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Covid-19: A Zoonosis Related to Deforestation and Foodborne Disease

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THE ORIGIN OF VIRUS CAUSED COVID-19

In 31 December 2019, a novel emerging disease, coronavirus disease 2019 (Covid-19), was emerged in China caused by a viral pathogen called severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) (WHO, 2020). SARS-Cov-2 is a new viral strain which shares 82% genomic similarity with human SARS-Cov which causes SARS occurred in 2002-2004 (Chan et al., 2020). The Covid-19 is one of the emerging infectious diseases that appear after exposure to the virus that belongs to a group called 'pathogens.' Emerging infectious disease is defined as one that either has appeared and affected human population for the first time, or has existed previously but is rapidly spreading (WHO, 2014). In broader definition, an increase in the prevalence of infectious disease in recent years (Dobson and Foufopoulos, 2001).

The deadliest emerging diseases mostly caused by zoonotic diseases or zoonosis, where the pathogens are transmitted between people and animals. Approximately 60% of emerging infectious diseases is zoonosis. The disease can spread through direct and indirect contact with infected animals. For example, getting bitten or touching the saliva, blood, urine, feces, or other body fluids. The virus can also spread indirectly when an infected animal contaminates an

object. Meanwhile, globalization made people move quickly to different places across the globe. The fast mobility has brought the disease to escalate far away from the origin. This indicates the similar pattern of the previous pandemic like SARS and MERS which were also zoonotic. Animal trade also amplified the emergence of zoonosis.

The starting point of the Covid-19 outbreak is still unknown, however environmental samples taken from Huanan Seafood Market in Wuhan City, China is associated with the outbreak (Andersen et al., 2020; WHO China, 2020). Furthermore, some of the early Covid-19 patients had a history visiting this wet market, where wildlife mammals are traded, suggesting a potential zoonotic origin (Lam et al, 2020; WHO China, 2020). So far, studies show that bats are the reservoir of SARS-Cov-2 but its intermediate host(s) remains elusive (WHO China, 2020; Zhou et al., 2020). Several studies postulate that SARS-Cov-2 might use pangolin as a host before infecting human (Zhang et al., 2020; Lam et al, 2020). The SARS-Cov-2 in humans is 85.5% and 92.4% genetically similar with the virus in smuggling pangolin (*Manis javanica*) in southern China (Lam et al., 2020). While the Covid-19 outbreak started from the live-animal market in Wuhan, the previous SARS outbreak also started from a similar market in Shenzhen, China. The bottom-line is the disease was transmitted from animals to humans although the

scientists still work to examine the data to determine which animal caused the outbreak.

THE LINK BETWEEN DEFORESTATION AND ZOOONOSIS

The biggest challenge of environmental disturbance comes from deforestation. Deforestation leads to biodiversity loss and numerous environmental problems (Rosa et al., 2016). The wildlife whose habitat is in forest potentially carries pathogens that can cause disease to humans. This pathogen can evolve to be an immune system on wild animal but not to humans. Deforestation leads human population to live on the edge of the forest which increases the opportunity to have contact with possible primary and intermediate hosts of pathogens. The transmission can be occurred when the infected species become human consumption or being preyed by other animals that spread the disease through wildlife hunting and butchering (Wolfe et al., 2005). This pathogen enters the body from mouth, eye, or wound. Eventually, the infected body will become its host.

Deforestation-related outbreak is not a novel phenomenon. It has been linked to the zoonotic disease since earlier civilization. Large-scale forest clearing for agricultural purposes demolish homes for the wildlife and intensify interaction between human and wildlife. Furthermore, land conversion from forest to animal husbandry adds domestic animals to the interaction. Malaria is also known as forest-associated disease originated from mosquitoes. Research on the Amazon forest in Brazil showed 10% of deforestation leads to a 3.3% rise in malaria cases (MacDonald and Mordecai, 2019). Although the mechanism of deforestation and the rising cases of malaria remained unknown, landscape change can affect mosquito distribution. There is an influence of the proportion of cleared land within one kilometer of households on the occurrence of *Plasmodium knowlesi*, a parasite that causes malaria (Brock et al., 2019). Other than that, deforestation or less forest cover also increases a dengue fever case in Indonesia (Husnina et al., 2019). When El Niño caused a tremendous wildfire in 1997/1998, millions hectares of forest and species habitat was destroyed. This made the fruit bats (Genus *Pteropus*) flown to the populated area to find fruits. *Pteropus* is a natural host and reservoir of the Nipah virus (NiV). The fallen infected fruits were eaten by local pigs, subsequently from pigs to humans (Sharma et al.,

2019). The emergence of NiV in 1998 from Malaysia had killed 105 people. The NiV diseases spread to India, Bangladesh, and Singapore, where the virus transmitted from bats to humans. The latest NiV case was still reported in 2018. The fruit bat is also a reservoir and host for the Ebola virus. It is a fatal disease that causes hemorrhagic fever in humans. First identified in Africa in 1976, the Ebola virus disease was strongly associated with deforestation (Olivero et al., 2017). The loss of forest has facilitated the virus to spread into a populated area.

The complex interaction between deforestation, land-use changes, and the social economy has increased the human contact with a pathogen that leads to zoonoses. Fragmentation of forest landscape and disturbance of forest structure will increase the number of hosts or vectors that move into the human population. Most importantly, it allows the pathogen to persist indefinitely and the disease to become endemic or even pandemic. Reducing animal-human contact is a big challenge as it requires dramatic behavioral change and support from the government, wildlife experts, epidemiologist, and social scientists.

FOODBORNE DISEASE HARMING THE FOOD SECURITY

Food security means all people at all times have enough food and access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs. Forests have become a source of food for many generations, such as collecting fruits and hunting. As the population grows and demand for food skyrockets, the production requires more land to plant crops.

Today, nearly two-third deforestation is linked to traditional or industrial agriculture purposes. The changing environment derived by agriculture increases the risk of zoonosis, where species assemblages from different habitats mix (Jones et al., 2013). Food security can be achieved through sustainable agriculture practice as it deploys responsible land management which preserves species habitat. Maintaining forest cover will reserve stock carbon, biodiversity, and the forest itself become natural barriers to pests and pollinators.

Another factor affecting food security is foodborne disease caused by pathogens that contaminate the

foods and occurs at any stages of food production, delivery, and consumption chain. A study reveals that SARS-Cov-2 can survive for up to 72 hours on plastic, four hours on copper, and 24 hours on cardboard (van Doremalen et al., 2020). Therefore, it is essential for the food industry to strengthen personal hygiene measures in order to avoid or minimize the risk of viral contamination. Furthermore, high risk foods e.g. raw milk, fresh meat, fruit or vegetables handled by a person with the virus or drinking water contaminated with feces or urine might also possible to transmit the virus. Of note, there is no evidences that foods act as a transmission media for SARS-Cov-2 (WHO, n.d.). As a general precaution, WHO suggests that raw food must be well-prepared and processed prior to consumption. Eating habits also contributed to emerging zoonotic diseases. The discovery of similarity coronavirus in bat and pangolin should be considered that they are the host of the virus. To prevent future outbreak, people should change their eating habits such as the consumption of raw or undercooked meat and reduce the demand for exotic foods such as bushmeat.

RECOMMENDATION TO PREVENT ZOOSES

In the Covid-19 case, most countries have failed to address the outbreak adequately. The government attempted to flatten the curve by slowing down the spread and preventing overload patients at health facilities. However, the actions taken by the authority remained ineffective due to lack of control, high people mobility, inconsistent regulation, under-testing, low capacity of laboratory, and disruption of public health service.

This paper proposes two crucial recommendations to prevent zoonoses in the future. First, reducing human and wildlife animal contact. Zoonosis is highly linked to ecosystem change or environmental disturbance (Morris et al., 2016). Different levels of disturbance can trigger different levels of the pathogen into the system. Pathogen lives inside the wildlife animal host, whose origin host has genotypes, immune system or symbiotic system that eliminate or live with the pathogen. When humans have contact with this pathogen, the disease is emerging because humans have not acquired adaptive immunity to eliminate the pathogen.

To address it in the source, habitat destruction and

biodiversity loss must end (Ostfeld, 2009). The approach will reduce the infectious disease because of less human-wildlife animal contact. A movie titled "Contagion" (2011) clearly described how clearing the rainforest in China destroyed the natural habitat of the bats. The destruction led to emerging deadly viruses in humans transmitted from the bats. Responsible forest management and food production is a promising solution to reduce the risk of zoonoses.

On the other end, control eating and trading wildlife animals can help reducing foodborne disease by preventing direct contact to the hosts. Learning from SARS and Covid-19 cases, closing the live animal markets was effective to stop new cases. A study identified 51 zoonotic pathogens (16 viruses, 19 bacteria and 16 parasites) potentially hosted by wildlife which threaten the human health risks (Cantlay et al., 2017).

Second, promoting proper food utilization. Applying essential food hygiene in the process or preparing food is important. Almost half of the foodborne disease cases in Indonesia originate from homemade food. Foodservice industry also contributes to foodborne disease. Studies in Jakarta show purchasing street food as an independent risk factor for paratyphoid (Volvaard et al., 2004). Street food is characterized by poor hand washing and improper food conditions. Foodborne diseases are also related to water because drinking water, dishwater, and ice cubes are frequently contaminated with fecal. Public health interventions to reduce transmission of foodborne illness should focus on general hygienic measures in the street food trade, i.e., handwashing with soap, adequate food-handling hygiene, and frequent renewal of dishwater. This case reflects global cases where foodborne reported, such as Hepatitis E from raw or undercooked venison in Japan.

Regarding hygienic food practice, educating people to process the food properly is also crucial. Even commonly consumed meat such as cattle, sheep, beef, and goats may contain disease if they are undercooked. The knowledge about zoonoses will help people how to process their food properly. These actions must be included in health protocol and regulation on the emerging disease from zoonoses. Otherwise, it can have a devastating impact on economic conditions and food safety.

CONCLUSION

In preventing future zoonosis and its outbreak, wildlife habitat protection and food utilization become significant. It is therefore necessary to enhance food security through sustainable agriculture, which is to improve agricultural yields without destroying wildlife habitat and biodiversity. The effort to support people's capacity to have proper food utilization should also put into action. Definitely, a multi-stakeholders collaboration between government, agriculturist, ecologist, health professional, social scientist, and all related agencies is crucial to find viable solution from recommendations above.

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