

CLIMATE CHANGE, GLOBALIZATION AND EMERGING DISEASE, CHALLENGES AND GOOD PRACTICES FOR ENVIRONMENTAL HEALTH SPECIALIST

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ABSTRACT

There is an apparent increase in a number of infectious diseases, including some emerging and re-emerging disease in the Asia Pacific region. This region has witnessed the spread of some new circulating agents such as SARS, Hanta Virus, Avian Influenza and MERS lately. This reflects the combined impacts of climate change, rapid and dynamics of its demographic, environmental, socials, technologies and other changes in ways-of-living. The phenomena of globalization as well as Climate Change contribute to the growing problem of public health as well as environmental health globally. It was predicted that Global Warming as well as the Change of the ecosystem will continue in the years ahead. The questions: what could be the Role of Environmental Health Practitioners with regard to the threat of emerging disease? It was expected that more emerging disease will affect human population in the future, as climate change shifts habitat and bring wild life and livestock and human into contact with new pathogens. The people are susceptible to pathogenic microorganism that they never been exposed before. The increase of intercontinental movements of goods and people including vectors and food, that characterize globalization, have contributed to the spread of new emerging diseases. Traditionally the Environmental Health Specialist in the developing countries, focusing on Wastes, Air Pollution, Water and Sanitation systems. It is time for Environmental Health Practitioners contribute more in the area for preventing emerging disease. They could contribute at all level, e.g. Policy and Legislation levels, Advocacy and Health Promotion, Research and Development, Practitioners e.g. health inspection in the agricultural area, Port Health Authority and Quarantine, which include Law Enforcement activities. The Curriculum for Environmental Health Specialist Education as well Refreshing Course on the above matter is also discussed.

Keyword: Climate Change, Globalization, Emerging Disease, Environmental Health Specialist

1.0 Introduction

Nowadays, there was an apparent global increase in number of infectious diseases, including some emerging and re-emerging disease. It reflected the combination impacts of many variables such as climate change, globalization, technologies and other changes in ways of life. The phenomena of globalization and climate change contributed to globally grown problem of public health as well as environmental health (WHO, 2015)

In the early 21st century the Asia Pacific region had witnessed the spread of some new circulating agents such as SARS, Avian Influenza and MERS Co V. In early 2003, this region was shocked by SARS epidemic which caused paralyze economic activities for a moment. People were scared to go abroad. Others emerging disease such as Hantavirus hemorrhagic fever entered Indonesia earlier at the end of 20th century and Wild Poliovirus entered in early 2001. We knew that Poliovirus was human dependent and a fecal oral disease, which had an association to not only immunization, yet basic sanitation program as well. We had evidence that the DNA virus of Polio circulated in west Java, Indonesia, matched with the one circulated in Africa (Achmadi, 2013). In other words, such wild polio viruses had travel brought by human being (as polio virus is human dependent), a long way from Africa, Middle East and finally west Java Indonesia.

The regional and intercontinental spread of those infectious diseases apparently was not new. In early 13 century, the disease, such a plague, was brought by traders from central Asia to Europe via the inland i.e. camel pilgrimage. Then, it was brought from Europe to South East Asia, particularly Java Island, Indonesia, by trading activities (Achmadi, 2012; WHO, 2015).

The development of emerging disease was bounded to ecosystem. Ecology was the beginning of basic knowledge over Environmental Health Specialist or Practitioners. Changing the ecosystem, changing the environment as well as globalization, will have been continued in years to go. The question was: what could be the role of Environmental Health Scientists, in the world with a threat of emerging disease? Understanding the basic knowledge of emerging disease is an essential part.

2.0 Climate change, ecosystem change and emerging disease

Evidences have had shown that climate change has been happening. The climate change simply referred to the global warming which was generated naturally and yet primarily by human activities. Conclusive evidence suggested that the burning fuels for transportation, industrialization and deforestation caused global warming by increasing the levels of greenhouse gasses and eliminating carbon sinks.

It was known that many aspects of vector behavior, including the range of habitability, were at least partially driven by temperature. Thus the concern about global warming, vector borne diseases could spread to new areas which were not contaminated yet. Evidences showed that global warming might affect the mosquito behavior which increased the biting rate, in addition increasing the risk of contracting vector or mosquitoes borne disease. It was also discussed that global warming could shorten the parasitic maturity (Patz, et al., 1996), affect the ecosystem as well as habitat of vector. There were more evidences of relation between climatic conditions and infectious diseases. Malaria has been one of public health great

concern, and likely to be the vector-borne disease of most sensitive, long-term climate change. The variation of Malaria was depended to the season in high endemic areas. The link between malaria and extreme climatic condition has been studied since long time ago in many parts of the worlds. Early identification of excessive monsoon and high humidity was a major influence, as well as enhancing mosquito breeding and survival.

Apparently, it was not malaria affected by the phenomena of global warming. Taylor, et al. (2001) reviewed more than 1415 pathogens had infected humans. They found 61% of those pathogens were zoonotic or transmitted between animals to humans. Considering zoonotic diseases, 75% of the pathogens classified as causative agents of humans emerging infectious diseases. It was known that zoonotic diseases have bounded to ecosystem. In other words, it has close association with the environment as well as climatic factors which influence the emergence and reemergence of infectious diseases. These changes can affect the introduction and dissemination of many serious infectious diseases.

Many theories about emerging diseases have been developed. Brooks and his co-author Eric Hoberg (2009), had observed how climate change influenced the ecosystems. Changing the ecosystem, mean changing the habitat of some parasitic as well as host. It was known that animals or human could have been exposed to brand-new parasites and pathogens. Therefore, the appearance of infectious diseases in new places and new hosts was a predictable result of climate change in the future.

Human could have expect such more illnesses to emerge in the future, as climate change influenced the habitats and wildlife, crops, livestock, and human into contact with pathogens, which they were susceptible and never been exposed before. Some pathogens are highly adapted to one host and easily shift to brand-new ones under the right circumstances. Ecological balance could explain such phenomena that the brand-new hosts were susceptible to infection and mostly fatal, because they haven't yet developed their immune system. Thus, climate change could affect ecological changes, which lead to formulation of new emerging disease under circumstances.

The focus discussions of emerging infectious diseases, was often on the clinical effects of the host-parasite relationship, rather than the examination of the biology of the pathogen (Gomez-Lus, et al, 2000). Understanding how pathogens are transformed into novel pathogen is important to be studied. So that prevention and promotion program toward new emerging disease can be developed.

Another theory was also proposed to develop new pathogenic agent which causing new emerging disease. Gross (2014) proposed the transmission of pathogen among wildlife and livestock, the way of pathogens spillover into human populations was a vital step in understanding how and when these pathogens would emerge in human populations. Clearing the forest plantation, e.g. palm oil or rubber will bring humans and wildlife into closer contact and increase the risk of pathogen spillover from wildlife to humans. Likewise when such a domestic or small scale poultries located in the middle of urban areas (such as this in the picture), surrounded by fruits tree, it would risk animal pathogen spill over or jump into humans (Dinoverm, 2013).

The spillover theory may also happen in the urban area. The urban population lives in an overlapped or shared ecosystem with the metropolitan bats. As we know, bats are virus

reservoir particularly in their saliva which tend to spit out the remaining material after squeezing the fruits and swallow the juice. Another animal came to eat the spitted fruits would be ingested virus particles from the bat, and the virus would have the opportunity to jump or spillover into a novel host species. Bats and humans tend to overlap in habitat, which provides opportunities for bat virus spillover into human populations. Some bats migrate, and their long-distance travel might help them to spread viruses. It is crucial for human health to understand those spillovers process.

In short, people should have have expect such more new emerging disease in the future, as climate change influenced the wildlife habitats, livestock, and human into direct contact with pathogens. The worldwide pandemic of emerging and re-emerging diseases, global warming, globalization, etc., illustrated how climate change gave an impact to the ecosystem, the emerging such a new agents, and spread globally by the travel intensity of goods and people. (WHO, 2015)

3.0 Globalization and the potential threat of emerging disease

Evidences showed that numbers of people and goods movements were increasing in recent days. Globalization of trade and goods movement has been followed by the increase number of people globally. International travel was observed particularly in the Asia Pacific region which the population-environment dynamics has changed.

Many scientists had predicted that Globalization increased risk toward the spread of infectious disease, which include emerging disease. Nowadays, the international travel was one of the fastest-growing industries worldwide. Yearly, international tourist arrivals are expected to pass one billion marks by 2015. Every region of the world was experiencing this increase. In 2012 the World Tourism Organization predicted that the number of travelers around the globe was 940 million peoples, of which 446 million arrivals or 51% are travelling for leisure (World Tourism Statistics, 2013). The reasons for travel were varied. Fifteen (15%) of them were professional travelers, 27 % for religious reason, meet relatives and friends, seeking treatment abroad, 51% via the air, 41% via the inland; 2% by train and 6% by ships. It was predicted that in 2020 there will be 2.1 billion travelling. According to the latest UNWTO World Tourism Barometer, International tourist arrivals reached 1.138 million in 2014 which increase over 4,7% of the previous year. In 2015, UNWTO forecasts international tourism grew from 3% to 4%, as further contribution to the global economic recovery. Meanwhile, the increasing tourism based on the regions were; America increased 7% and Asia Pacific increased 5%, both registered as the strongest growth. Meanwhile, Europe increased 4%, the Middle East increased 4% and Africa increased 2% which grew as slightly more modest pace. Based on the subregion, North America increased 8% which shown the best results, followed by North-East Asia, South Asia, Southern and Mediterranean Europe, Northern Europe and the Caribbean, which all increasing by 7%.

Along with the dynamic movement of people, the international movement of goods, meats, food may have important implications for intercontinental spread of infectious diseases. It might be goods, people, and the food stock in the market originated from other places across the world that brings some microorganism. A global food supply rose awareness about contaminated food by pathogen and or other chemical agents. Along with the movement of

goods, many countries opened the airlines to the intercontinental of movement of disease vector. The mosquitoes could cross the globe by airplane in addition the widening area of subtropical area which suites to the habitat of dengue hemorrhagic vectors. It was something in association with the global warming phenomena. The increasing movements of people, commodities, vectors, food, capital, over globalization, have contributed to affect the emergence and spread of infectious diseases. The unprecedented number of people and their speed of travel were perhaps the most significant manifestations of the present era of globalization.

A few years ago, it took about many days to travel from one place to another. Thus the incubation period of many infectious diseases was not longer than the time took by the infected to travel from one location to another. In the past, infectious disease outbreaks were readily detected on ships before they arrived at port, and the ships were quarantined until the diseases had burned themselves out. Now, a local outbreak spread silently and globally by an infected traveller or tourist, soon cases will likely start emerging only days or weeks later in clinics and communities worldwide. The worse situation of globalization was not only about spreading the disease, but also antimicrobial-resistant genetic materials. Biological agents picked up microbes and drug-resistant microbial genetic materials in one part of the world and have them transported to another place. In addition, we also have to consider the spread of infectious disease, brought by natural migration.

4.0 The evidence of emerging disease in 21st century globally and in Indonesia

There was several numbers of regional outbreaks as well as global pandemic outbreaks following SARS Epidemic, e.g. Mexico influenza, MERS Co V. As Asia Pacific, one of the busiest regions, could have been in high alert toward emerging disease. Based on the experiences, the epidemic was exacerbated by globalization, in which the human dynamics movement from one continent to another influenced by the increasing of commerce around the world. Movement statistics of people in a very dynamic region such as Asia Pacific increased almost in all countries.

In Indonesia, it was not only the number of tourists increased but also the amount of the Indonesian departure to other countries in Asia, Europe and American Continent. In 2012 both the number of tourists' arrivals in Indonesia and departures from Indonesia was almost equal (BPS, 2013). In 2013, the number of Indonesians who went abroad was 8,8 million people. Otherwise, in January-August 2012 the total of domestic tourists reached 35,5 million people, it rose slightly from 33,7 million people at the same period last year which approximately increased 5,20 %. At the same time, the increasing of flight either national or international reached 8,87 %. In 2012 the number of foreign tourists' arrivals in Indonesia through the entire entrance was increased as much as 5,16 %, from 7.649.731 last year to 8.044.462 tourists. In January to July 2013, the total of tourists increased to 4.872.262 people from 4.577.510 people in January-July 2012 or it increased 6,4 %.

In 2003, Indonesia as well as other countries in Asia was shocked by the epidemic of new emerging disease, SARS. We might assume that SARS or Severe Acute Respiratory

Syndromes were caused by novel viruses, i.e. Corona Virus. Panic attacked decision makers of countries in the region. As we learnt lately, Co V is a virus that depended on the environment. In 2005, the Indonesian Ministry of Health was shocked by an outbreak of polio among children. Apparently the coverage of immunization was very low in that particular village. This has to do with the faith of the local people. More evidences indicated that the wild polio virus circulated in local outbreaks, its DNA sequenced was match with the one circulated in Middle East and Central African countries. As poliovirus is an Oro-fecal virus, so this virus is human dependent. There was a hypothesis stated that someone (human) brought such wild poliovirus from Middle East or central Africa to the local village. Further investigation indicated that there were no local people having history of travelling to the mid-east area, instead people coming from Mid-east or Africa brought the poliovirus to the village in West Java of Indonesia. The conclusion suggested a theory that it was an intercontinental movement of people who bring the human dependent virus i.e. poliovirus. Another lesson taught us that the Environmental Health Practitioners should see the polio problems as apparently their domain i.e. basic sanitation for the poor people.

Other emerging disease which entered Indonesia at the end of 20th century was Hantavirus disease. This infectious disease was an example of outbreaks associated with the increasing goods as well as ships and cargo movement. Along with the cargo movements, it increased the risk of rodent associated outbreaks of the emerging disease. In 1999, Indonesia did serological survey in several harbors in Indonesia (as was seen in the slides) which indicated Hantavirus was found in several ports area. Hantavirus problem had been associated to rodent control in the ships and in the ports. In addition to follow up of the serological survey in the harbor another survey was done in its hinterlands of the harbors, which was also indicated that rodent which follow the movements of goods in the hinterland already affected.

An introduction of Avian Influenza A (H5N1) to Indonesia in 2003 through poultry sector forced the Indonesia Ministry of Health on high alert. First human case was found in the greater Jakarta in July 2005. The high pathogenic virus of Avian Influenza first infected humans in 1997 during a poultry outbreak in Hong Kong SAR, China. It was re-emerged in 2003 and 2004 spread from Asia to Europe and Africa resulting in millions of poultry infections, several hundred human cases, and many human deaths (WHO, 2015). Most of infections were due to direct/indirect contact with poultry/ poultry products and contaminated environments. Fortunately no sustained human-to-human transmission has been reported.

The Jakarta government learnt that many urban families of the Greater Jakarta were having small scale poultries in their backyards. It was then, refer to the spillover theory, of which it may increase the possibility of pathogens spillover into human and spread to the urban populations, the Government of Jakarta ban all these small scale backyard poultries (Gross, 2014).

5.0 The Role of EH Specialists

The root of Environmental Health Science is Ecology which studies the ecosystem. Environmental Health Science has concerned about humans' interaction with the hazardous environment including pathogens microorganism. It also focused on how to identify, measure, analyze potential hazards and find solutions so that people are protected from the

dangers of the disease caused either by a pathogens microorganism or toxic chemicals (Achmadi, 2012).

In other words, environmental health specialists have a duty and obligation to protect the public in their work area from a danger or threat of pathogens microorganism, including novel pathogens which cause new emerging infectious disease. The good practices in protecting Public Health were conducted by Environmental Health Specialist as following activities:

1. Enhance knowledge continually. Such problems of ecosystem change, climate change, emerging disease and globalization have been running in the last two decades. However, these problems appeared as if it's sort of a very sudden and shocking. Its emergence in the early 21st century was very shocking as if the world was not ready and there was a gap between the change and readiness. This reaction was not surprising since education and curriculum of environmental health in some countries did not cover the appearance of new pathogens related to climate change. In other words, the curriculum did not prepare to deal with these emergencies. Curriculum, training or refreshing courses for the Environmental Health Specialist are important in dealing with this case. It includes seminar workshops to face emerging pandemic disease.
2. New theories about the emergence of a novel microorganism e.g. spill over theory of virus jump from animal into human, basic knowledge about the co-evolution, and ecological fitting should be learned and studied to produce a body of knowledge as the basis prevention efforts based on environment. The practice of controlling animal diseases and/or using new knowledge to prevent and protect the community (population at risk) would have been the main task of environmental health specialists. In other words, environmental health specialists were able to actively involve and participate in the new infectious diseases research and development by using ecological approach. So that, We should also invest in more research on bat ecology.
3. Environmental Health Specialist could also play a role in the level of legislation and make policies that lead to the health promotion and prevention. For example, drafting regional regulations in urban areas to ban poultry. In developing countries such as Indonesia, especially urban cities on Java Island tend to have poultry such as chickens and hummingbirds. Banning poultry in big cities will prevent the appearing and spreading of avian flu.
4. Environmental Health Specialist could also play a role in the field of the practitioners' level by conducting inspections and law enforcement for the potential outbreak of a new infectious disease. Sixty-one (61%) of infectious diseases are zoonotic disease. Healing the environmental condition which potentially widespread the zoonotic disease must have been controlled by following legislation and policy.
5. Environmental Health specialists could also perform advocacy, outreach to the community, especially the urban and/or workers in the animal's sanctuary (livestock). It's important for butchers, farm workers, and other community (population at risk) to have such counseling. Hygienic practices are vital for containing the spread of emerging diseases in the affected (Gross, 2014).

6. Environmental Health Specialist could also play a role at the health quarantine, at the airports and ports since either the entry or exit points of pathogens is likely grown in this region. Health Quarantine office is an important point in preventing the entry of emerging disease from and to another country.

7. So that, the networking and knowledge about distribution pattern as well as the epidemiology of new infections should be the environment health specialist's main concern in many countries. Networking and good cooperation between the environment health specialists in a region would be something important. ASEAN countries have to work together, as well as China, Korea and other countries in Asia Pacific. It is the environment health specialist's task to protect the respective regions from the emerging threat of pandemic disease.

Conclusion

As it had been reviewed, climate change effect to ecosystems, habitats of animals and emergence of novel microorganisms, could lead to emerging infectious disease. In addition, Human activities such as deforestation, air pollution in urban area, as well as combustion energy for daily activities aggravated world ecosystems change, global warming and climate change. Ecosystems change might lead to a transition between pathogens agents with the host. It was characterized by the proliferation of animal diseases (zoonotic) jumps to human. The relationship between host-pathogen recently spread in the process of globalization and provided pandemic threat. Environmental Health specialists had had basic scientific ecological which the main task of these sciences and practices were supposed to be about the protection against a new disease. In short, Profession as environmental health specialist or practitioners could involve as it's been their duty to participate in controlling of new infectious diseases. It was described that there were at least 7 areas that Environment health specialist should be involved; curriculum change and organizing refreshing courses, networking, research and development, law enforcement practitioners, legislation and policy, training, and health quarantined at ports and airports.

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