Abstract

In this report, we will find the answer to whether it is Scrub typhus causes poverty, or it is poverty that causes Scrub Typhus. The methods that we choose to proceed are; first, we set up the hypothesis that Scrub Typhus is causing more poverty by using the assumption from paper which included the agricultural and Globalization section, which directly affect the peasants where they have lower income compared to other industry as more Globalization means more risk to face with the disease that leads to poverty, and climate change that can transport and promote the severity of the disease by the unstable environment and ecosystem, for instance, tempest, and acidic ocean. To answer our hypothesis, there is no right or wrong answer. However, what we see from the research is that Scrub Typhus mostly occurs with farmers in the agricultural sector. This research will provide in-depth information for readers.

Introduction

What is one of the reasons that lead to poverty in the Asia-Pacific? Around the 19th century, most people who lived in poverty were in South Asia, and East Asia and the Pacific. Basically, the causes of poverty are lack of education, natural disasters, corruption, overpopulation, and economic issues. However, sociologists and economists would argue that the epidemic has been one of the main impacts of poverty.

Throughout the century, Epidemics have changed the way people live. Since the 19th century, Scrub Typhus has first occurred among the Burma and Ceylon troops during World War II, leading to many deaths of the military; thereby, in 1944, there were no cures or clearly diagnosing what is causing their death. In the contemporary study, it can be indicated that Scrub Typhus is a threat to undeveloped areas, lack of knowledge people, and especially areas of poverty. "Scrub Typhus" started to outbreak in Asia around the 19th century, it has affected several social and economic issues. Many of the poor have less opportunity to access essential health care or health insurance. Due to the fact that there are tremulous poor that live in bad living conditions as it is overcrowded, this can be one of the causes. To be comprehensive, Scrub Typhus can strongly affect social issues "Poverty" in Thailand because most people in the agricultural sector and trade areas are lacking opportunity and access.

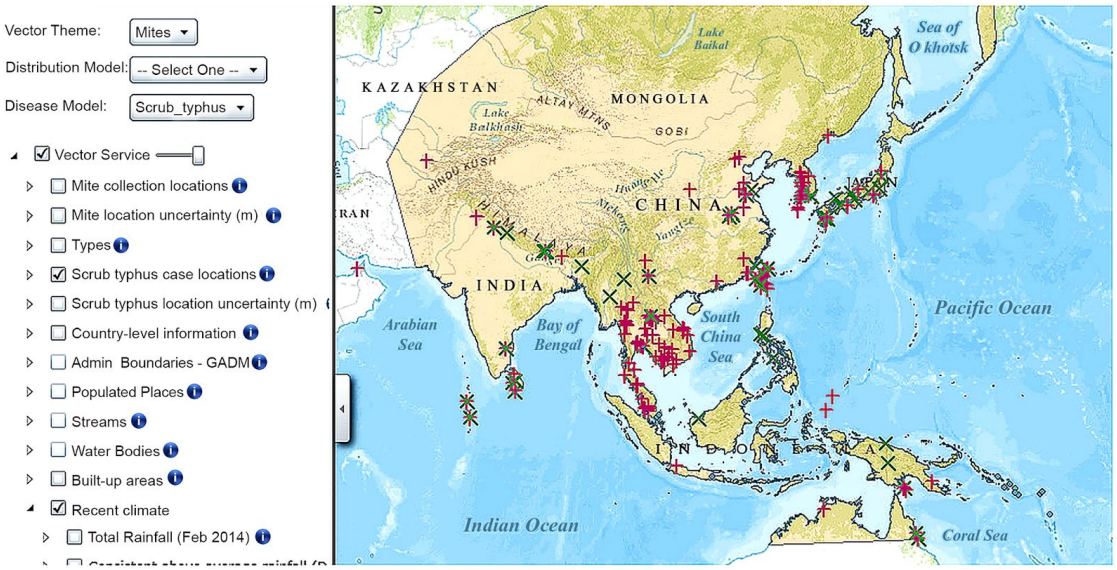
As we can see in many historical pandemic, some pandemic such as Cholera occur only in low income people; However, some pandemic occurs in everyone no matter their income or status. What about this disease "Scrub Typhus", is it only affects the poor or it affects everyone no matter what.

Because of environmental conditions that the poor can easily face with the chigger this means that the answer for this problem is since Scrub Typhus is mostly affected with the poor making the poverty occur at a higher level. However, the reason behind it is not only because of environmental conditions. In this research we are going

to separate all of the issues from our research question which will relate poverty to Scrub Typhus.

Background

Scrub Typhus is one of the diseases caused by bacteria Orientia tsutsugamushi related to Rickettsia and belongs to the family Trombiculidae. Mites are carriers of the disease, most mites usually live in shrubs or forests which transfer to humans by the bite of the larval stage of trombiculid mites (Pai et al., 1997). The cause of spreading came from the incident that humans accidentally grabbed on and bit by an infected larval mite that naturally lives on that particular ground causing the Scrub Typhus to affect people. Thus, the Asia continent geographically promotes the mite to be widely spread, people in this area are mostly at risk of getting infected, for instance, Korea, Japan, China, Thailand, etc. The majority are in rural areas ("Acariasis", 2013).



(https://journals.plos.org/plosntds/article/figure?id=10.1371/journal.pntd.0004161.g005)

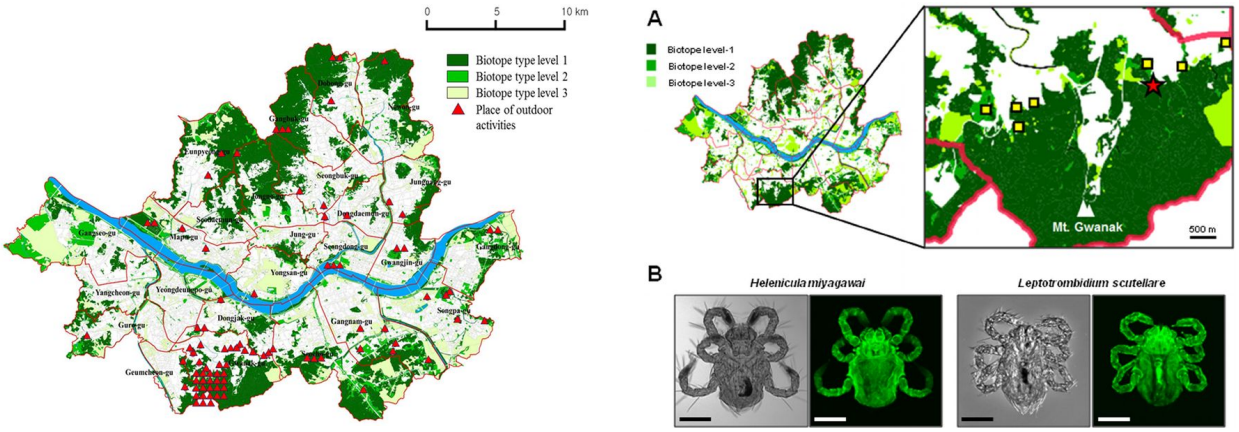
Scrub Typhus can be well known as an acute fever and may reach 40.5 celsius, headaches, sweating, vomiting, and enlarged lymph nodes which causes eschar and can be as long as 6 to 21 days from exposure. Cough can occur in the first 7 days of fever then worsen to pneumonitis. After that red spots may show up 5 to 8 days after the onset of fever. Lymphedema may also occur, high fever may continue for over 14 days. Death is usually shown within 14 days of symptom onset, mostly are because of

bacterial pneumonia, encephalitis, circulatory failure, central nervous system involvement, or hematological abnormalities (Devine et al.,2003) But unfortunately, There is still no vaccine that can be used to prevent Scrub Typhus. (CDC, 2020)

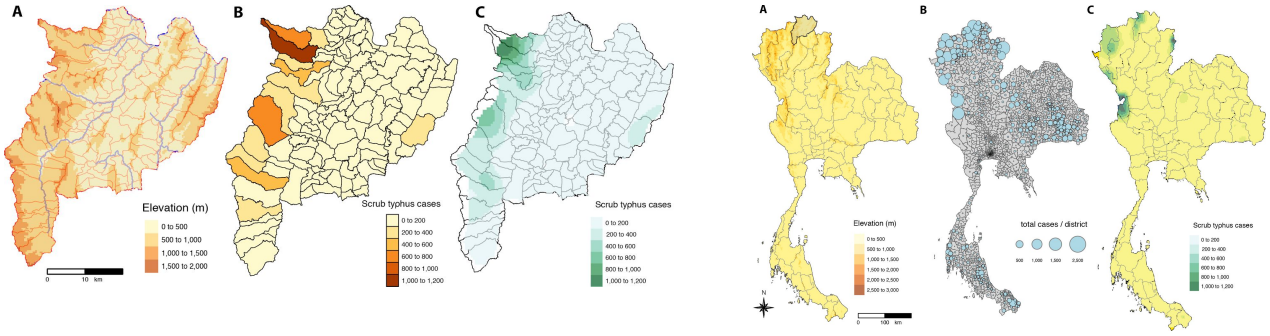
In order to reduce the chance of getting Scrub Typhus, a person should abstain from contacting chiggers that can be found whether from wild animals or bushes. Moreover, a person should avoid the possible areas that infected chiggers could be found, like rural areas that consist of vegetation and brush. In which, Chiggers must occur where there is a high humidity area which is 60 percent to 85 percent and a low temperature around 20 degrees celsius to 30 degrees celsius. For example, in South Korea, there is a high chance of September to November in autumn, in Japan most occurs in autumn and winter. Moreover, a 1-degree celsius change in temperature can increase more cases. Insect repellents are also recommended to use against chiggers. By the reason that There is much more risk in farmers or those who work in the field, outdoor activities. Especially, People who work in short sleeves and use their bare hands. Also, keep clothes and belonging hygienic enough to preclude living chiggers. ("Scrub typhus," 2019)

Globalization with Agriculture

There are many historical pandemics such as Black Death and Ebola that are caused by Globalization. In terms of globalization in the case of Scrub Typhus, it is not a common disease for travelers who returned from Asia. However, there are many cases of coma and organ failure because of traveling to northern Thailand. The mortality rate is high in the area that Scrub Typhus is endemic, especially when camping, rafting, or trekking which contact with Chiggers (Watt & Strickman, 1994). For example, in a case in South Korea, a traveler visited a farm in the south of Seoul. The evidence showed that the possible sites of infection in Seoul where mountain area is 56.8%, city parks are 20.5%, the residence is 17% and riversides is 5.7% c. We can see through the graph below that most occurs during outdoor activities within seoul.



We can see that in Thailand the reporting data is similar to South Korea by the fact that, mountain area, The province is the northernmost province in Thailand and is divided into 18 districts, 124 sub-districts and 1,816 villages. Chiangrai has the highest number of reported cases since 2003 by the number of 103,345 cases of Scrub Typhus (Wangrangsimakul et al., 2020).



Social structures are also part of globalization, as people are adapted to the world. As western culture influences our life such as hugging, kissing or holding hands this all makes a huge difference from the past before the world convergence. People are going out more since there are more single family such as single mom and single dad. Since social structure has changed throughout history, more women are working instead of staying home doing housework for example, taking care of their child.

Globalization means global travel, international flights and contracts with each other. there are more likely that any disease will rapidly spread. Southeast Asia turned to be a tourist destination leading to an increased number of travelers with Scrub Typhus. Also, there is evidence from Malaysia that more development of oil palm plantations leads to more prevalent mite-borne Scrub Typhus as it is also outdoor activities (Abdullah and Hezri 2008, Kwa 2008).

With agriculture, From the huge number of dividends saying that the patient of Scrub Typhus is working in the agricultural sector and 91 percent of the patients work in the rice field . Moreover, we can clearly see that the primary job of rural area citizens is doing agriculture and mostly doing rice fields; 40 percent of Thais who work in agriculture, 16 percent of them were rice farmers by estimated. ("Rice production in Thailand ", 2020) Thai government also subsidizes the farmers to do agriculture making farmers interested in doing agriculture. Among the number of rice exporter thai farmers are the leader in exporting compared to other countries(2020). If we look deeper separating provinces in our country, Surat thani Province is the nation's leading rice-producer, ("Rice production in Thailand", 2020) 7.3% of the disease in there is Scrub

Typhus due to the condition of weather and the factor that chiggers (larval mites) can easily spread since rain water is good for rice and especially for chiggers. Now, we want to see the effect of this province given the rice that they have also the effect of exporting rice to other places. From the information that Scrub Typhus grow and spread well in humid areas meaning some agriculture products cannot export or sometimes produce with less quality occur which affect faithfulness if the farmer still exports bad quality of agriculture making less loyal customers for other countries less people buying thai agriculture. Less income of the farmer. Looking into the eyes of economists, when farmers get infected by scrub typhus meaning less labour to watch or making the farm because some need to stay at hospital taking care of themselves meaning cost in economic occurrence or opportunity cost occur.

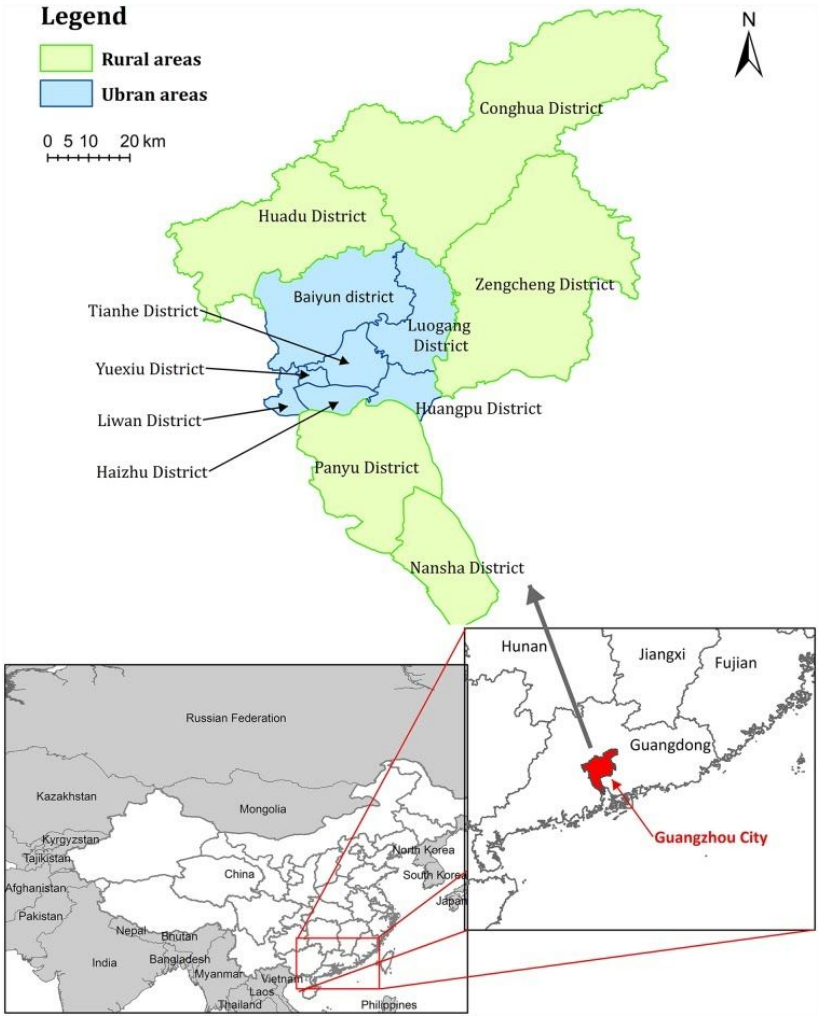
Another interesting sector relating to Scrub Typhus and Poverty is the fabric sector. Since in the previous information we can see that Chigger transmit very well in fabric. However, we found out one interested experiment saying that wearing military uniforms treated with permethrin or dibutyl phthalate as protection against the chigger dibutyl phthalate provided a 97.6% increase in protection of the chigger The results show that wearing clothing impregnated with either compound is not really relate to the infected of the disease what matter is about personality how they taking care of their self or the career that they did (Validate User, 2020).

The negative powerful impact here is that there is more risk in trade in agricultural commodities. In developed countries, global trade has an impact on the ecological landscape (Keyder and Yenal, 2011). As Taiwan is mostly mountains and fields, Since 2001, In Taiwan's agricultural WTO policy is to remove the trade barrier leading to the abandonment of rice paddies. The government subsidizes the farmers twice yearly. Due to the flood and low humidity of the country. Abandonment of rice paddies can cause an increase in the risk in chiggers, luckily plowing the field can lower humidity so chiggers can reduce the risk in this case. Rice is only produced twice or three-time annually (Wang and Apthorpe, 1974) and flooded most of the time so this is

lower the incidence rate of Scrub Typhus. During this time there are less farmers because people are breaking out from forestry or farming activities (Wei et al., 2014) this caused an economic burden, in order to cover this the government is subsidizing the field to bring back the farmer to work in the agricultural field.

Climate change

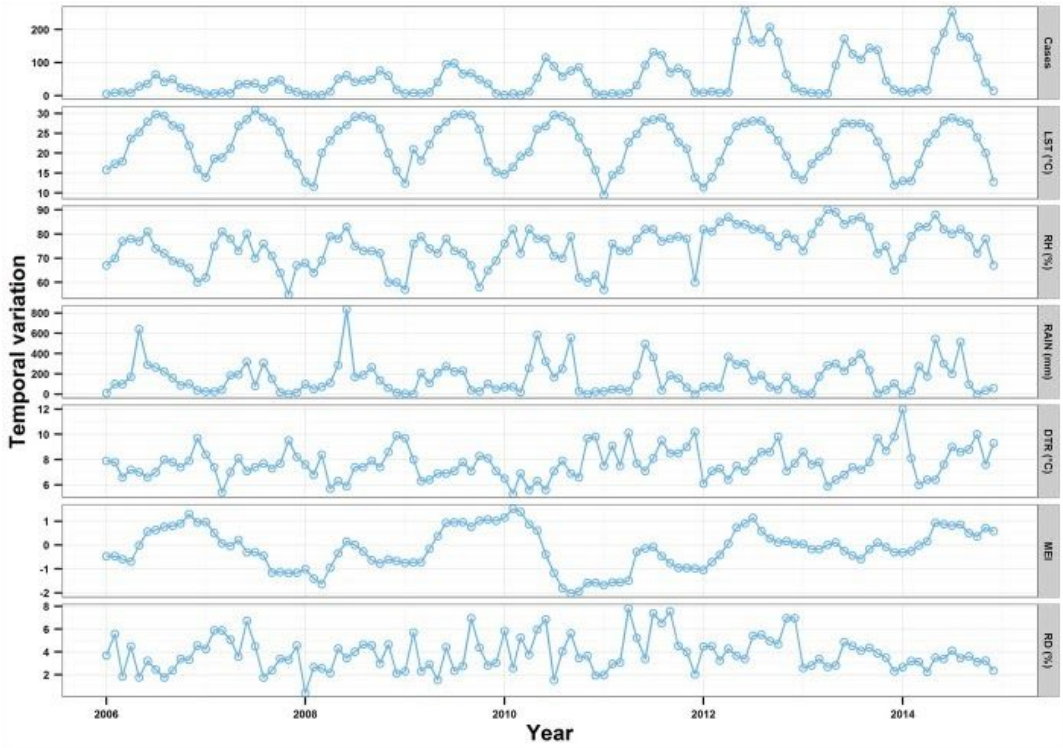
Climate change promotes the threats of agriculture and food security, and its effect commits a series of poverty. Many of the global's underprivileged people depend on agricultural jobs to be alive: farming. Moreover, climate incidents, for example, typhoons, depression storms, flooding, leave millions of the world's vulnerable populations confronted with hunger; indeed, human health and immune systems are defenseless to climate change. Nevertheless, from the global warming perspective, an increase of 1-degree celsius can affect not only the ecosystem but also its intermediate hosts, which can increase the severity of disease transmission; drug resistance and grow



the tendency of many vector-borne diseases; thereby, climate change likely to last long the disease epidemiology, meaning that Scrub Typhus can become a long-term epidemic (The Korean Journal, June 2020). The unstable environment and ecosystem are causing more poor air quality, heat stress, and disease that is disseminated by mites and rodents. As well as the ocean, it absorbs the carbon dioxide that comes from burning fossil fuels, so the ocean turns out to be more acidic and raises the sea level according to the melted ice sheets, which can increase for storms or tempest (Climate change impacts | National Oceanic and Atmospheric Administration. 2019). As a matter of the fact that these people rely on their livelihood, they have to be able to feed themselves and have to deal with their financial security, which is intimidating for them and their families; thus, livestock and agricultural products are destroyed (Concern Worldwide US, & Giovetti, O. 2020).

Surprisingly, climate change has become one of the prominent roles to enhance Scrub Typhus. Transmission of the disease is highly reliant on climate factors and rodent quantity, both of which should be considered in prevention and strategies in order to avoid the disease and extreme poverty. Several research has been focused on the influence of climate and rat density; however, they are independent of one another. Besides, the transmission rate of Scrub Typhus, which varies across seasons and geographical in Southern China, has been determined by the infected rodent population by making contact with humans.

This situation is thought to be influenced by climate; for instance, high temperature and humidity causing an increase in chigger profusion and speed up the transmission of Scrub typhus. Specifically, in Guangzhou, which is the largest city in southern China, the illness has become an epidemic in that region is facing a tropical monsoon climate with an annual average humidity of 75% and temperature of 22℃ also between the year 2006 and 2014 have a total of 4795 Scrub Typhus cases and its increase during summer. In terms of agriculture, the entire case from farmers is 54.01% or 2590 cases, which is half of the aggregate cases (L. C. Small, P. 2017, March 1).

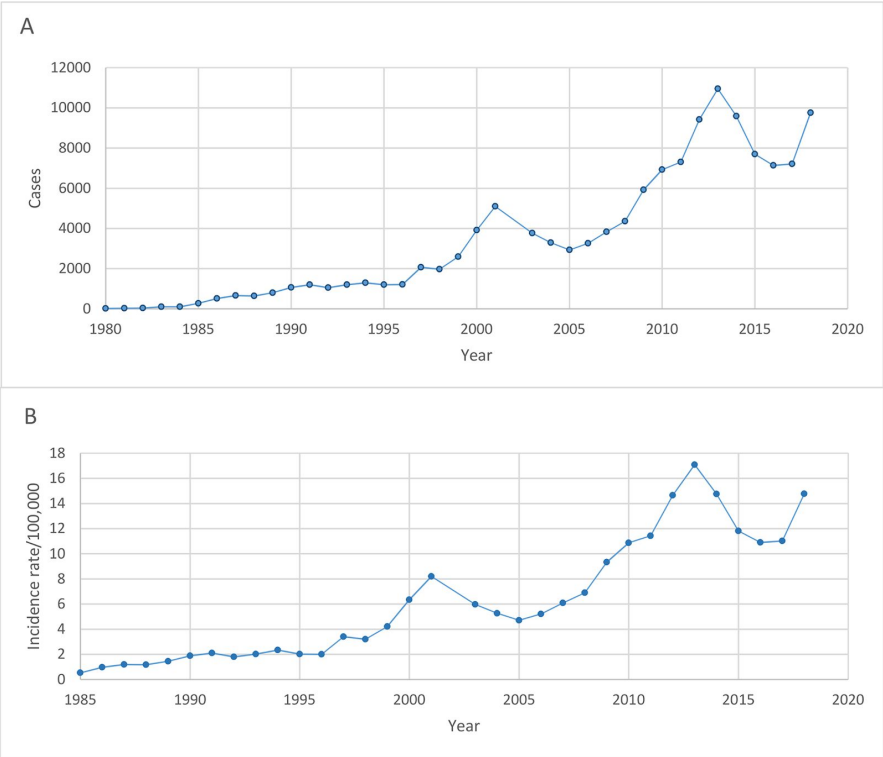


According to the first graph, the area illustrates the geographical location of Guangzhou city, which is colored in red, has subtropical monsoon climate.

The second diagram shows the number of scrub typhus cases, temporal climate variation, and rodent density in Guangzhou between 2006 and 2014 (2017, March 8).

Without a doubt, Northern Thailand, Chiangrai that is mentioned in the above paragraph, has a similar average weather conditions around 20℃ to 27.6℃ and high humidity level at the 79% similar to Guangzhou, besides, in the Northern area of Thailand is a key element in the economy from producing rice, tea and coffee some natives said that "you can plant a pencil in Chiang Mai and it will grow" because Northern Thailand is blessed with abundance soils and fruitful yield, therefore its produce high-quality product and gaining reputation from the world (C. 2020, April 20). However, this particular condition and climate would also directly promote the distribution of mites and rodents which can be a carrier of the disease that spread to

humans especially, the farmers that would be mostly affected from having close contact with nature and doing vegetation.



The line graph illustrates the annual number of confirmed reported scrub typhus cases from 1980 to 2018 A. and B. yearly incidence rate per 100,000 population from 1985 to 2018 (Wangrangsimakul, n.d.).

Climate change likes flooding and drought is something unpredictable that has happened to or affected civilians, and people in agricultural sectors have handled these problems before, but for Scrub Typhus, which is not something people are aware of and it could obviously occur in this area since Thailand has so many factors that can influence Scrub typhus to evolve and harm humans especially direct to peasants themselves. The results of this investigation show that Climate change is definitely one of the critical factors to be considered when studying Scrub Typhus in Thailand.

Is it Poverty that causes Scrub Typhus or Scrub Typhus that causes Poverty?

"...the relationship between poverty and health is inextricably linked, presenting a chicken-an-egg situation where one seemingly exists in part, because of the other"("Diseases and the Links to Poverty | Health", 2020). To emphasize, poverty has an incentive conditions which are the cause of poor health and the spread of Scrub Typhus. On the other hand, Scrub Typhus can also be the cause of poverty.

Poverty is capable of leading the spread of Scrub Typhus. Due to the fact that the poor people have worsened access to health care systems, health environments like water, air and sanitary. ("Poverty and Health | READ online", 2020) Since the poor have limited access to healthcare, they are more likely to get infection disease and have poorer health compared to those who are richer. As Scrub Typhus mostly occurs in rural areas, it mainly affects the workers who work in agriculture,such as farmers and ranchers, which most of them are likely to be poor.("Scrub Typhus | Typhus Fevers | CDC", 2020).Whereas some of the workers who work closely to forests and areas that contain bushes can be infected by the chiggers that stay in the bushes and scrubs. Especially during the rainy season, many areas are humid and damp,which allow the disease to spread more easily. The workers are unable to work well due to the illness, worse than that is they cannot go to work at all. Even if they want to be treated, they could not afford to pay for such a high cost of healthcare. Therefore, they rather stay home and let the symptoms of Scrub typhus to calm down after a few weeks, resulting in the escalation of the disease. Moreover, the cost of repellent and other prevention that used to avoid the chiggers, the Scrub Typhus carrier, are quite expensive compared to their low income, causing the increase in number of chiggers.

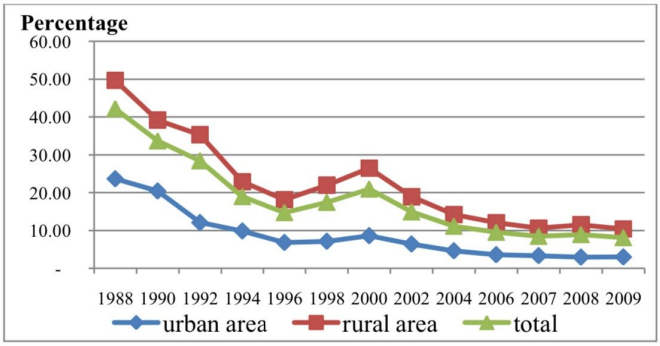
In the different circumstances, where Scrub Typhus is a cause of poverty. When the workers are infected by the disease, they will have fever, headache, body aches, eschar, enlarged lymph nodes including rash. Organ failure and bleeding can happen if

the infection is left untreated. ("Scrub Typhus | Typhus Fevers | CDC", 2020). When the workers, especially those who work in agriculture,are infected by the chiggers. Their capacity of work will be lower. Healthier workers are definitely more productive, able to earn higher wages. This increases the output and the enterprise profitability and agricultural production.("Poverty and Health | READ online", 2020) As a result of Scrub Typhus, the farmers could earn less wages since they have to stay home or in the worse case they can be jobless. This leads to the reduction in their income, risking them to fall below the poverty line.

In conclusion, there is no right or wrong answer whether poverty is the cause of Scrub Typhus or Scrub Typhus is the cause of poverty. As stated above poverty is contributory in providing conditions that allow the infection disease to spread. While Scrub Typhus can worsen some unavoidable factors that contribute to poverty. Both of them have components of causing one another to happen. Their aspects are different depending on the point of view that they are looking at.

The burden of the disease varies geographically (Wu and Perrings, 2017). There are some countries the economy is mostly agricultural. At this time the economy is in a downturn, especially in Nepal where the country has poor sanitation, low hygiene, and low health standards. Most people approximately 80 percent are living in a rural area working along with the agricultural field. More people are living in temporary shelters leading to overcrowding. Due to the fact that in many countries there are more priority diseases that cause more economic burden. So the government is unable to afford all of the financial cost of the prevention of all disease (Acharya, Adhikari and Tariq, 2020). Nepal clearly showed that there is more poverty in this case. People are living in bad conditions and less public health concerns. There are only 5 countries that have a Scrub Typhus surveillance system. In a rich country where the country is developing most patients who were hospitalized are unlikely in the poor country, health practices are so much different (Bonell et al., 2017).

Figure 4: Poverty rate by location

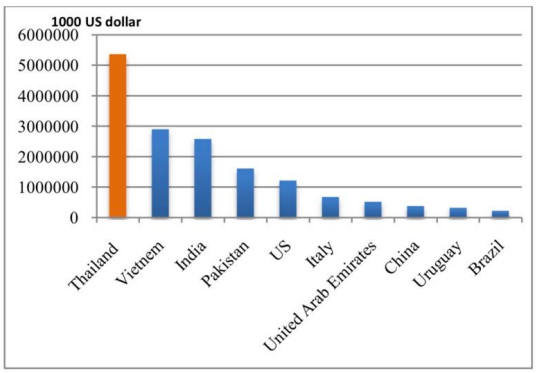


Source: NESDB (2011)

In the case of Thailand, Poverty is the long lasting issue in Thailand. In Thailand poverty rates are declined throughout the time. However, at the end there is still a freeze around 8 to 15% Most of the poor live in rural areas (NESDB, 2011). Their lives depend on agriculture and non agriculture (Timmer, 2003). The reduction of their income and standard of living based on agricultural production. Since the number of farmers are decreasing, the lower agricultural product increases poverty. Agricultural productivity improves the poverty situation in an overall region.

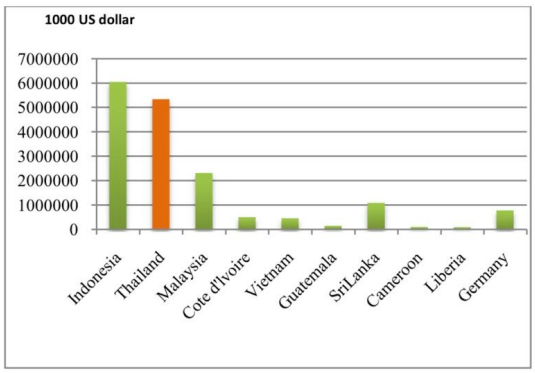
Figure 3: Major exporters in milled rice and natural dry rubber in 2008

(A) Major exporters in rice milled



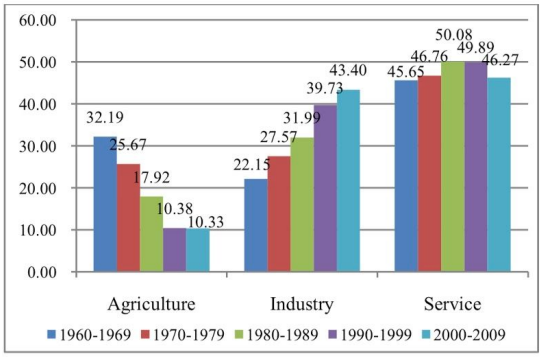
Source: FAO (2011)

(B) Major exporters in natural dry rubber



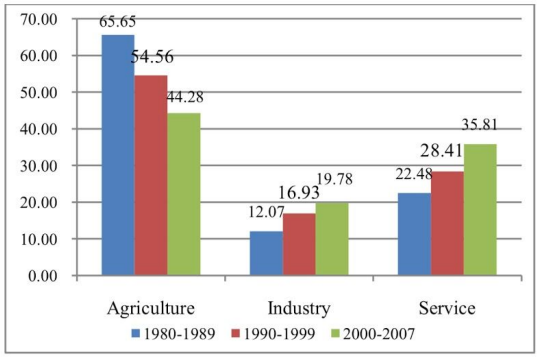
Source: FAO (2011)

Figure 1: Sectoral Value-Added (% of GDP)



Source: World Bank (2010)

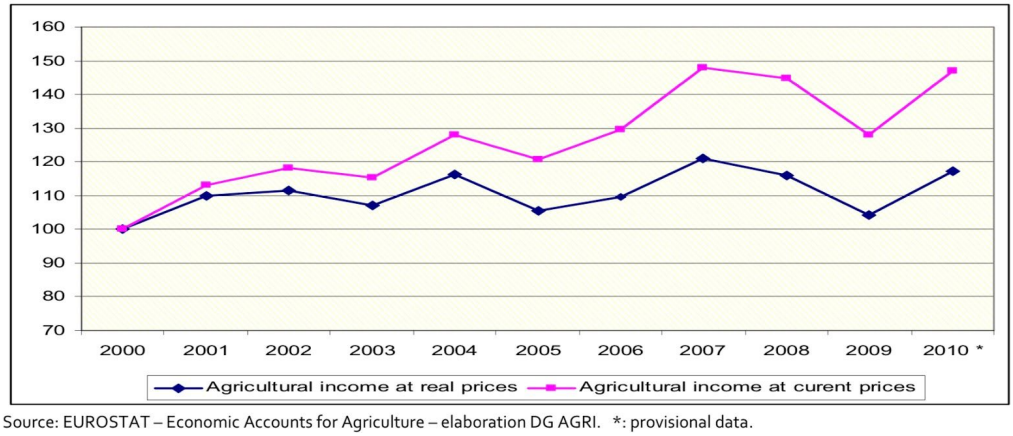
Figure 2: Sectoral Employment (% of Population)



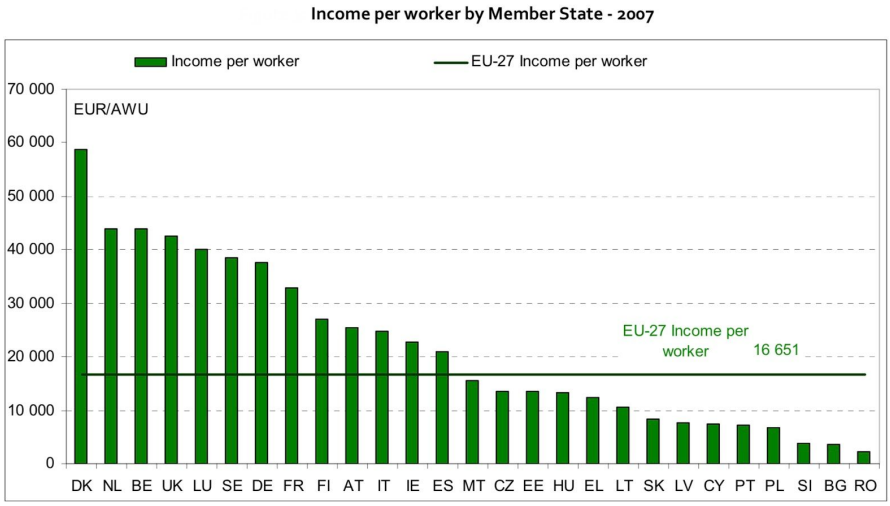
Source: World Bank (2010)

In the case of the EU, Big differences occur among countries in different sectors in the EU. For example in 2007, some states that most of the people are in the manufacturing sector in the EU such as Denmark had very high income compared to the lowest one which are Portugal and Greece where most of the population are small farmers. The countries in the agricultural sector have income that is even lower than average income.

Figure 2: Index of EU 27 agricultural income per annual working unit (2000=100)



Source: EUROSTAT – Economic Accounts for Agriculture – elaboration DG AGRI. *: provisional data.



Source: EU FADN — DG AGRI. FNVA/AWU: Farm Net Value Added per Annual Work Unit (see methodological box).

Scrub typhus is probably one of the most underdiagnosed and underreported sickness requiring hospitalization in the region. The nonexistence of definitive signs and symptoms associated with a general dependence upon serological tests make the differentiation of scrub typhus from other common febrile diseases such as murine typhus, typhoid fever and leptospirosis quite difficult.(WHO | Communicable disease surveillance and response systems. Guide to monitoring and evaluating, 2020)

Scrub Typhus shows unusual signs of fever that require laboratory examination to diagnose. From past to present there are in total 3 alternative ways to check which are Serological Test, Complement-Fixation, Indirect Immunofluorescence Antibody, and Polymerase Chain Reaction. The main method used to diagnose this disease is Serology. The Weil-Felix OX-K agglutination reaction is commonly used due to its ease. The test shows the result overnight, easy to perform, and inexpensive. However, it lacks precision and delicacy. On the other hand, the Indirect Fluorescent Antibody (IFA) test is more precise and gives results within two-hour; however, the test is harder to perform and more expensive. (Gavin C. K. W. Koh|Richard J. Maude|Daniel H. Paris|Paul N. Newton|Stuart D. Blacksell, 2010).

Due to the below average income of agricultural workers, they could not afford to do the IFA test due to the high costs. Even if they choose to do the Weil-Felix OX-K

agglutination reaction test that is less expensive, the result is not precise. So they still do not know if they are infected. The workers decided to not go to have the tests at all, knowing that the money that they spend doing the test does not give the correct result. This leads to more spread of Scrub Typhus, people did not know that they got infected so they did not properly prevent themself from Scrub Typhus. Moreover, it could worsen their symptoms, causing them to be unable to work well enough like they used to, meaning their capacity to work is worse. This leads to further declines in their income.

Let's imagine what happened in school and what happened with the kids that got infected by Scrub Typhus. At the time when Scrub Typhus occurs, some families don't even have money to go for the medical check. Some of them don't know that now they already got infected by Scrub Typhus. Some also make life as usual sending their kids to school. With the living conditions that the school in rural areas of Thailand is just a small school, some of the schools have just only 1 classroom, having the same food, not really hygienic material of study for every student. Also most of the parents that the kids are in the same school are in the same village which usually have the same career or the same job which is farming. With all of that condition with one family that got infected by Scrub Typhus, it has a high risk for others to get infected too.

With the village that Scrub Typhus occurs less trading also occurs as a consiquence. With not safe conditions for export and import from that village, locals tend to have less income making poverty occur at a more extreme level.

How government react

Once Scrub Typhus occurred the government was taking serious preventive measures and travelers that should be taken when visiting rural areas. People should be instructed to minimize exposure to infectious diseases. For example, Everyone should wear loose light colored clothes with long-sleeved tops and trousers and also use insect repellent “DEET or diethyltoluamide” on your body and clothes and always use shoes that cover all parts of your feet. While visiting, you should always walk on the footpath not going on the sidewalk and avoid staying in a dark place. After visiting, clean yourself clearly every time.

There are more likely that attached ticks found on the body are to Gently removed by tweezers near the skin, then sterilize the bite and wash your hands with soap and water. The most effective way to prevent Scrub Typhus is to maintaining good personal hygiene ("Centre for Health Protection, Department of Health - Typhus and Other Rickettsial Diseases", 2020)

In the case of India, on 23rd August 2018, After a few cases of Scrub Typhus occurred the state government has taken preventive measures in order to check the outbreak. Health department announced that there are 4,103 people examined. unluckily 219 people were found positive for Scrub Typhus.

At this time India not only had good control but also treatment facilities were available Elisa kits are all available to all district hospitals and also weil Felix tests in all civil hospitals. All of medicine and test kits were available for free to everyone (Bureau, 2020)

Summary

There are two conclusions that we could learn from the research. First, it is poverty that causes Scrub Typhus to occur and spread. Due to the reason that Scrub Typhus affects mostly the poor who are working in the agriculture field. Especially in Thailand, this determines that the poor are mostly in rural areas rather than urban areas. Not only this but also people that are doing outdoor activities are way more riskier. As more globalization means more travelling and working outdoor activities. Moreover, the agricultural sector in Thailand is mostly located in the Northern because of the weather and humidity which the output can grow easily. It is a grateful place for chiggers to spread. In addition, the farmers did not have enough income to get an accurate and precise laboratory test whether they have got Scrub Typhus or not. Even if there was an inexpensive one, the result was not very accurate. So they rather not spend any money at all. Causing the spread of the disease since the workers did not know if they were sick, they did not do anything to prevent or get any treatment.

On the other hand, Scrub Typhus can cause people to enter poverty as well. When Scrub Typhus happens around that area where it is a tourist destination less people come, making the locals have lower income, less opportunity to exchange, trade or export goods. Before Scrub Typhus occurred farmers had lower income than The average.

To answer the question whether climate change, which is eventually one of the main reasons leading to poverty, is the reason that Scrub Typhus still appeared as an on-going problem. Climate change, which is not something people are aware of, has so many factors that can influence Scrub typhus to affect Thai people directly. Most of them are already facing poverty, they can be seriously and easily affected by Scrub typhus. Though, Scrub typhus involved in resources could be simple and fixable, its involvement in people would be much harder to encounter with. When the farmers got

the disease, their capacity to work would decline. They might not be able to work, and could earn less income, and worsen getting fired. Those who originally are not in the poverty zone might enter one. And the one who is already in the poverty zone might go down even further.

In contemporary societies, people should be responsible and follow the instructions from the government. For now in India showing that they provided free tested kits with free medicine in all around both district and civil hospital which is a one of effective ways to help poor with all expenses.

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