



Rabies in the Dutch East Indies a century ago – A spatio-temporal case study in disease emergence



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ABSTRACT

Rabies continues to spread through the Indonesian archipelago. During the past 20 years, several islands – including Flores, Ambon and Bali – that had historically been free of rabies have become infected. However, the Dutch East Indies (a Dutch colony that became modern Indonesia following World War II) had been infected since the 1880s. The spread of rabies is a lesson in the emergence of an infectious disease.

Reports of human cases treated for rabies and livestock rabies cases from the 1880s to 1917 were compiled. The spatial and temporal distribution of these cases was analyzed using maps, spatial statistics and time-series techniques. The first confirmed case of rabies was reported in 1889 from the Batavia [Jakarta] district (although disease suspicion was reported as early as 1884). During the 1890s rabies was already commonly reported from Java and the east coast of Sumatra, and by the late 1890s, from Celebes [Sulawesi]. Between 1900 and 1916, cases were reported from other parts of Java, Sumatra and Sulawesi, and from Borneo, the Moluccas and other outlying islands. Between 1897 and 1916, a total of 8826 human cases treated for rabies were reported and between 1908 and 1917, 1033 livestock cases were reported. Most (97.5%) human cases treated were attributed to rabid dogs. Increasing numbers of reports were observed during the period. Between 1908 and 1916 the correlation between human and livestock case reports was 64.2%, and at the district level it was 75.9%. Moderate correlations (>40%) were found between human cases and livestock cases reported up to six months previously. Based on year of first report from each district, human cases were strongly clustered (Moran's autocorrelation 0.47, $P=0.005$). The most likely spatio-temporal cluster of reported cases of humans treated for rabies originated from the west coast of Sumatra between 1899 and 1905, and other clusters were identified in west Java (1898–1899), the district of Batavia and in east Java (1910–1911), Nusa Tenggara Barat (1912), Borneo (1914) and the east coast of Sumatra (1903–1906).

Rabies was probably first introduced to the colonial capital of the Dutch Indies, Batavia [Jakarta] in the 1880s. It then spread rapidly throughout most of the archipelago during the next two to three decades because of the movement of dogs via the military forces, for trade and as pets, despite government regulations designed to control the epidemic. Such a history suggests that further emergence and reemergence of rabies in rabies-free islands will occur based on an island's location and position within the complex social, trade and transport network that represents the Indonesian archipelago. Targeted surveillance and enforcement of quarantine regulations remain critical, to prevent history repeating itself.

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1. Introduction

The year in which rabies was introduced to the Dutch East Indies (a Dutch colony that became modern Indonesia following World War II) is uncertain. The first report of a rabies outbreak was published in 1889 (Esser, 1889) in relation to the investigation of a disease outbreak in buffalo in the district of Bekassie (located in West Java on the eastern border of modern Jakarta) undertaken in April, 1888. Esser (1889) reported being told that similar cases had occurred among cattle previously in 3 districts in Bekassie, and that the outbreak had started in two of these districts with a tame deer that had died under “very peculiar circumstances”, followed by cases in buffalo. It was also reported that “two mad dogs” had been observed about 3–4 months previously and that two people had died. Esser (1889) described clinical signs and gross pathology consistent with a diagnosis of rabies, but laboratory testing results were not reported (the Pasteur Institute at Weltevreden had only been established in 1895 [Winckel, 1918]). However, the history and epidemiological characteristics of the outbreak support the conclusion that this was rabies. Rabies may have been present in the colony earlier than 1889. In 1884, a case report was published describing suspect rabies symptoms in a stallion that had a tendency to bite (Schoorel, 1886). A diagnosis of encephalitis was made arguing that the rapid progression of the disease (reportedly about 1 day) and the absence of any bite wounds or areas of sensitivity, ruled out rabies. In this report, no mention is made of the status of the colony with respect to rabies infection, and there is no discussion of whether a diagnosis of rabies might represent the first diagnosis in the colony. This is curious and might suggest that rabies had been diagnosed previously. These early reports of rabies in the Dutch Indies were contemporary with microscopic identification of the rabies virus and Pasteur’s experiments on rabies vaccination and the treatment of victims in France, 1880–1886 (Straub, 1891).

In 1889, C.A. Penning (a veterinarian) wrote about rabies in the Dutch Indies (Penning, 1890). Penning reported that the signs of rabies in dogs had been publicized via the popular press, implying that the disease had been present for at least several years. His inquiries suggested that rabies was widespread in the villages (presumably in West Java) at the time. He states (page 120) that ‘many will perhaps be surprised that this dangerous disease in the Indies is so widespread, while almost never heard of’. It is likely that rabies existed at least in West Java during the 1880s, and probably on the east coast of Sumatra (Penning, 1890). Lack of reports might be attributed to few Europeans or livestock being infected (Esser, 1893). By 1899, rabies was already reported from many locations (Nijland, 1901). By World War I, rabies was common in the Dutch Indies and was considered an important disease by the authorities and by those Europeans who planned to settle in the colony (Winckel, 1918). Rabies in dogs was known on the Greater Sunda Islands (Sumatra, Java, Borneo and Sulawesi), and also many smaller islands of the archipelago.

Rabies continues to spread through the Indonesian archipelago. During the past 20 years, several islands – including Flores, Ambon and Bali – that had historically

been free of rabies have become infected. Rabies was detected in Bali in 2008, triggering a large-scale response in an attempt to eradicate the disease from this island (Putra et al., 2013; Townsend et al., 2013). The source of the incursion has not been conclusively demonstrated; conflicting reports suggest that rabies was introduced either via an infected pet dog accompanying an emigrant from Flores (Clifton, 2010), or via an infected dog on a fishing boat (Townsend et al., 2013; Putra et al., 2013). Regardless, these would have been illegal movements, since dogs from infected islands cannot be transported to rabies-free islands. An incursion of rabies on the island of Flores was reported to have occurred in 1997. Based on limited phylogenetic analysis, rabies virus isolates from Sulawesi and Flores cluster, which has led to the suggestion that Sulawesi was the source of the 1997 rabies incursion in Flores (Susetya et al., 2008). It has been suggested that a fisherman brought infected dogs from southeast Sulawesi to East Flores island (Windiyarningsih et al., 2004). Phylogenetic analysis results also show that rabies viruses isolated in Kalimantan and Sulawesi are related, suggesting that rabies may have been transferred via human activities, in a manner similar to that in the case of Sulawesi and Flores islands (Susetya et al., 2008; Putra et al., 2013).

The emergence and re-emergence of infectious diseases is complex, including globalization, human population growth, destruction of natural habitats and climate change. In particular, many drivers of emergence have been identified for zoonoses, including the translocation of infected animals (Cutler et al., 2010). However, the reasons for such human behavior are not well-understood, but likely include economic, ethic, religious and social factors. Until the motivation for translocating infected animals in countries such as Indonesia are understood, efforts to control and prevent the spread of rabies are likely to be ineffective.

The spread of rabies through the Indonesian archipelago during the late 19th and early 20th centuries provides a clear example of the propensity of this disease to be translocated despite attempts to regulate the movement of dogs and other susceptible species. The aim of this study was to investigate the spatio-temporal spread of rabies in the former colony of the Dutch East Indies during the period 1897–1917 to provide insight into how rabies might be currently spreading in modern-day Indonesia.

2. Material and methods

2.1. Data source and management

Annual reports of the Pasteur Institute (located at Weltevreden, Batavia, the site of modern-day Jakarta in West Java) and the State Veterinary Service (including diagnoses from the veterinary laboratory at Buitenzorg, modern-day Bogor in West Java), published in the journal *Veerartsen-jikundige bladen voor Nederlandsch-Indie* [Veterinary Journal of the Dutch Indies] between 1886 and 1917, were accessed. Each report included information on the number of people presenting to the Pasteur Institute for anti-rabies treatment, or the number of livestock diagnosed with rabies. In published reports, information about human cases treated

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