condition, the Dutch East Indies government devoted immediate attention to preventing a recurrence of the cholera epidemic. To reduce the occurrence of infection and the spread of cholera, the City Council organized a group of workers to clean the river of livestock carcasses and garbage. In addition to the foregoing, the government, through the City Council of Batavia, urges Batavians not to rely on the polluted

river for basic necessities such as toilet activities and drinking water sources (Hanna 1988).

The natural phenomena and climatic conditions of Batavia, which had a significant impact on the outbreak of various types of epidemics, demonstrated that, in addition to medical treatment, public awareness was required in adopting a healthy lifestyle; in this case, a cultural approach played an important role in changing the Batavian people's various unhealthy life habits. In this case, culture serves to shape people's habits in carrying out daily tasks, so medical treatment is ineffective in dealing with the spread of the epidemic in Batavia. Furthermore, the colonial government's lack of understanding of the characteristics of tropical diseases, as well as the limitations of medical technology, exacerbated the situation. This research also discovered that the spread of disease epidemics in Batavia could be caused by a number of factors. First, the Batavian people's habits, which frequently involve unhealthy activities and lifestyles. Second, there was the tropical climate, which had a direct impact on the health of the people of Batavia at the time. Third, dealing with the unfavorable spread of epidemic epidemics.

Epidemic of Infectious Disease in Batavia in the 20th Century and Handling Process

The emergence of cholera was one of the disease outbreaks that was quite dangerous to the safety of life and was responsible for the large number of deaths experienced by the people of Batavia at the time. It is unknown when the cholera epidemic first appeared in the lives of the Batavian people; however, according to the notes made by the personal physician of the first VOC Governor, Jan Pieterszoon Coen at the time, Jacobus Bontius, cholera struck Batavia around 1629-1630. In his notes, Bontius also mentioned how cholera had become such a horrifying disease at the time that it had infected nearly half of Batavia's population. Even at that time, Jan Pieterszoon Coen himself had to die due to exposure to this vicious disease in 1629 (Van Gorkom 1913, 31).

Cholera disease is one of the disease outbreaks that attacks the human digestive tract. This disease is caused by the bacterium *Vibrio*

Cholerae and can cause the small intestine to release a large amount of fluids containing minerals and salts, resulting in acute fluid deficiency with symptoms of severe diarrhea, vomiting, and muscle cramps felt throughout the body. Those who have been infected with cholera and have severe symptoms may experience a rapid decline in their body condition due to dehydration, shock, or a severe physiological reaction to body trauma. If this is not addressed immediately, the situation can become fatal and result in the sufferer's death. (Irianto 2013, 38).

Cholera is a disease that does not completely disappear in Batavia after its appearance in 1629-1630; it continues to appear and haunt the lives of Batavians. The cholera epidemic always struck Batavia in waves, first in 1881-1882, then in 1889, 1892, 1897, 1901-1902, and finally in 1909-1911. In fact, the cholera epidemic that occurred in 1909-1911 affected not only people in Batavia but almost the entire area of the Dutch East Indies, particularly Java island, which became the area with the highest number of deaths at the time, with an estimated 60,000 lives lost due to this vicious disease outbreak (Flu 1915).

In addition to what occurred on Java Island in 1909, a nearly identical incident occurred in the Batavia area that same year. At the time, cholera was the leading cause of death in Batavia, and it was reported that in just three months, the cholera disease in Batavia managed to kill over 6000 people, as shown in Table 1. In his research on the cholera epidemic that occurred in Batavia around 1909, doctor Isaac Gronemen argued that this disease has the ability to quickly adapt to its host's body. Groneman assumed that there was still a cholera epidemic in the midst of people's lives after several periods of cholera occurred in their lives. Apart from being supported by a lifestyle that did not pay attention to the environment around where they lived, there were several chemical factors that changed the structure of the cholera disease that existed at the time. Groneman (1909) named his discovery cholera sicca (dry cholera), and it proved to be twice as dangerous as the cholera epidemic that had previously existed. Previously, it was because the cholera sicca did not get rid of toxins and germs in the patient's body when the patient had severe diarrhea and acute lack

of fluids, the germs and bacteria that were left in the sufferer's intestines will continue to exist and cause the sufferer great pain.

Table 1. The Number of Deaths of The People of Batavia Caused by The Cholera Epidemic in 1909

Months	Number of Deaths
September	1.218
October	3.058
November	1.296
December	978
Total	6.550

Sources: Verslag Omtrent de Cholera Epidemie in 1909 te Batavia 1910.

Due to the limitations of medicine and medical technology at that time, to treat the cholera sicca sufferer in Batavia, Groneman used a technique to treat cholera that he developed himself and named opium therapy. The advantage of opium therapy to the sufferer of cholera sicca is that had been done by giving a drink mixed with opium to the sufferer, the function on giving the sufferer mixing opium by Groneman to the sufferer of cholera sicca is to prevent a decrease in the body condition experienced by the sufferer, in addition to the opium substance also serves to restrain the rate of doubling of the disease caused by the decrease in the body's immunity of people with cholera sicca. Giving such therapy has side effects that can be dangerous to the patients Groneman gives an important note to people who want to use opium therapy as a way to get cured of this cholera disease, opium therapy can only be given to cholera sicca patients whose stomach still working as normal as it has to be, it is because the opium therapy requires maximum absorption of the stomach wall and minimizes the occurrence of organ dysfunction caused by opium liquid that cannot be absorbed by the patient's stomach wall (Groneman 1909, 3).

Meanwhile, in response to the spread of cholera in Batavia, the colonial government established the Cholera Intelligence Bureau, a special institution dedicated to the investigation of cholera outbreaks. This institution was chaired by doctor D. Ouwehand, who previously worked as a teacher at an educational institution in Stovia and as a doctor in Batavia. During its implementation,

this institution was tasked with collecting data on cholera patients who were not hospitalized, as well as data on the number of cholera deaths in the community. The results of Ouwehand's research provide a new fact that two years before the great cholera epidemic hit Batavia in 1909, patients with cholera symptoms were still found, albeit in relatively small numbers, proving that the cholera disease in Batavia was not really handled well by the colonial government at the time (Schrieke 1918).

In addition to the establishment of the Cholera Intelligence Bureau, other instruments to combat the cholera epidemics were also carried out, precisely in 1910 when the colonial government in Batavia made a mass vaccination program that served to inhibit the rate of transmission of cholera that occurred in Batavia's community. Even though the execution of this vaccination was quite late, considering the number of deaths caused by the cholera epidemic, it was considered a wise decision made by the Dutch colonial government. The Director of the Pasteur Institute, S.H. Nijland is the most optimistic person to fight for the success of the cholera vaccine, he reasoned that the cholera vaccine causes blood changes that lead to immunity to cholera disease, furthermore, the mass vaccination is one of the most feasible programs in the Dutch East Indies. One of the advantages of using vaccines is that they have an expiration date that is long enough to be used efficiently and allow the government health services to focus on the production, storage, and distribution of the vaccines (Nijland 1911, 501).

Surprisingly, vaccination as a method of controlling the cholera epidemic finally paid off in 1912. Several health institutions, including the Pasteur Institute, Cikini Hospital, and Chinese Hospital, vaccinated the people of Batavia, and the results were spectacular. According to Nijland, the death rate for non-Europeans in Batavia has decreased by 53.8%. Meanwhile, the mortality rate among Europeans who received vaccination was 0% (Nijland 1911). Romer (1917), the former Head of the Batavia Health Service, concluded in 1917 that there was a significant reduction in the number of cases of cholera infection in Batavia between 1913 and 1916. Several years after the vaccine was introduced, the number of cases

among Europeans began to decline. The indigenous population and other ethnic groups in Batavia followed the same pattern (Romer 1917, 295).

Other than the cholera epidemic, around the 20th century the Batavia area was also plagued by two other epidemic outbreaks that were quite contagious and killed many lives continuously almost every year, the epidemic of these diseases were malaria and typhoid fever. Basically, the Dutch colonial government had realized what factors made the epidemic of the disease grow and thrive in Batavia. The research done by the colonial government on environmental health in Batavia resulted in an important conclusion regarding the spread of the malaria epidemic. The colonial government assumed that the construction of ditches in the environment around the city of Batavia at that time caused an increase in malaria outbreaks in several periods, including 1733-1738, and 1763-1767 which was estimated at 228 deaths per thousand people (Blackburn 2011, 71).

Malaria is a disease that cause by a parasite called plasmodium which is transmitted through the bite of a female *Anopheles* mosquito. Based on the classification, there are 4 (four) species of plasmodium that can infect humans they are *plasmodium falciparum*, *plasmodium vivax*, *plasmodium malariae*, and the last is *plasmodium ovale*, among these four plasmodia the *plasmodium falciparum* is the most dangerous parasite that can cause acute symptoms such as death (De Jong 1909, 35). Entering the 20th century, the malaria epidemic re-emerged and began to hit the residents of Batavia, precisely in the period 1903-1911.

The majority of those infected with the malaria epidemic at the time were indigenous and Chinese people, owing to the fact that many of them lived in slums and dirty areas such as river banks and around ditches or swamps. However, the indigenous people are more affected by this epidemic than the Chinese people. According to experts, this is due to Chinese lifestyle habits, which prioritize health over natives. As evidenced by their habit of drinking mineral water that has been pre-cooked and their preference for tea as a health drink. (Blackburn 2011).

In the research conducted by Van Gorkom (1909) regarding the emergence of malaria epidemics in Batavia in the 20th century, he thought that malaria was no longer a disease with a high number of death ratio like what happened in the previous centuries (Cobban 1971). Van Gorkom made a research on 16 villages that spread over the whole city of Batavia and he found a fact that cholera is a disease labeled as the most dangerous disease at that time with a higher number of death compared to malaria. It can be seen in Table 2.

Table 2 The Number of Death Ratios of The People of Batavia in 1909 Affected by Cholera and Malaria in 16 Villages in Percent

Districts	Cholera %	Malaria %
Angke	44,4	11,1
Blandongan	6,3	8,0
Djawa	14,3	7,1
Djembatan Lima	11,0	11,0
Doerie	0,0	19,0
Kebondjeroek	22,7	13,6
Klenteng	11,1	2,8
Kroeket	38,0	11,1
Manggabesar	11,6	0,0
Petjebokan	7,0	4,7
Petodjo ilir	0,0	0,0
Pintoebesie	24,1	3,4
Sawah Besar	24,0	15,2
Tanah Sereal	14,7	8,8
Tandjong Kramat	0,0	0,0

*For the ratio of the number of deaths (number of sufferers of each disease per 100 patients examined).

Source: Ongenzond Batavia, Vroeger en Nu, Noodzakelijkheid Van Een Organieken Stedelijken Gezondheidsdienst 1913.

Based on Table 2, it can be seen that the presence of a malaria epidemic in 1909 was not as prevalent as it had been in previous centuries; however, in certain villages, the ratio of deaths caused by malaria outbreaks remains relatively high, at or above 10%. The fatality rate was unquestionably higher when compared to the number of deaths caused by the cholera epidemic.

Malaria epidemic infections are usually more under control, even if they continue to kill people in the years that follow. Adding to Van Gorkom's research, he was able to collect a few new facts about the presence of the malaria epidemic in Batavia. He concluded that every village in Batavia that had a death rate above 10% had the same environmental conditions, which was the location of the village, which was directly related to the swamp; the prevalence of malaria in a village also depends on the number of breeding sites for larvae. Furthermore, various types of household waste, such as water tanks, pots, cans, broken bottles, and broken pottery, as well as other household objects that have not been used and have caused puddles of water, have a high potential as a breeding ground for mosquitos carrying malaria bacteria. Other facts were discovered in several villages such as Patjebokan and Pintoebesie, where the people live in a healthy environment far from swamps, yet malaria infection with a low death ratio was discovered in both areas. Van Gorkom concluded that the incidence of malaria in the two areas was caused by livestock activities such as cows and horses, which frequently left their footprints on the ground, causing an overdraft filled with puddles of water and becoming a breeding ground for the *Anopheles mosquito* (Van Gorkom 1909, 97).

Several other studies discussing the malaria epidemic in Batavia conclude that the decrease in the number of deaths caused by the disease in the 20th century was due to the discovery of traditional herbs used by the people of Batavia at that time. The people of Batavia believe that drinking processed products made from the quinine plant can prevent them from getting malaria. Although this was immediately refuted by H.B. Cayaux, a Dutch military pharmacist through the research and study he did on urine samples of adults who drank a mixture of processed quinine plants, the result was that the herb did not make any difference in increasing a person's body resistance to avoid malaria infection, and concludes that the use of quinine plants that have been carried out by the community has proven to be ineffective in preventing malaria infection (Van Bergen 2019, 386).

The government's early detection as a method of dealing with malaria outbreaks in Batavia could only be carried out in 1917. The colonial government, through the Health Intelligence Bureau, administered blood tests to the majority of Batavia residents. The blood tests were used to detect malaria parasites in the blood, as well as to determine the level of infection in that area against malaria outbreaks. As a result of the findings, several villages were identified as having a high number of infections classified as dangerous. These villages were located in four sub-districts: Pendjaringan, Mangga-doea, Antjol, and Tandjoeng-Prioek. These four areas are located in Batavia's northernmost region, directly adjacent to the sea. Malaria infection rates in the four sub-districts were 92%, 96%, 93%, and 95%, respectively. Meanwhile, in other parts of Batavia, the rate of malaria infection is relatively low; for example, infection in Weltevreden was 10%, Gambir 3%, Tanah Abang 3%, and Gondangdia 8% (B.G.D. 1919, 4).

To respond to the great potential that could be caused by the spread of malaria in Batavia, the refinement of the environmental aspects around the community's residents that immediately carried out by the government of the city of Batavia. To be exact on January 27th, 1919, The City Council of Batavia submitted an application to the Dutch colonial government with a demand (Land Kosten) of state funds to take over the ponds along the coast of Batavia between Kalis Angke and Soenter and then proceed with draining these areas. However, this demand was rejected by the colonial government due to the budget savings they made for the regions. Yet, this refusal did not dampen the desire of the City Council of Batavia to implement the reclamation ideas despite the city government's budget and costs. After several months of these reclamation efforts, the government of the city of Batavia experienced a deficit in their budget which forced them to stop the reclamation in the coastal area of Batavia, and in a matter of time, they leave the reclamation efforts just like that. To overcome the failure of reclamation carried out by the City Council of Batavia, the Dutch colonial government ordered the Public Health Council to take over and find a

way to overcome the coast that had not been touched due to the impact of reclamation which had the potential to become a new source for the spread of malaria outbreaks due to former excavations, not until the Public Health Council chose a method that was deemed effective enough to cope the abandoned reclamation excavation project by turning it into a fish pond which was then rented out, indeed with constant standardization of maintenance supervision accompanied with advice on how to operate it properly and profitably (Eggink 1930).

After discussing the two disease outbreaks that hit Batavia, another type of disease that was always mentioned as a disease that frequently affected the lives of Batavians was Typhus Abdonamalis, also known as typhus and typhoid fever. P.C. Flu, the assistant director of the Batavia medical laboratory, believed that typhus was a disease caused by small organisms that move quickly and enter the human body through the oral system, carrying various types of infectious bacteria known as typhoid bacilli. The infectious typhoid bacilli bacteria are most commonly found in the feces or bloodstream of typhus patients. In general, this disease is more complicated than the cholera infection that existed at the time because the typhoid disease that entered the sufferer's bloodstream brought the typhus bacilli to the liver, where they were excreted through the bile. If the typhus bacilli reach the sufferer's liver or bile, the consequences can be fatal, even leading to death. Many of those who died as a result of typhoid infection in Batavia in the twentieth century experienced organ dysfunction, particularly in their liver, which was caused by inflammation and infection of the gallbladder (Flu 1920,72).

Several factors contributed to the spread of typhus in Batavia, including the city's bad habits, which included drinking river water directly without first cooking it. Infection through drinking water played a critical role in the spread of typhoid bacillus infection; nearly 80% of Batavians are infected because they drink river water from the Ciliwung river. Despite the fact that some other cases of drinking water that had been properly cooked and mixed with healthy drinks such as milk and tea were not completely free of the danger of spreading typhoid bacteria, this was due to the fact

that the existing typhoid bacteria did not come from water that had been boiled through the boiling process, but came from the hands of those who did not maintain cleanliness when doing activities, whether eating or drinking (Flu 1920, 73).

In a study on the spread of the typhus epidemic in the Batavia region, A.H. Nijland concluded that the difficulty of detecting this disease was one of the main impediments to eradicating the epidemic at the time. With the enormous risk of infection faced by the community, it is nearly impossible to predict that someone who is healthy and has never contracted typhus and is thus less susceptible to exposure. Meanwhile, Nijland explained another fact related to the number of deaths caused by typhoid in the period 1906-1916, about 1/5 of the total deaths of Dutch East Indies soldiers associated with the spread of typhus infection, the typhus epidemic contributed about 1.21% of the number of deaths of soldiers caused by disease in the percentage of 1000 deaths of Dutch East Indies soldiers caused by infectious diseases (Nijland 1921, 72). Asked why the typhus epidemic was more dangerous than the cholera epidemic at the time, Nijland explained that the cholera epidemic still has a temporary epidemic nature in its spread, whereas in a typhoid epidemic, someone who thought they were physically healthy and did not feel anything strange in their body has the potential to spread typhoid bacteria through feces or urine. In a study conducted by bacteriologists in Batavia, there was a hotel that became a source of infection for the spread of typhus at the time, based on the results of an investigation done by the Public Health Council, it was revealed that the hotel owner was the first infected and became the center of the spread of typhus clusters in the hotel environment. The results of a medical history examination revealed that the hotel owner had suffered from an illness, which, according to symptom detection, was the same as the symptoms experienced by cholera patients. However, the results of feces and blood tests performed on the hotel owner by the Public Health Council revealed that the typhus bacillus was still present in his body, despite the fact that he felt physically healthy (Mededeelingen van

den Burgerlijken Geneeskundigen Dienst in Nederlandsch Indie, 1919).

Based on the case of typhoid infection, the Public Health Council concluded that there were two ways for typhoid infection to spread to people in the hotel environment. First, typhoid bacilli infection spread through toilet rooms, where feces and urine play an important role as carriers of typhoid bacilli. Second, the typhoid bacilli bacteria were transmitted through the hands of those who were already infected, who then turn out to be the carrier of typhoid bacilli that is fatal to others, causing the contamination process to move quickly and cause numerous infections (Nijland 1921, 73).

Van Gorkom reported in 1912 on his research in the village of Manga Besar for the previous 36 weeks, recording 533 deaths from a population of 14,475 people, 10 of which were caused by typhus, accounting for 1.9% of total deaths. The 49 typhus cases in the village increased the total percentage of typhus infections in the village by 5%. Meanwhile, according to the findings of another study conducted by a doctor in Batavia, D. Ouwehand, as many as 220 Chinese died in Chinese hospitals in Batavia between 1909 and 1912, with the typhus epidemic accounting for 12% of the total number of deaths (Leopold 1915, 66).

To prevent and control the spread of typhoid infection in the Dutch East Indies, the government began to promote a community-wide vaccination program. Typhoid vaccination began in Batavia in 1914, but before it was given to the general public, the Public Health Council vaccinated military institutions. This was done because the spread of typhus in military camps in Batavia was severe, with a high death rate. Before the vaccination, the infection rate of typhus experienced by the soldiers in Batavia was 11.2%, while the percentage of death was 1.7%. As a result, the situation improved significantly, with a decrease in the percentage of the spread of infection and death. Within three years of the vaccine program's implementation, the percentage of typhoid infection spread decreased to 5.7% for the number of infections and 0.7% for deaths (Nijland 1921, 74).

Meanwhile, the implementation of the vaccination process carried out for the people of Batavia was carried out quite well and effectively, it was recorded that in the period 1914-1920 75% of

the population of Batavia had received the vaccine. In most areas of Batavia, especially in densely populated districts, Typhus and Cholera vaccines were mixed then In most areas of Batavia, especially in densely populated districts, Typhus and cholera vaccines were mixed together then the two vaccines injected to the body. This such effort was made to speed up the vaccination process by the colonial government and prevent the increasing of death numbers as a result of the two epidemics of the disease. In the implementation, almost zero side effects were found from the mixture of the two vaccines, the effectiveness obtained as good as a single vaccination process, therefore many medical experts suggested that all vaccinations in the Dutch East Indies imitate the composite vaccine procedure applied in Batavia.

Conclusions

During the twentieth century, Batavia's lag in the development and control of infectious disease outbreaks became one of the key records of why epidemics of diseases such as cholera, malaria, and typhoid fever could appear and afflict the people of Batavia. The lack of knowledge about proper disease management, as well as the government's lack of interest in investing in the medical sector, has hampered clinical diagnosis of various diseases in Batavia. The Dutch East Indies government could only control the epidemic after the vaccination program was chosen as an effective solution for epidemic control in the Batavia area in the period 1910-1920. Furthermore, in addition to vaccination programs, the establishment of institutions or institutions related to dealing with epidemic disease outbreaks provides solutions in dealing with various types of existing outbreaks, and over time, a lot of knowledge could be gained through government-owned health institutions and institutions related to dealing with the current outbreak.

The emergence of various types of infectious disease epidemics in Batavia cannot be separated from the various health-supporting factors that existed at the time, also because of a lack of public awareness to maintain the habit of cleanliness, also supported by their lack of knowledge about the disease and how to handle it, and in addition, the

climatic and weather factors in Batavia had been influenced on the outbreak of a pandemic, and this cycle continues to this day. The tropical climate and hot weather in Batavia have their own set of health effects, particularly on the human respiratory tract. Unknowingly, hot weather causes the lungs, a vital organ in the respiratory tract, to malfunction and have difficulty circulating oxygen into the blood. This situation frequently causes significant damage to the function of body organs such as the liver, heart, and other vital organs. This was also the primary reason why the people of Batavia were so susceptible to disease at the time.

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