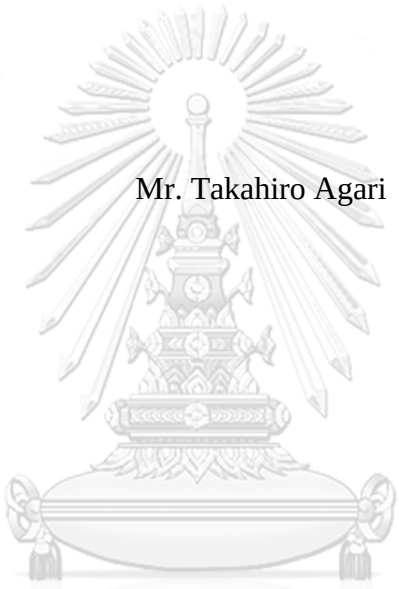
KNOWLEDGE ATTITUDE AND PRACTICE REGARDING NIPAH VIRUS INFECTION IN NAKHON PATHOM PROVINCE IN THAILAND

Mr. Takahiro Agari



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การส่งเสริมองค์ความรู้ ทัศนคติ การปฏิบัติ ในการดูแลตนเองจากเชื้อไวรัสนิปาห์ ในจังหวัดนครปฐม ประเทศไทย

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Thesis Title	*KNOWLEDGE ATTITUDE AND PRACTICE REGARDING NIPAH VIRUS INFECTION IN NAKHON PATHOM PROVINCE IN THAILAND*
By	Mr. Takahiro Agari
Field of Study	
Thesis Advisor	Professor Peerasak Chantaraprateep, DVM, M. Sci, Vet
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ทากาฮิโร่ อาการิ : การส่งเสริมองค์ความรู้ ทัศนคติ การปฏิบัติ ในการดูแลตนเองจากเชื้อไวรัสนิปาห์ในจังหวัดนครปฐม ประเทศไทย (*KNOWLEDGE ATTITUDE AND PRACTICE REGARDING NIPAH VIRUS INFECTION IN NAKHON PATHOM PROVINCE IN THAILAND*) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ศ. พีระศักดิ์ จันทร์ประทีปศ.เกียรติคุณ น.สพ. ดร., อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ผศ. เนาวรัตน์ กาญจนาคารป.เอก, 90 หน้า.

บทนำ: โรคไวรัสนิปาห์เป็นโรคที่มีความรุนแรงและมีอัตราการเสียชีวิตสูงมีผลกระทบอย่างมากทางด้านสาธารณสุข เนื่องจากยังไม่มีวัคซีนที่จำเพาะต่อเชื้อนิปาร์หรือยาใดที่รักษาได้ดังนั้นการป้องกันโรคจึงมีความสำคัญอย่างยิ่ง อย่างไรก็ตามข้อมูลที่สำคัญเกี่ยวกับเรื่องนี้ยังไม่เป็นที่เข้าใจกันอย่างชัดเจนนัก วัตถุประสงค์ของงานวิจัยนี้เพื่อหาคำตอบในเรื่องความรู้ ทัศนคติ และการปฏิบัติตนเพื่อป้องกันโรคนิปาห์และหาปัจจัยที่มีความสัมพันธ์กับการเกิดโรคในกลุ่มประชากรที่อาศัยอยู่ในบริเวณใกล้เคียงกับค้างคาวแม่ไก่ซึ่งเป็นพาหะนำโรค วิธีการวิจัย:การศึกษาแบบภาคตัดขวางของกลุ่มประชากรที่อาศัยอยู่ในหมู่บ้านที่มีความใกล้ชิดกับค้างคาว ในเขตตำบลบ้านหลวง อำเภอดอนตูม จังหวัดนครปฐม เก็บรวบรวมข้อมูลในเดือนพฤษภาคม 2561 การสุ่มเลือกครัวเรือนทำโดยวิธีการสุ่มตัวอย่างแบบแบ่งชั้น จำนวนสมาชิกเพียงหนึ่งรายในแต่ละครัวเรือนจะได้เข้าร่วมการวิจัยโดยการสุ่ม การเก็บข้อมูลทำโดยการตอบแบบสอบถามด้วยการสัมภาษณ์แบบตัวต่อตัว การวิเคราะห์ข้อมูลแบบสองตัวแปรเพื่อเปรียบเทียบระหว่างกลุ่มและใช้การวิเคราะห์ถดถอยเชิงเส้นแบบพหุเพื่อหาความสัมพันธ์ระหว่างความรู้กับทัศนคติต่อการปฏิบัติตนเพื่อป้องกันโรคนิปาห์ไวรัสของกลุ่มประชากร ผลการวิจัย: ประชากรที่ถูกคัดเลือกเข้าร่วมงานวิจัยทั้งสิ้นจำนวน 272 ราย ผลการศึกษาพบว่าประชากรมีความรู้และทัศนคติต่อการปฏิบัติตนเพื่อป้องกันโรคนิปาห์ไวรัสอยู่ในระดับต่ำ ประชากรเพียงร้อยละ 30.5 และร้อยละ 43 สามารถตอบได้ว่าค้างคาวสามารถนำโรคสู่คนและสัตว์ได้ตามลำดับ ไม่มีประชากรผู้ใดเคยได้ยินหรือรู้เรื่องโรคนิปาห์ไวรัสมาก่อนเลย ร้อยละ 10.3 ของประชากรเห็นด้วยว่าพวกเขามีความเสี่ยงที่จะติดโรคจากค้างคาว มีประชากรเพียง 5 ราย (ร้อยละ 3.3) รายงานว่ามีประวัติของการปฏิบัติตนเพื่อการป้องกันโรคที่เกิดจากการปฏิสัมพันธ์ระหว่างคนกับค้างคาว จากการวิเคราะห์แบบหลายตัวแปรพบว่า การพบเห็นค้างคาวบริเวณบ้านพักมีความสัมพันธ์อย่างมีนัยสำคัญกับระดับความรู้ (β=0.92 p=0.001) และสำหรับปัจจัยที่มีความสัมพันธ์อย่างมีนัยสำคัญกับทัศนคติได้แก่ การศึกษา (β=2.23 p=0.004) การดูแลสัตว์เลี้ยงในบ้าน (β=3.65 p<0.001)และระดับความรู้ (β=0.55 p<0.001) บทสรุป: จากการวิจัยพบว่าประชากรยังขาดความรู้และทัศนคติต่อการปฏิบัติตนเพื่อการป้องกันโรคจากค้างคาวรวมทั้งนิปาห์ไวรัส จึงมีความจำเป็นเร่งด่วนในการเผยแพร่ข้อมูลทางการวิชาการเกี่ยวกับเรื่องนี้ให้แก่กลุ่มประชากรที่อาศัยอยู่ในบริเวณใกล้เคียงกับแหล่งอาศัยของค้างคาวแม่ไก่เพื่อเพิ่มพูลความรู้และเพิ่มความระมัดระวังต่อการติดเชื้อนิปาร์ไวรัสจากค้างคาว

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2560 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

6078848553 : MAJOR PUBLIC HEALTH
KEYWORDS: EMERGING INFECTIOUS DISEASE, HUMAN-ANIMAL INTERFACE, KAP, BAT-BORNE DISEASE, NIPAH VIRUS DISEASE, ZOONOSES

TAKAHIRO AGARI: *KNOWLEDGE ATTITUDE AND PRACTICE REGARDING NIPAH VIRUS INFECTION IN NAKHON PATHOM PROVINCE IN THAILAND*. ADVISOR: PROF. PEERASAK CHANTARAPRATEEP, DVM, M. Sci. Vet, CO-ADVISOR: ASST. PROF. NAOWARAT KANCHANAKHAN, Ph.D., 90 pp.

Background: Nipah virus disease is a fatal disease with high mortality rate and can cause a serious impact on public health. Due to lack of a specific agent for vaccination and treatment, prevention is crucial. However, key information for health promotion were poorly understood. The objectives of this study were to figure out knowledge, attitude and practices in the context of Nipah virus disease and identify associated factors among people living close to a roost of flying foxes. Method: A cross sectional study was conducted among people living in the villages close to the flying fox roost in Ban Luang subdistrict, Don Thum district, Nakhon Pathom Province, central Thailand. Data collection was carried out in May 2018. Households were chosen by a stratified random sampling and one respondent was recruited from each household by chance. A face-to-face interview with a questionnaire was conducted to elicit information. Bivariate analysis was employed to compare responses among groups and multiple linear regression was used to explore factors associated with knowledge and attitude. Results: In total, 272 respondents were included in this survey. Poor knowledge and attitude toward Nipah virus disease were found; 30.5% and 43.0% of respondents perceived that bats can transfer disease to human and animals, respectively; no respondents have ever heard of Nipah virus disease; 10.3% of respondents agreed there was a risk of disease from bats. Only five respondents (3.3%) reported history of the practices related to human-bat interaction. Multivariate analysis showed “seen bats in or around a house” was significantly associated with knowledge score (ß=0.92, p=0.001). Education (ß=2.23, p=0.004), “take care of domestic animals” (ß=3.65, p<0.001) and knowledge score (ß=0.55, p<0.001) were significantly associated with attitude score. Conclusions: Our findings presented inadequate knowledge and attitude toward bat-borne disease including Nipah virus disease. There is an need to provide educational information to enhance knowledge and awareness toward Nipah virus disease among people living close to a habitat of flying foxes.

Field of Study: Public Health
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Student's Signature .....
Advisor's Signature .....
Co-Advisor's Signature .....

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LIST OF ABBREVIATIONS

EIDs	Emerging Infectious Diseases
HeV	Hendra virus
IOC	Item Objective Congruence
MARS	Middle East Respitatory Syndrome
NiV	Nipah virus
SARS	Severe Acute Respiratory Syndrome
SEA	Southeast Asia
WHO	World Health Organization

CHAPTER I INTRODUCTION

1.1. Background and Rational

1.1.1 Bat and bat-borne disease

The awareness of the threats of emerging infectious disease (EIDs) has been growing. Zoonotic pathogens are critical in EIDs because around 60% of emerging infectious diseases are originated in animals, of which wildlife accounts for the majority (1). Bats are particularly important natural reservoirs of zoonoses (2). They host zoonotic viruses that may have a serious impact on public and animal health, including Rabies and other lyssaviruses (3), Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) coronaviruses (4, 5), Hendra virus (HeV) (6), Nipah virus (NiV) (7), and Ebola and Marburg viruses (8, 9).

1.1.2 Bat-borne disease in Southeast Asia and neighboring regions

In Southeast Asia (SEA) and neighboring areas, Henipaviruses, HeV and NiV, are important bat-borne viruses, whose natural reservoirs are flying foxes, the fruit bats of genus *Pteropus* distributing across the SEA and other regions (10)(11). NiV is a particularly important bat-borne pathogen in the SEA. NiV is first recognized during the outbreak in Malaysia in 1998 to 1999 (12). To date, more than 600 cases of human infection have been reported in Malaysia, Singapore, India and Bangladesh with high mortality rate (13). Because of its seriousness and absence of a vaccine and a specific agent, NiV is included in the WHO's priority list of emerging diseases that could cause a global health emergency (14). In Thailand, there are no reported cases in both human and domestic animals. However, the existence of NiV has been confirmed in bats and the risk of spillover is suggested (15, 16). Besides, HeV was first recognized in the outbreak in 1994 in Australia. HeV causes fatal infection in humans and horses (6). Seven cases in human and around 100 cases in horses are confirmed, all of which occurred in the north-eastern coast of Australia.

In addition to Henipaviruses, lyssavirus should be paid attention. Rabies caused by bat bites or scratches has not been reported in the SEA, while this transmission route is common in the American continent (17). On the other hands, novel lyssavirus, Australian Bat Lyssavirus, whose natural reservoirs include flying foxes (*Pteropus spp.)*, caused neurological symptoms similar to rabies in a human in Australia (18). Lyssavirus in flying foxes in Thailand has been shown, which means potential public health impact of lyssavirus in Thailand (17).

1.1.3 Transmission route of bat-borne disease

Bats inhabit roosts in forests or caves, and people do not have frequent contacts with bats. In many cases, bat-borne pathogens are transmitted from intermediate hosts to human. In the NiV outbreak in Malaysia, people contracted NiV due to close contact with pigs which are considered to get infected NiV via consumption of fruits contaminated by bats (19). In the case of the SARS outbreak in China in 2003, wildlife including civets is possible intermediate hosts. It is considered that SARS coronavirus was transmitted from bats to wildlife and people got infected through eating infected wildlife (20). Another transmission route is consumption of contaminated food. In Bangladesh, transmission of NiV from bats to human is mainly caused by consumption of contaminated raw date palm sap (21). Moreover, people can get infected bat-borne pathogens through direct contact with bats. The outbreak of Ebola hemorrhagic fever in the Democratic Republic of Congo, which caused 186 deaths, occurred due to consumption of fruits bats (22). Rabies caused by bat bites are common on American continents. Also, NiV was found in bat urine and fruits that bat ate, thereby NiV infection via direct contact with bat secretions are suggested (23).

1.1.4 Human-bat interactions in Thailand

A wide range of factors are related to the spillover of bat-borne pathogens, and human-bat interaction is one of the key factors, which is closely related to people's exposure to pathogens (24, 25). In Thailand, people have interactions with bats in many locations. Hunting and consumption of flying foxes and other bats were reported. A kind of flying foxes lives in the areas relatively close to human residences

such as a temple and a bush. Fruit bats come to orchards or fruits trees near houses to eat fruits, which may cause human-bat interaction. Besides, guano (bat excreta) mining is common in Thailand, which is used as good fertilizer. Collection of guano is taken place at a location where bats are roosting such as a cave and a bush, which might get people to come into contact with bats and exposure to bat-borne pathogens (26).

1.1.5 Problem Statement

Nipah virus disease is severe disease and can seriously affect public health. Prevention of this disease is extremely important. In dealing with infectious disease, especially zoonoses, it is crucial to understand people's knowledge, attitude and practices, which can be a driver of transmission of zoonotic disease (10, 24, 25). In addition, to understand these factors would be useful for changing people's behaviors in this context and contribute to the prevention of NiV infection and other potential bat-borne diseases (27, 28). However, few researches have been conducted in Thailand regarding human-bat interactions and associated factors, and there is still a lack of information. Thus, the findings of this study are useful to understand people's level of knowledge, various attitude and practices related to human-bat interactions and successive potential exposure to Nipah virus or other bat-borne pathogens as well as factors with them. This research would contribute to the mitigation of the risk of transmission of Nipah virus to humans in Thailand and others settings.

1.2. Research questions

1. What are the sources of information about infectious disease?
2. What are knowledge, attitude and practices toward Nipah virus disease?
3. Are there any association between general characteristics, knowledge, attitude and practices toward Nipah virus disease?

1.3. Objectives

(a) General objective

To determine knowledge, attitude and practices toward Nipah virus disease in Ban Luang subdistrict, Don Thum district, Nakhon Pathom province, Thailand

(b) Specific objectives

1. To describe the sources of information on disease
2. To assess and determine the level of knowledge, various attitude and the extent of practices toward Nipah virus disease among population in Ban Luang subdistrict
3. To examine association between general characteristics, level of knowledge, attitude and practices toward Nipah virus disease.

1.4. Research hypothesis

1. There is an association between general characteristic and knowledge, attitude and practices toward Nipah virus disease among population in Ban Luang subdistrict.

1.5. Operational definitions

- **General characteristics:** socio-demographic characteristics such as age, gender, marital status, education, type of occupation, income, family member, duration of living and living environment.

- **Knowledge toward Nipah virus disease:** the ability of a person to have correct understanding about general infectious disease from animals, bat-borne disease, Nipah virus disease and preventive measure.

- **Attitude toward Nipah virus disase:** beliefs on susceptibility, seriousness and threat of bat-borne disease including Nipah virus disease and perception on bats

- **Practice toward Nipah virus disease:** activities and actions related to direct contact with bats and/or bat secretions/excretions, including hunting,

butchering/preparing and eating bats, collecting and using bat feces (guano), bat bites or scratches and protective measures.

- **Wild animals:** animals which are living outside a house and not tamed or domesticated. An animal that a resident feed is not categorized as a wild animal even though it is living outside his/her house.

1.6. Conceptual framework

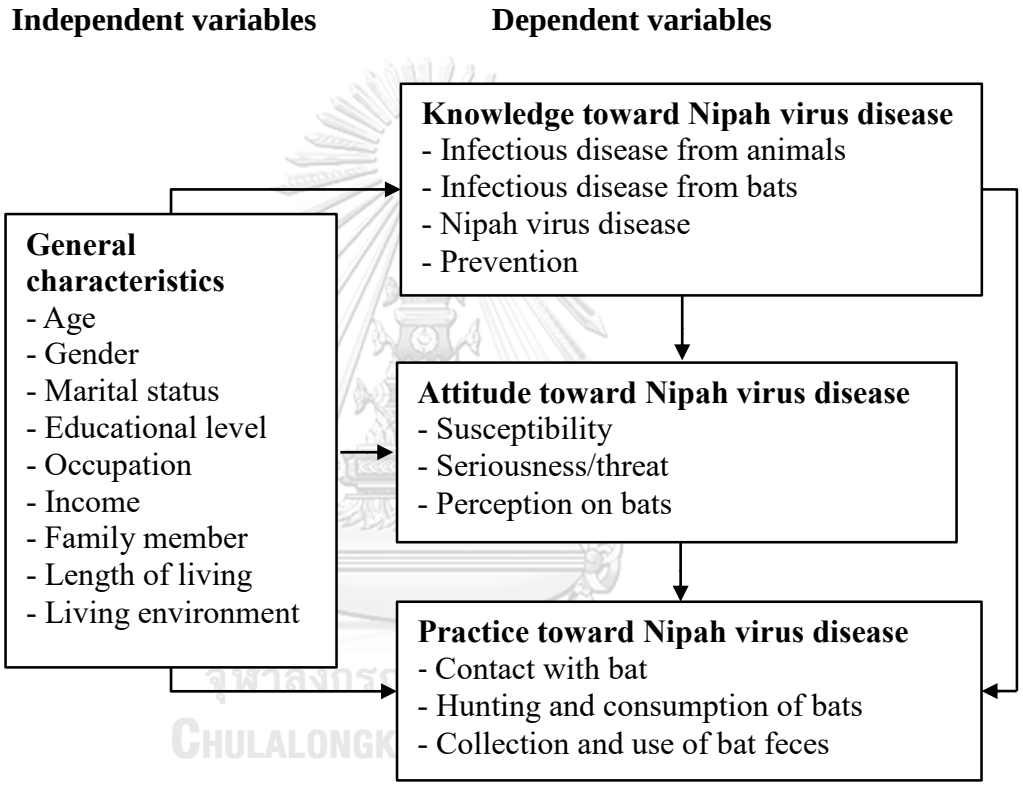

Figure 1 Conceptual framework

1.7. Expected benefits

The study would contribute to understanding a level of knowledge, attitude and practices regarding Nipah virus disease and associated factors among the population living in a semi-urban area in Thailand, thus findings of the current study are expected to be instrumental for prevention of Nipah virus disease and other potential bat-borne diseases in Thailand. Besides, this study can help government sectors involving in prevention of animal-borne diseases to understand characteristics

of local residents particularly in the context of Nipah virus disease, leading to a better policy planning for prevention of Nipah virus disease. Moreover, the study could be useful basic information for prevention of Nipah virus disease and other bat-borne diseases not only in Thailand but also in other areas with similar settings. Finally, the findings of this study would be applicable to disciplines other than public health, such as animal health and environmental health in the light of One Health approach.

CHAPTER II LITERATURE REVIEW

2.1. Nipah virus infection

2.1.1. Definition of Nipah virus infection

Nipah virus infection is bat-borne zoonosis caused by Nipah virus (NiV), which is a member of family Paramyxoviridae, genus Henipavirus. NiV is emerging virus; it is identified in 1999 during the initial outbreak in Malaysia and Singapore. There is no specific agent for treatment of Nipah virus infection, and the mortality rate can be extremely high. Incubation period is reported from five to 14 days (29).

2.1.2. Natural reservoir of Nipah virus

Although Nipah virus infection has been shown in both frugivorous and insectivorous bats, flying foxes (fruits bats of the genus *Pteropus*) have been identified as natural reservoirs of NiV, which broadly distribute in Thailand and other neighboring countries (30). In Thailand, mainly three species of flying foxes are living; *P. lylei, P. vampyrus* and *P. hypomelanus*. Although all of these three species roost on trees, the characteristics of habitats are different. *P. lylei* lives relatively close to human such as near/at a temple. *P. vampyrus* and. *P. hypomelanus* usually roost in a forest or an island. Flying foxes have essential roles in ecology as pollinators of forest trees, and protection of flying foxes are another important issue (15).

Figure 2 Pteropus lylei
(from https://en.wikipedia.org/wiki/Lyle%27s_flying_fox)

2.1.3. Distribution of Nipah virus

The evidence of NiV infection in bats have been demonstrated in several countries, including Malaysia, India, Bangladesh Cambodia, Indonesia, Madagascar and Thailand (15, 31). The possibility of spillover has been suggested across the wide range of areas in the Southeast Asi (16).

2.1.4. Mode of transmission

Several transmission routes of NiV have been reported.

(i) Bat-animal-human transmission

One of the major routes is transmission through intermediate hosts. In the outbreak in Malaysia in 1998 to 1999, pigs infected with NiV caused human infection via close contact between them. Pigs were considered to get infected with NiV by consumption of fruits contaminated by bats. The possibility of transmission via other animals such as cow, goats and horses are also suggested (21, 32). Moreover, NiV can infect dogs and cats, although whose contribution to human infection is unclear (33, 34).

(ii) Transmission via contaminated fruits

NiV can be transmitted to human through consumption of contaminated fruits. In Bangladesh, NiV transmission through consumption of contaminated date palm sap is most profound as a source of primary cases (21). In Malaysia, NiV was detected in the swabs of fruits foraged by bats, implying the possibility of transmission via fruits there and in the other settings (35).

Figure 3 Collection of date palm sap in Bangladesh

(left; a man cuts a date palm tree to collect a sap; http://modernbaul.blogspot.com/2015/11/dates-tree-juice-in-winter.html, right; a container hung in a tree to collect date palm sap; http://wamc.org/post/disease-detectives-find-really-good-reason-not-drink-date-palm-wine)

(iii) Human-to-human transmission

Human-to-human transmission can occur due to close contact with NiV infection patients, which has commonly been observed in India and Bangladesh. NiV is considered to be transmitted through respiratory secretions of patients (21). This transmission route can spread NiV infection in a household and a hospital. For example, the study analyzing the outbreaks occurred in Bangladesh from 2001 to 2007 unveiled 62 out of 122 (51%) NiV infection cases developed their symptoms after having close contact with patients (36).

(iv) Bat-to-human transmission

Transmission through bat secretions or excretions is possible, in which infected bats can shed NiV. This transmission route is suggested in the outbreak in Bangladesh in 2004 (23). NiV RNA was detected in bat blood, which indicates that drinking of fresh bat blood may cause NiV infection, although no case due to bat blood consumption has been reported (37).

2.1.5. Signs and Symptoms

The symptoms usually start with flu-like symptoms such as fever and pain, and then neurological symptoms such as drowsiness, disorientation and mental confusion can develop. NiV infection can progress to coma and fetal outcomes. Pulmonary signs are observed among half of the patients with severe neurological signs (29). The characteristics of symptoms were different among the outbreak sites; respiratory symptoms were more frequently observed in Bangladesh and India than Malaysia and Singapore (38).

2.1.6. Prevention and control

There is no specific treatment for Nipah virus infection, which is limited in supportive care. To prevent NiV infection, primary strategy is to avoid contact with what can get people come into exposure to NiV, including bats, sick animals and fruits that a bat foraged. In Bangladesh where NiV infection is endemic, the instrument to prevent bats from reaching date palm has been developed (39). Moreover, people should avoid being exposed to the saliva or other respiratory secretions of severely ill patients to prevent human-to-human transmission. Basic hygiene strategy such as wearing gloves and hand-washing with soap is effective for reducing the chance of getting infected (21, 29, 40). In addition, it is important to prevent domestic animals from being exposed to NiV. Domestic animals can be exposed to NiV via direct contacts with bat secretions and/or excretions or eating fruits dropped after a bat ate by which NiV infection can be caused. Living areas of domestic animals in the household should be separated from the areas with fruit trees.

2.1.7. Nipah virus infection outbreaks

The outbreaks of NiV infection occurred in Malaysia, Singapore, India and Bangladesh. As of 2015, more than 600 cases have been reported with the markedly high mortality rate, sometimes which was up to 100% (13).

i) Malaysia and Singapore

The initial outbreak of NiV infection occurred in Malaysia in 1998 to 1999. The outbreak started among pig farmers living in northwestern peninsular

Malaysia. The NiV infection in the human was caused by direct contact with pigs infected with NiV and spread out to other areas through the movement of infected pigs. In this outbreak, overall reported cases were 283 with 109 deaths (fatality rate was 39%) (12).

The outbreak in Singapore occurred in 1999 during the outbreak in Malaysia. In the abattoir, 11 workers developed encephalitis or pneumonia and were confirmed NiV infection. One of the patients died. This outbreak was considered to be caused by close contact with pigs infected with NiV, which were imported from Malaysia during the outbreak there (41).

ii) Bangladesh and India

Bangladesh is the endemic area of NiV infection, and the outbreaks have been reported annually since the initial outbreak in 2001. From 2001 to 2013 a total of 227 cases were reported in Bangladesh and the overall fatality rate was more than 75% in this period (42). In India, the outbreaks were reported in 2001, 2007 and 2018. In these two countries, the major transmission routes are bat-to-human transmission via consumption of contaminated date palm sap and human-to-human transmission via contacting with NiV infection patients, which are different from Malaysia and Singapore where NiV transmission occurred mainly due to close contact with infected pigs (13, 43).

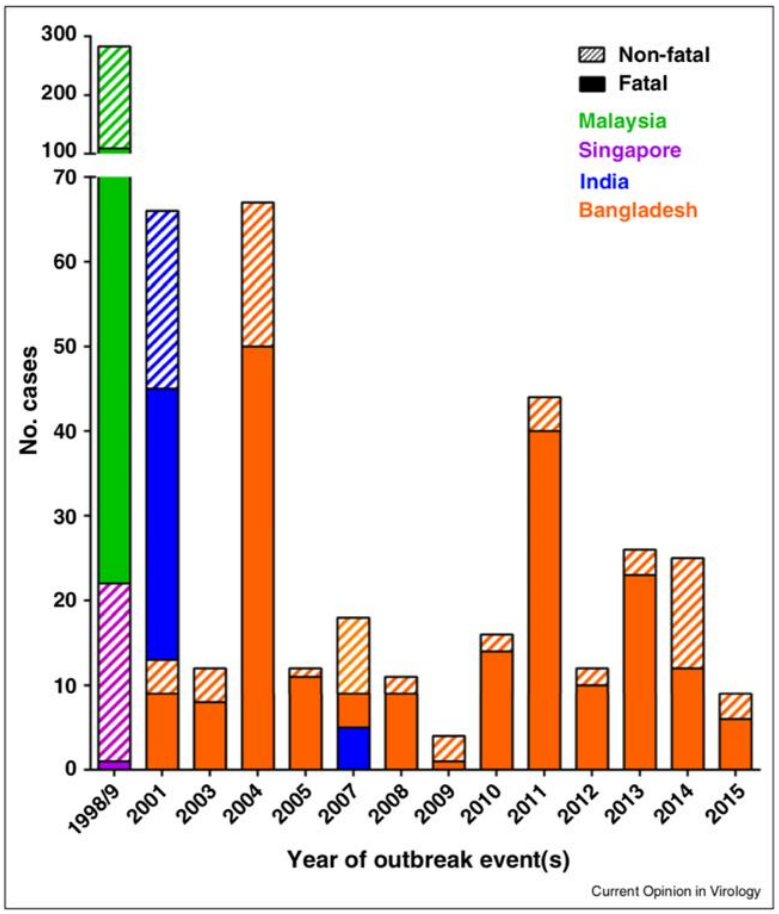

Figure 4 The outbreaks of Nipah virus infection (from 1998 to 2015) (13)

2.1.8. Nipah virus infection in Thailand

To date, no human and animal cases are reported in Thailand. However, some research showed the evidence of NiV infection in flying foxes (*P. lylei*, *P. vampyrus* and *P. hypomelanus*) and *Hipposideros larvatus* (insectivorous bat), and the possible spillover event is suggested (15, 16). In central areas, intensive surveillance of NiV in *P. lylei* has been conducted, which detected NiV RNA in its urine samples (15). In southern areas, NiV RNA was found in the urine samples of *P. hypomelanus* and NiV IgG antibody was detected from both *P. hypomelanus* and *P. vampyrus* (31, 44). In addition, the infection in *P. hypomelanus* and *P. vampyrus* around peninsular Malaysia has been confirmed, and NiV invasion to Thailand through the movement of *P. hypomelanus* and *P. vampyrus* could occur (45). Based on the distribution of natural reservoirs and detections of NiV in flying foxes, it is plausible that there is a potential risk of spillover in the broad range of areas in Thailand, in particular, the central and south area.

2.1.9. Other viruses in bats in Thailand

In addition to Nipah virus, the exiting of some other viruses has been indicated in Thailand. Evidence of infection of lyssavirus has been shown in the central region (46). Coronavirus has been found in bats in the eastern region and guano in the central region (47, 48). Because of the limited information, the impact of these viruses on public health is still unclear. However, people can be exposed to such viruses, which might cause illness.

2.2. Reviews of relevant research findings

2.2.1. Human-bat interactions, knowledge and risk perception

Suwannarong et al. conducted a qualitative study to understand activities associated with exposure to bats and bat excreta among people involving in guano mining business in 2014 in Thailand. In-depth interview and focus group interview were conducted among a total of 67 people in four provinces (Ratchaburi, Sakaeo, Nakorn Sawan and Phitsamulok). The participants were composed of mine managers who are in charge of the management of guano mining, guano miners, workers who were involved in drying and packaging guano, spouses and other adult family members of miners, guano vendors and users of guano as a fertilizer. The study reported the existing of people's activities related to bat consumption such as hunting and eating of flying foxes and other bats in all 4 provinces and bats were sold in some communities. In addition, drinking fresh bat blood mixed with alcohol as a health supplement was occasionally reported. People's perception of disease risk of bat consumption and the beneficial roles of bats in ecology were low. The community-level research to explore and enhance knowledge and perception of the health risk related to bat consumption is recommended to prevent Nipah virus infection and other bat-borne diseases (26).

Chumkaeo et al. conducted a cross-sectional study to explore knowledge, attitude and practices related to Nipah virus infection among pig farmers in 2013 in Songkhla province in Thailand. The knowledge and attitude were examined with the 6-item questionnaire. The study reported the proportion of direct contact with bats among pig farmers, showing 42 (21.65%) of 194 pig farmers had direct contacts with bats (20 bat hunters and 22 bat consumers) and 152 (78.35%) pig farmers did not have direct contact with bats. The results showed that the indirect contact group has higher knowledge about the outbreak than the direct contact group ($p<0.05$). Also, the indirect group showed higher seriousness toward Nipah virus infection than the direct group ($p<0.01$) (49).

Robertson et al. conducted a cross-sectional study to assess the knowledge and practices on rabies among people at the risk of bat exposure in 2009 in Thailand. A total number of 106 participants were recruited purposively in eight provinces,

including Chiang Rai, Kamphaeng Phet, Khon Kaen, Ayutthaya, Srakaeo, Kanchanaburi, Chachoengsao and Surat Thani province. The participants consisted of 41 workers/residents at the temples where bats were roosting, 28 guano miners, 19 game wardens who were responsible for monitoring and protecting bat caves and 18 bat hunters. Interview with a 41-item structured questionnaire was conducted. The experience of the bat consumption, scratch and bite were reported from 57 (54%), 23 (22%) and 18 (17%) of participants, respectively. Regarding knowledge, the results showed 11 out of 106 (10%) could identify bats as a potential source of rabies and only 18 (17%) answered that human can get any disease other than rabies from bats. Guano miners and bat hunters were more likely exposed to a bite and scratch than temple workers/residents (adjusted OR=6.7; 95% CI 1.8-25.6; $p<0.05$, OR=12.0; 95% CI 1.0-7.5; $p<0.05$, respectively). Univariable analysis showed the association between self-assessment of knowledge and a bite or scratch event, while the association was not significant after the adjustment of other variables. The frequency of being in a cave or roost area was significantly associated with a bite or scratch event. Participants doing such activities more than 5 times per year were more frequently exposed to a bite or scratch than those who less than 5 times (adjusted OR=10.6; 95% CI 2.9-39.7; $p<0.05$) (17).

Moran et al. conducted the study to assess knowledge, attitude and practices on rabies and exposure to bats in the rural communities in Guatemala. A total of 300 households were randomly selected from the area located within 2 kilometers of a bat roost, and a total number of residents was 1,721. Among them, 77 (5%) reported history of bat exposure, which was defined as bite, scratch or touching a bat with bare hands at any time in the past, and 41 out of 77 (53%) reported a bat bite. Regarding knowledge of bat-borne disease, 26 out of 270 (10%) identified bats as a source of rabies and 27 (10%) answered bats host other diseases. The study showed several relationships between factors and exposure to bats. In household level (n=270), people whose age was less than or equal to 46 (mean age of participants) were 54% less likely exposed to bats (OR=0.46; 95% CI 0.25-0.81; $p<0.01$) and female people were 62% less likely exposed to bats (OR=0.38; 95% CI 0.21-0.70; $p<0.01$). On the other hand, living or working more than 5 years near a bat roost (OR=2.53; 95% CI 1.42-4.51; $p<0.01$), agricultural occupation (OR=2.80; 95% CI 1.13-6.94; $p<0.01$) and

being inside a bat cave (OR=3.43; 95% CI 1.91-6.23; p<0.05) showed positive association with exposure to bats (50).

Kamins et al. conducted the study to explore the risk perception of bat-borne disease from 2009 to 2011 in Ghana. The participants were recruited from both urban and rural areas. The total number of participants was 577, which included bat hunters and bat vendors. It was reported that bat hunters and bat vendors have been exposed to bat bites, scratches and bat blood. People's perception of bat consumption was described in this study. Bat consumption was related to socio-cultural aspects, 50% of respondents answered that bat consumption was cultural or traditional activities. A quarter of respondents answered, "all kinds of people eat bats". The reasons of bat consumption were taste (43%), one of the source of food (20%), tradition (14%), health benefit (9%), curiosity (7%) and recommendation (6%). In addition, they found several relationships among socio-cultural characteristics, risk perception and bat bushmeat activities. Living in the rural area and older age was significantly associated with the activities (p<0.01). The trend of educational levels corresponded to the living areas and the proportion of the activities. Regarding the risk perception, people living in the urban areas and having higher educational level had significantly higher risk perception (p<0.01). Higher risk perception was negatively associated with bat preparation and bat consumption (p<0.05) (28).

Harrison et al. explored the risk perception on bat-borne disease among people hunting and/or selling flying foxes in central Kalimantan, Indonesia. The research was conducted in the hunting hot spots where bat hunting was more intensive compared with other regions. A total of 151 of hunters or vendors were interviewed. Their risk perception regarding bat-borne disease was extremely low. Under 10% of them answered that they were aware of the risk of bat-borne disease, and few people reported they had used personal protective equipment when handling bats, despite many of them had experiences of being bitten or scratched by bats. Almost all participants answered that they would not get sick after being bitten by flying foxes (1% in hunters and 2% in vendors answered yes). They also investigated the consumers' background of eating flying foxes. The results showed 80% of the vendors answered people ate bats for nutritional reasons and 29% answered health benefits for chest ailments (51).

Openshaw et al. conducted a cross-sectional study in Bangladesh from 2011 to 2013 to explore bat hunting activities and factors associated with exposure to bats. The households were selected in three different areas. The villages selected included all of 60 villages where the primary NiV infection cases were reported, 73 villages randomly selected in the regions with the risk of spillover and 74 villages randomly selected in the regions outside the spillover risk areas. The results of the household head survey showed the prevalence of bat hunting in selected households was 1% and 8% answered that they knew someone hunting bats in their neighborhood. Bat hunting was reported 101 out of 204 (49%) selected villages. Bats were consumed as some combination of medicine (17%), food (30%) or both (14%). Regarding the factors associated with bat hunting, the presence of a bat roost in the household was associated with bat hunting (adjusted PR=2.3; 95% CI 1.1-4.9; $p<0.05$). Moreover, a geographical difference was associated with bat hunting, which was more likely to occur in the north-west (adjusted PR=7.5; 95% CI 2.5-23.0; $p<0.05$) and south-west regions (adjusted PR=6.8; 95% CI 2.1-21.6; $p<0.05$) compared with the north-east region (52).

2.2.2. Risk factors associated with Nipah virus infection

Montgomery et al. explored the risk factors associated with the outbreak occurred in 2003-2004 in Bangladesh. They conducted a case-control study on 12 cases and 36 controls in the outbreak areas. The results showed the association between having contact with suspected or probable cases (OR=21.4; 95% CI 2.78-966.1; $p<0.001$) and visiting a hospital (OR=32.4; 95% CI 5.18-∞; $p<0.001$). Remarkably, the habit of climbing trees was also associated with cases (OR=8.2; 95% CI 1.25-∞; $p<0.05$). This activity was exclusively observed among boys under 15-year-old. This association implied that children might have gotten infected by contacting with fruits contaminated by bats or the secretions/excretions of bats (23).

Chakraborty et al. conducted the case control study in the outbreak in Bangladesh from 2010-2011. The analysis in this study included 40 cases and 155 controls in the outbreak areas. Cases more likely drunk raw date palm sap (adjusted matched OR=17.9; 95% CI 4.0-80.5; $p<0.05$) and touched or was in the same room with a person with fever and altered mental status (adjusted matched OR=24.3; 95%

CI 3.0-197.0; $p<0.05$) as well as previous cases. In addition, independent associations were observed between cases and bats' visit to trees near the household at night (adjusted matched OR=40.1; 95% CI 3.9-416.7; $p<0.05$) and at daytime (adjusted matched OR=6.5; 95% CI 1.1-37.5; $p<0.05$). These results implied potential additional transmission routes other than consumption of date palm sap and contact with patients in this outbreak (53).

Hegde et al. conducted the case-control analysis to explore risk factors associated with Nipah virus infection in Bangladesh. The data from the investigations of the outbreaks between 2004 to 2012 were analyzed, which included 157 cases and 632 controls. The study reported association between cases and bats in trees around house at night (adjusted OR=3.25; 95% CI 1.20-8.83; $p<0.05$), visited any area outside own sub-district (adjusted OR=3.50; 95% CI 1.49-8.22; $p<0.05$), date palm sap consumption (adjusted OR=16.7; 95% CI 6.50-42.7; $p<0.05$), and contact with Nipah case (adjusted OR=8.38; 95% CI 2.59-27.2; $p<0.05$). (54).

As well as Malaysia and Singapore where NiV transmission was mainly caused by close contact with infected pigs, several studies conducted in Bangladesh showed the putative roles of domestic animals in the outbreaks there. Hsu et al. investigated the outbreaks occurred in Bangladesh and explored the risk factors related to Nipah virus infection cases. A case-control analysis of the outbreak in 2001 was conducted among 13 cases and 83 controls. The results showed contact with a sick cow was strongly associated with cases (OR=7.89; 95% CI 2.24-27.7; $p<0.05$), although the role of a cow in this outbreak was unclear because the tests among cow had not conducted (55). The investigation conducted by International Centre for Diarrhea Disease Research, Bangladesh (ICDDRB) showed the association between cases and experience of contact with a nomadic pig herd in the outbreak in 2003 (OR=6.1; 95% CI 1.3-27.8). In addition to such evidence, the case probably caused by contact with domestic animals were reported in the outbreak in 2004. The boy developed Nipah virus infection after having contact with two sick goats (21).

Chowdhury et al. investigated the prevalence of antibodies against NiV glycoprotein among cattle, goats and pigs from May 2009 to January 2011 in the area with previous human cases of Nipah infection in Bangladesh. The antibody was found in 26/400 (6.5%) cattle, 17/400 (17%) goats and 138/312 (44.2%) pigs. In addition,

the results showed the association between detection of antibodies and owners' activities of feeding domestic animals. Feeding of fruits that were partially eaten by a bat and/or a bird (adjusted PR=3.1; 95%; CI 1.6-5.7; $p<0.05$) and drinking of raw palmyra juice (adjusted PR=3.9; 95%; CI 1.5-10.2; $p<0.05$) were associated with high prevalence of antibodies. Domestic animals can get infected with viruses via consumption of contaminated fruits, which may lead to subsequent human infection (42).

Pernet et al. investigated the seroprevalence of Henipavirus in bats and human from 2001 to 2003 in southern Cameroon with NiV cross-neutralizing antibodies and explored the risk factors associated with seropositive cases. The results showed that the seroprevalence of Henipavirus-like infections is 48% in bats and 3-4% in human samples. Regarding the risk factors, seropositive was exclusively found among the participants who had contacted with bats (Bat exposure group; 7/227, 3.1% versus Non-exposure group; 0/260, 0%, $p<0.01$). Bat exposure group was more likely seropositive than non-exposure group (OR=17.72; 95% CI 1.01-312.2; $p<0.01$). Moreover, there was a significant difference in the seropositive rate among the type of exposure. People butchering bats were more likely to be seropositive compared with those who had not butchered (7/164, 4.1% versus 0/316, 0%, OR=28.86; CI 1.64-508.45; $p<0.01$), while there was no association between age, gender, hunting bats and seropositive. The author pointed out that people hunted bats with firearm, nets or catapults and hunters did not have physical contacts with bats in the study areas, which may contribute to no association between hunting and seropositive. The association was found between living areas and seropositive. People living in the areas where deforestation had proceeded were more likely seropositive than those who lived in the other areas (6/185; 3.2% versus 1/302; 0.33%, OR=10.09; CI 1.20-84.48; $p<0.01$) (56).

CHAPTER III RESEARCH METHODOLOGY

3.1 Research design

The research is a cross-sectional, descriptive analytical study, regarding knowledge, attitude and practices toward Nipah virus disease among residents in Ban Luang subdistrict, Don Thum district, Nakhon Pathom province, Thailand

3.2 Study area

This study was conducted in Ban Luang subdistrict in Don Thum district, Nakhon Pathom province, Thailand. Ban Luang subdistrict was purposively selected for the study site because there was a bush where flying foxes (*P. lylei*) are roosting, which was close to the semi-urban, residential area.

- Ban Luang subdistrict, Don Thum district, Nakhon Pathom province, Thailand
  - Semi-urban area located about 50 km northwest of the central area of Bangkok
  - Number of Village: Five
  - Population size: 3,695
  - Number of Households: 919

  *Information was obtained from the ban Luang subdistrict health center

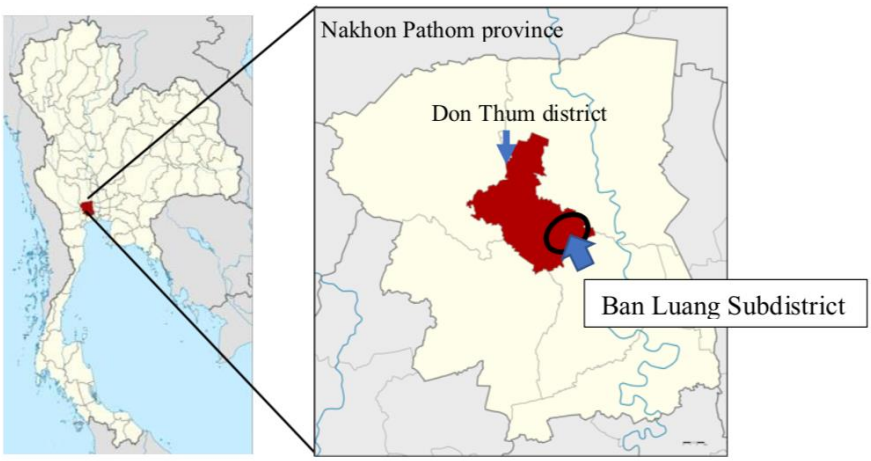

Figure 5 Location of Ban Luang subdistrict, Don Thum district in Nakhon Pathom Province
(https://en.wikipedia.org/)

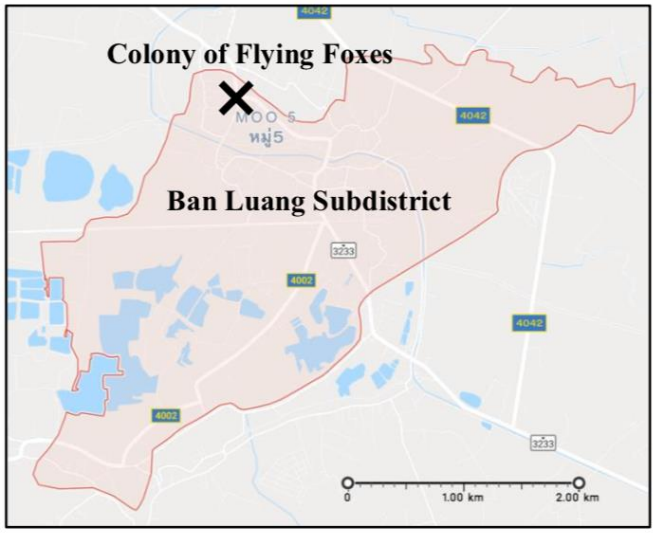

Figure 6 Location of colony of flying fox (P.lylei) at Ban Luang subdistrict (https://www.google.com/maps/)

Figure 7 The bush where flying foxes were roosting in Ban Luang subdistrict *(A; Bush and surrounding area, B; Bush, C; Flying foxes hanging from trees)*

3.3 Study population

The target population consisted of people whose age was equal to or more than 18, both male and female who were currently living in the five villages of Ban Luang subdistrict more than one year. In a selected household, a respondent who was eligible for the criteria below was chosen randomly.

Inclusion criteria

- Age 18-year-old or above at the time of this survey
- Being a member of selected household over a year
- Living in the selected village over a year
- Voluntarily agree to participate in the study
- Be able to communicate well (not be drunk during an interview and suffer from a mental disorder)

Exclusion criteria

- Having a physical problem to go outside

3.4 Sample size calculation

The sample size was calculated by using the following formula (57):

$$n = \frac{Np(1-p)z^2}{d^2(N-1) + p(1-p)z^2}$$

N = population size = 3,695

n = desired sample size

z = the reliability coefficient at the 95% CI=1.96

p = proportion of those who have experiences of hunting or eating bats

= 21.65% = 0.2165

(from the result of the previous study in Songkhla Province, Thailand, 2013) (49)

d = absolute precision of study = 0.05 (acceptable error)

With the formula above, the desired sample size was 244.

Assuming 10% incomplete data, 269 respondents were required for the study.

3.5 Sampling method

A multi-stage sampling method was used in this study. First, Ban Luang subdistrict and all of its five villages were purposively selected based on bat habitat data. The second step was a selection of households, which were chosen by systematic random sampling from the household list by which around one-third of households were selected in each village. The list of households of the selected villages was obtained from the health center of Ban Luang subdistrict. The next step was a selection of respondents from the selected households. Only one member of the household was chosen by using the Kish selection method, which randomized a selection of a person from each household (58) (APPENDIX III). In total, 285 respondents from 285 households were chosen from the five villages in Ban Luang subdistrict. All of the selected households were located within four kilometers from the roost of flying foxes.

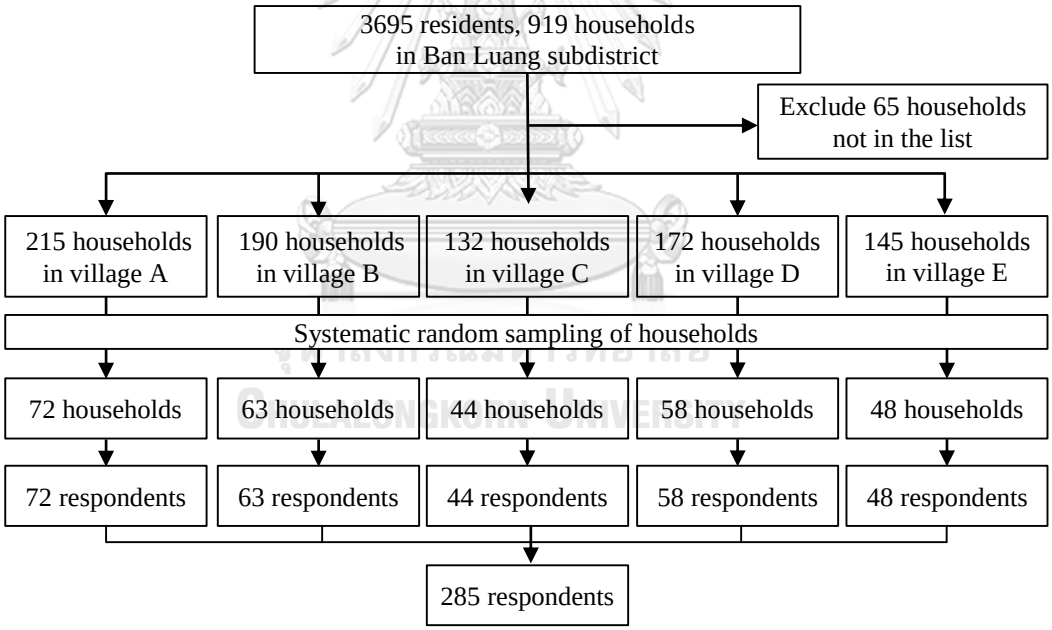

Figure 8 Sampling framework

3.6 Research instruments

The research instrument was a questionnaire developed by the researcher in English. First of all, the questions were constructed from the result of the intensive literature review described in Chapter II. After that, the validity and reliability were tested through review by four experts and a pilot testing among 30 respondents in Don Phutsa subdistrict, followed by a translation from English to Thai.

The questionnaire was comprised of four sections (62 items), including section A; General Information (19 items), section B; Knowledge (23 items), section C; Attitude (13 items) and section D; Practice (7 items).

1. Section A: General characteristics

This part of the questionnaire consisted of 19 questions on the socio-demographic profile of the sample population including; age, gender, marital status, education, type of occupation, income, family member, duration of living and living environment in Ban Luang subdistrict.

2. Section B: Knowledge toward Nipah virus disease

This part of the questionnaire was comprised of a source of information, general knowledge of infectious disease from animals, bat-borne disease, Nipah virus disease and preventive measurement.

There were 23 yes/no questions on knowledge. Score for a correct answer was one and score for both an incorrect answer and “Don’t know” was zero. Regarding question 1.1 and 1.2, a score is one if the respondent could give at least one correct answer. The score ranged from zero to 23. The knowledge level of the participants was classified into three levels according to Bloom’s cut-off point as below (59).

- Poor 0-13 points (<60%)
- Moderate 14-18 points (60-80%)
- Good 19-23 points (>80%)

3. Section C: Attitude toward Nipah virus disease

This part of the questionnaire aimed to determine the attitudes of the participant toward bat-borne disease such as susceptibility, seriousness/threat and perception on bats. There were five statements in susceptibility and four statements in seriousness/threat and perception on bats. In total, there were 13 questions with Likert scale (from 1: “Strongly disagree” to 5: “Strongly agree”). In the negative statement, the score was turned back. The participants were asked to rate their level of agreement on each expression.

The score ranged from 13-65. Individuals whose score was equal to or below the median were categorized to have a negative attitude (poor) and those with score high than median were to have positive attitude (good).

- Negative (Poor) Less than or equal to median score
- Positive (Good) Higher than median score

4. Section D: Practices toward Nipah virus disease

This part of the questionnaire aimed to determine practices with focus on the sample population’s activities and actions related to direct contact with bats and/or bat secretions/excretions, which included hunting, butchering/preparing and eating bats, collecting and using bat feces (guano), bat bites or scratches and protective measures. In this section, there were seven yes/no questions on practices. Except for the question regarding bat bites and scratches, participants were asked their experience of doing each activity in the current one year and the frequency of each activity (from weekly to less than several times per year). For bat bites and scratches, the participants were asked their experience of being bitten or scratched and how many times they had been exposed to bat bites or scratches. The practices limited those done within current one year to include at least one fruit harvest season.

3.7 Validity test

To achieve the validity of the questionnaire, a literature review was conducted to construct sections and questions as described in Chapter II. Then, all items of the questionnaire were reviewed by four experts through the Index of Item Objective Congruence (IOC) method (60). If the IOC score was lower than or equal to 0.5, the question was deleted or revised according to the experts' comments. Afterward, it was translated from English to Thai. The questionnaire in Thai was re-translated to English to examine the validity of the translation.

The validity of the questionnaire was re-examined through pilot study among 30 people living in the village of Don Phutsa subdistrict, which was located next to Ban Lung subdistrict and similar to the villages of Ban Luang district in terms of the socio-economic characteristics and living environment. According to its result and subsequent consultations with experts, the questionnaire was adjusted to improve the validity.

3.8 Reliability

To establish the reliability, the questionnaire was tested through the pilot study by interviewing 30 people in Don Phutsa subdistrict. Afterward, it was adjusted to achieve reliability following the result of the pilot study. Internal consistency reliability assessed by KR20 and Cronbach's alpha was employed to examine the reliability of the rating scales. The result of the reliability testing was as followed;

- Section B: Knowledge toward Nipah virus disease; KR20 was **0.737**
- Section C: Attitude toward Nipah virus disease; Cronbach's alpha was **0.743**

3.9 Data collection

The researcher recruited and trained three research assistants for data collection. The researcher explained the research rationale, objectives, contents of the questionnaire and data collection process. Besides, the researcher and assistants did a following rehearsal training of a face-to-face interview so that they could clearly understand the research instrument and do a face-to-face interview smoothly and adequately.

The list of households was obtained from the health center of Ban Luang subdistrict and households were selected through systematic random sampling. The research assistants visited the selected households and checked eligibility criteria of household members. After choosing the respondent, the research assistants explained the instructions of the questionnaire, purpose, benefit of this study, confidentiality and some ethical consideration with a participant information sheet. Before proceeding to the interview, an informed consent form was provided to each participant. After getting the agreement of the participation and the signature on the informed consent form, the research assistants started a face-to-face interview. Participants were free to withdraw if they felt unwilling to participate during and after the interview. After finishing the interview, the researcher and the research assistants checked on the correctness and completeness of the questionnaire.

3.10 Data analysis

After data collection, all data was entered, cleaned, coded, and scored on Microsoft Exce. Statistical analyses were carried out by using SPSS program, MAC version 22 licensed by Chulalongkorn University. Level of statistical significance was set at $\alpha = 5\%$.

- Descriptive statistics

  Descriptive statistics such as percentage, median, quartile and range were used to present and summarize the general characteristics, knowledge, attitude and practices toward bat-borne disease.

- Bivariate analysis

  Chi-square test was employed to determine the association among general characteristics (categorical variables), knowledge and attitude level. As knowledge and attitude scores were not normally distributed, Spearman correlation was determined to examine the correlation between general characteristics (continuous variables), knowledge and attitude score. Also, Kruskal-Wallis H test and Mann-Whitney U test were used to determine the difference between general characteristics (categorical variables), knowledge and attitude score (Table 1)

- Multivariate analysis

  To explore the factors associated with dependent variables (knowledge or attitude score), multiple linear regression was employed. The predictors with *p*-value < 0.20 in at least one bivariate analysis were put into the multiple regression analysis to identify the predictors of dependent variables after controlling other variables. Regression coefficients (ß), standard error (SE), 95% confidence intervals (CI), *t*-value and *p*-values were reported for variables along with R^2 square and *F* value.

Table 1 Independent variables and dependent variables in bivariate analyses

Analysis	**Independent variables**	**continuous /categorical**	**Dependent variables**	**continuous /categorical**
Spearman's correlation	General characteristics (age, family member, duration of living)	continuous	Knowledge score Attitude score	continuous
Chi-square test	General characteristics (gender, marital status, education, occupation, income, living environment)	categorical	Knowledge level Attitude level	categorical
Kruskal-Wallis H test or Mann Whitney U test	General characteristics (gender, marital status, education, occupation, income, living environment)	categorical	Knowledge score Attitude score	continuous
Spearman's correlation	Knowledge score	continuous	Attitude score	continuous
Chi-square test	Knowledge level	categorical	Attitude level	categorical

3.11 Ethical consideration

Approval of the study, design, data collection tools and consent forms were obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (029.1/61).

Permission to conduct the study in Ban Luang subdistrict was granted by Nakhon Pathom Public Health Office. Before starting an interview, a consent form was obtained from all participants. Every received data was treated carefully and confidentially. The respondents could refuse to join this study and in case they do not need to explain the reasons. The obtained data was used only in this project and their information was kept secret.

CHAPTER IV RESEACH RESULTS

4.1. Descriptive statistics

4.1.1. Study population

In this cross-sectional study, respondents were recruited from the five villages in Ban Luang subdistrict according to inclusion and exclusion criteria. Data collection was carried out from 11th to 31th in May 2018. Expected number of respondents was 285. The response rate was 100% (285/285). With 13 respondents excluded due to incomplete questionnaires, 272 respondents were included in the analyses (valid response rate was 95.4%).

4.1.2. General characteristics

This part described the background socio-demographic characteristics and living environment of the respondents. Table 2 showed overall socio-demographic characteristics including age, gender, marital status, education, occupation, family income, family members and duration of living.

The age of respondents ranged from 18 to 85 years. The median age was 44 years old. A similar proportion was found in the age group of 21-30, 31-40, 41-50 and 51-60 years old, whose proportion was 17.6%, 21.0%, 19.9% and 22.8%, respectively. Small numbers of respondents were found in the age group of 18-20 years old (3.3%) and over 60 years old (15.4%). Concerning gender, female respondents (53.3%) were larger than male respondents (46.7%).

Regarding marital status, the majority was found in the married group with 52.9%, followed by the single group with 31.6%. Small numbers of respondents were separated (1.8%), divorced (3.7%) and widowed (9.9%).

The majority of respondents were educated at lower secondary level (38.2%). A relatively high number was found in the groups with primary level (29.8%). The proportion of people without education was 9.9%. The small number of respondents finished upper secondary level (13.6%) or a college or university degree (8.1%).

Regarding the occupations, over half of respondents were employees (52.9%). A relatively high proportion was found in the farmer group (29.4%). A small number

of respondents were housewives or unemployed (9.9%), students (4.4%) and shop owners (3.3%).

In the study sample, the majority of household income per month was under 20,000 bahts (26.8% in the less than 10,000 bahts group and 50.4% in the 10,000 to 20,000 bahts group), followed by 20,001 to 30,000 group (16.9%). Only 1.1% of households earned more than 30000 bahts, and 4.8% answered they did not know the family income. The range of family members was from one to ten. The median number of family members was four. The majority of household consisted of from four to six people (59.9%). The number of members aged less than 18 and equal to 18 ranged from zero to four with median one, and that of above 18 ranged from one to eight with median three. The period of living of the respondents ranged from eight to 77 years. The median length of stay was 37.5 years. The majority of the respondents has stayed for 25 to 50 years (54.8%).

Table 2 Socio-demographic characteristics

Characteristics	Number (n=272)	Percentage (%)
Age (year)		
18-20	9	3.3
21-30	48	17.6
31-40	57	21.0
41-50	54	19.9
51-60	62	22.8
>60	42	15.4
Median	44	
Min-Max	18-85	
Gender		
Male	127	46.7
Female	145	53.3
Marital status		
Single	86	31.6
Married	144	52.9
Separated	5	1.8
Divorced	10	3.7
Widowed	27	9.9

Education		
None	27	9.9
Primary	81	29.8
Lower secondary	104	38.2
Upper secondary	37	13.6
College University/	22	8.1
Others*	1	0.4
Occupation		
Farmer	80	29.4
Employee	144	52.9
Shop owner	9	3.3
Student	12	4.4
Housewife/unemployed	27	9.9
Family income per month (Bahts)		
< 10,000	73	26.8
10,000 to 20,000	137	50.4
20,001 to 30,000	46	16.9
> 30,000	3	1.1
Don't know*	13	4.8
Number of Family members		
Total		
1	29	10.7
2	30	11.0
3	50	18.4
4	58	21.3
5	55	20.2
>5	50	18.4
Median	4	
Min-Max	1-10	
Under 18		
0	126	46.3
1	83	30.5
2	49	18.0
>2	14	5.1
Median	1	
Min-Max	0-4	

18 or above		
1	37	13.6
2	52	19.1
3	72	26.5
4	76	27.9
>4	35	12.9
Median	3	
Min-Max	1-8	
Length of Living (year)		
<25	46	16.9
25-50	149	54.8
>50	77	28.3
Median	37.5	
Min-Max	8-77	

*excluded from statistical analysis

The characteristics of the living environment of the respondents were summarized in Table 3. In this region, almost all of respondents (97.4%) reported that they had their animals and 185 of them (68%) answered that they took care of their animals. Cats were the most common animal in the study area; 53.7% of respondents had cats, followed by dogs (43.0%) and chicken (26.8%). A small number of respondents had cattle (4.0%), birds (2.6%), pigs (2.2%), horse (1.1%) and goat (0.4%). Regarding history of seeing wildlife, 42.6% of respondents responded that they saw wild animals and 33.8% of them saw bats in or around their house.

Concerning questions related to fruit trees, 85 respondents (31.3%) answered that they owned fruit trees at home. Among them, only six (7.1%) said they had seen bats near fruit trees at their home and none of them answered that they kept their animals near fruit trees. Regarding fruit orchards, only two people (0.7%) had a fruit orchard and none of them had seen bats at their orchard and kept their animals there.

In this study sample, almost half of the respondents (49.6%) recognized the regulation regarding bats in this area. In face-to-face interviews, most respondents referred to the prohibition of the hunting of bats, in particular, flying foxes.

Table 3 Living environment

Category	n	Yes		No	
		Number	Percentage (%)	Number	Percentage (%)
Ownership of domestic animals					
Own domestic animals	272	265	97.4	7	2.6
Cat		146	53.7	126	46.3
Dog		117	43.0	155	57.0
Chicken		73	26.8	199	73.2
Cattle		11	4.0	261	96.0
Birds		7	2.6	265	97.4
Pig		6	2.2	266	97.8
Horse		3	1.1	269	98.9
Goat		1	0.4	271	99.6
Other		2	0.7	270	99.3
Take care of domestic animals	272	185	68.0	87	32.0
See animals in/around house					
Wildlife	272	116	42.6	156	57.4
Bat	272	92	33.8	180	66.2
Fruit trees					
Own fruit trees at home	272	85	31.3	187	68.8
See bats near fruit trees at home†	85	6	7.1	79	92.9
Keep animals near fruit trees at home†	85	0	0	85	100.0
Fruit orchard					
Own a fruit orchard	272	2	0.7	270	99.3
See bats in a fruit orchard†	2	0	0	2	100.0
Keeping animals at a fruit orchard†	2	0	0	2	100.0
Existence of regulations regarding bats	272	135	49.6	137	50.4

†questions were asked only to whom answered that they had fruit trees at home and/or a fruit orchard

4.1.3. Source of information on infectious on disease

The sources through which respondents usually get information on disease were showed in Table 4. The primary information source was Internet (58.8%), followed by public health officers (54.4%), a hospital (53.7%), newspaper (51.5%), television (48.2%) and smartphone (38.2%). Family members or neighbors were not major sources of information on infectious disease; 28.3% of the respondents obtained information from their family members and 20.2% of them did from their neighbors.

Table 4 Source of information on disease

Source of information*	Number (n=272)	Percentage (%)
Internet	160	58.8
Public health officer	148	54.4
Hospital	146	53.7
Newspaper	140	51.5
Television	131	48.2
Smartphone	104	38.2
Family member	77	28.3
Neighbor	55	20.2
Other	8	2.9

*Multiple answers

4.1.4. Knowledge toward bat-borne disease

Regarding experience of getting information on bat-borne disease, only 9 out of 272 (3.3%) answered that they have ever received any information related to bat-borne disease (Table 5).

Table 5 Experience of obtaining information on bat-borne disease

Statement	n	Yes		No	
		Number	%	Number	%
Obtain information on bat-borne diseases before	272	9	3.3	263	96.7

The knowledge toward bat-borne disease was assessed through 23 questions with the four parts.; general knowledge of infectious disease from animals, knowledge

of bat-borne disease, knowledge of Nipah virus disease and Preventive measure. The proportion of answers and correct answers were illustrated in Table 6 and *Table 7*, respectively. The median score of the attitude section was 11 (lower-upper quartile; 10-13, Min-Max; 5-17). As for the Nipah virus disease, no respondents have ever heard of Nipah virus disease.

In the general knowledge part, almost all respondents answered that animals can transfer disease to human (99.6%) and provided correct examples of specific names of animals that can bring disease to human (99.3%) (dog, cat, rat and others) and zoonotic disease (98.2%) (rabies, avian influenza, dengue fever, leptospirosis and others). Also, the majority of respondents correctly responded that animals could get sick due to disease transferred from other animals (83.5%) and eating raw or not well-cooked animals can cause disease (70.6%). In contrast, around half of respondents (51.4%; 29.0% for No, 22.4% for Don't know) failed to answer that zoonotic disease can be transmitted without direct contact (physical contact) with animals.

Regarding the bat-borne disease part, around a third of the respondents (30.5%) answered that bat can bring disease to human. Surprisingly, the number of the respondents who reported that bats can transfer disease to other animals was higher than to human (43.0%). Regarding the transmission of bat-borne disease, most respondents correctly answered that eating raw or not well-cooked bats might make people sick (73.9%). Besides, the majority of the respondents responded that people can get disease by eating fruits eaten by bats (61.8%). On the other hands, most respondents failed to answer to other questions; 37.9% of the respondents answered that rabies can be transmitted by bats, 25.0% reported that bat urine or feces could transmit disease to human. Only a small number of the respondents answered that hunting and butchering bats might cause make them sick (9.9%).

Concerning the questions for prevention, the importance of avoiding contact was well-known among respondents; most of them answered that they should avoid touching fruits eaten by a bat (83.5%) and contacting with sick animals (84.2%). Also, the majority of the respondents recognized that wearing glove was important to prevent a disease from bats (78.7%). Only around one-third of the respondents (36.4%) correctly recognized that hand cleaning with soap is not sufficient to prevent infectious disease.

Table 6 Knowledge toward bat-borne disease

	Statement	Yes	No	Don't know
		n (%)	n (%)	n (%)
General Knowledge of Infectious Disease from Animals				
1-1	Animals can transmit disease to human	271 (99.6)	0 (0)	1 (0.4)
1-2	Specify the name of animals which can transmit disease to human.	270 (99.3)	2 (0.7)	3 (1.2)
1-3	Specify the name of diseases which can be transmitted from animals to human.	267 (98.2)	0 (0)	5 (1.8)
2	Animals can get sick with diseases transmitted from other animals.	227 (83.5)	10 (3.7)	35 (12.9)
3	Zoonosis develops only when people have direct contact (physical contact) with animals. *	132 (48.5)	79 (29.0)	61 (22.4)
4	Eating raw or not well-cooked animals can cause disease.	192 (70.6)	56 (20.6)	24 (8.8)
Knowledge of Bat-Borne Disease				
5	Bats can transmit disease to human.	83 (30.5)	45 (16.5)	144 (52.9)
6	Bats can transmit disease to other animals.	117 (43.0)	36 (13.2)	119 (43.8)
7	People cannot get a disease due to a bat bite or scratch. *	23 (8.5)	202 (74.3)	47 (17.3)
8	Hunting bats might make you sick.	27 (9.9)	104 (38.2)	141 (51.8)
9	Butchering bats might make you sick.	27 (9.9)	109 (40.1)	136 (50.0)
10	Eating raw or not well-cooked bats might make you sick.	201 (73.9)	18 (6.6)	53 (19.5)
11	People cannot get disease by eating fruits that a bat ate. *	17 (6.3)	168 (61.8)	87 (32.0)
12	Disease can be transmitted via bat urine or feces.	68 (25.0)	69 (25.4)	135 (49.6)
13	Rabies can be transmitted by bats.	103 (37.9)	32 (11.8)	137 (50.4)
Knowledge of Nipah Virus Disease				
14	Have you ever heard Nipah virus disease?	0 (0)	75 (27.6)	197 (72.4)
15	Nipah virus can be transmitted by bats and other animals. †	NA	NA	NA
16	Nipah virus disease is life-threatening disease. †	NA	NA	NA
17	Nipah virus disease can be transmitted from human to human. †	NA	NA	NA
Prevention				
18	Hand cleaning with soap is sufficient to prevent infectious disease. *	157 (57.7)	99 (36.4)	16 (5.9)
19	People should avoid touching fruits that a bat ate.	227 (83.5)	20 (7.4)	25 (9.2)
20	People should avoid contacting sick animals.	229 (84.2)	16 (5.9)	27 (9.9)
21	Wearing glove when touching bats is important to prevent disease transmitted from bats.	214 (78.7)	26 (9.6)	32 (11.8)

*Negative statement; †Questions No.15-17 were skipped because no respondents have ever heard Nipah virus disease; NA: not applicable

Table 7 Number and percentage of correct answers on knowledge

Statement		Correct answer	
		Number (n=272)	Percentage (%)
General Knowledge of Infectious Disease from Animals			
1-1	Animals can transmit disease to human	271	99.6
1-2	Specify the name of animals which can transmit disease to human.	270	99.3
1-3	Specify the name of diseases which can be transmitted from animals to human.	267	98.2
2	Animals can get sick with diseases transmitted from other animals.	227	83.5
3	Zoonosis develops only when people have direct contact (physical contact) with animals. *	79	29.0
4	Eating raw or not well-cooked animals can cause disease.	192	70.6
Knowledge of Bat-Borne Disease			
5	Bats can transmit disease to human.	83	30.5
6	Bats can transmit disease to other animals.	117	43.0
7	People cannot get disease due to a bat bite or scratch. *	202	74.3
8	Hunting bats might make you sick.	27	9.9
9	Butchering bats might make you sick.	27	9.9
10	Eating raw or not well-cooked bats might make you sick.	201	73.9
11	People cannot get disease by eating fruits that a bat ate. *	168	61.8
12	Disease can be transmitted via bat urine or feces.	68	25.0
13	Rabies can be transmitted by bats.	103	37.9
Knowledge of Nipah Virus Disease			
14	Have you ever heard Nipah virus disease?	0	0.0
15	Nipah virus can be transmitted by bats and other animals. †	NA	NA
16	Nipah virus disease is life-threatening disease. †	NA	NA
17	Nipah virus disease can be transmitted from human to human. †	NA	NA
Prevention			
18	Hand cleaning with soap is sufficient to prevent infectious disease. *	99	36.4
19	People should avoid touching fruits that a bat ate.	227	83.5
20	People should avoid contacting sick animals.	229	84.2
21	Wearing glove when touching bats is important to prevent disease transmitted from bats.	214	78.7

*Negative statement; †Questions No.15-17 were skipped because no respondents have ever heard Nipah virus disease; NA, not applicable

Level of knowledge was categorized into three level, according to the score of the respondents. The distribution of level of knowledge on overall and each part is presented in Table 8. The median score of the knowledge section was 11 (lower-upper quartile; 10-13, Min-Max; 5-17). No one was categorized into the good knowledge group of overall knowledge. Forty-six respondents (16.9%) had moderate overall knowledge and 226 (83.1%) respondents were considered to have poor overall knowledge.

In part for general knowledge of infectious disease from animals, the majority of the respondents (65.8%) had good knowledge and 29.8% of them had moderate knowledge. Only 12 (4.4%) of the respondents had poor knowledge. A relatively high proportion of good knowledge was found in the prevention part; 20.6% of the respondents had good knowledge and 53.7% had moderate knowledge, while 25.7% had poor knowledge.

A large proportion of low knowledge level was found in the bat-borne disease and Nipah virus disease part. In the former part, most respondents (83.8%) were considered to have poor knowledge and only 2.6% of the respondents had good knowledge and 13.6% had moderate knowledge. In the latter part, no one had good or moderate knowledge.

Table 8 Distribution of knowledge level toward bat-borne disease

Category	Level of knowledge (n=272)					
	Poor (<60%)		Moderate (60-80%)		Good (>80%)	
	n	%	n	%	n	%
Overall knowledge	226	83.1	46	16.9	0	0.0
Infectious disease from animals	12	4.4	81	29.8	179	65.8
Bat-borne disease	228	83.8	37	13.6	7	2.6
Nipah virus disease	272	100.0	0	0.0	0	0.0
Prevention	70	25.7	146	53.7	56	20.6

4.1.5. Attitude toward bat-borne disease

The attitude toward bat-borne disease was measured in the three parts; susceptibility, seriousness/threat and perception on bats. The median score of the attitude section was 43 (lower-upper quartile; 38.3-46.0, Min-Max; 30-57). Table 9 shows the distribution of answers on each statement.

Regarding the susceptibility, the majority of the respondents did not agree that there is a risk of getting disease from bats (6.3% for strongly disagree and 57.0% for disagree). Although 22.6% of the respondents responded that contacting bats can make human sick (2.6% for strongly agree and 20.6% for agree), the number increases to 65.8% (0.7% for strongly agree and 65.1% for agree) if people have frequent contact with bats. Over the half of the respondents perceived that food or fruit eaten by bats are contaminated (64.7%; 8.1% for strongly agree and 56.6% for agree). More than one-third of the respondents agreed that they have more risk of getting disease from bats if they get into a bat cave or go to near a bat roost (38.6%; 0.7 for strongly agree and 37.9% for agree).

As for seriousness and threat, the proportion of the respondents who perceived that disease transferred from bats would not be serious or life-threatening (31.7%; 0.4 for strongly disagree and 31.3% for disagree) was higher than those who did (24.7%; 0.4% for strongly agree and 24.3% for agree). Similarly, 29.0% (1.1% for strongly disagree and 27.9% for disagree) of the respondents disagreed that disease from bats can be incurable, which was higher than those who agreed this statement (12.5% for agree), although 58.5% had a neutral attitude toward this statement. The highest proportion of agreement was found in concern about bat-borne disease; 43.0% of the respondents agreed this statement (0.7% for strongly agree and 42.3% for agree). Perception of the risk of touching bats was also relatively high; 38.3% of the respondents (6.3% for strongly disagree and 32.0% for disagree) recognized that touching bats with bare hands is risky, although 51.1% showed neutral attitude.

In the part of perception on bats, one-fourth of the respondents (25.0%; 2.2% for strongly agree and 22.8% for agree) answered that bats bring disease to human, which was lower than who disagreed it (27.2%; 0.4% for strongly disagree and 26.8% for disagree). On the other hand, the majority of them perceived that bat excretions can get them sick (64.8%; 7.4% for strongly agree and 57.4% for agree). Attitude

toward bat preservation was high; 73.1% (15.4% for strongly agree and 57.7% for agree) of the respondents. agreed that bats should be protected. Most of the respondents disagreed that eating bats is good for health (78.3%; 23.2% for strongly disagree and 55.1% for disagree).

Table 9 Distribution of attitude toward bat-borne disease on each statement

Statement	Percentage (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Susceptibility					
1 I think there is a risk of getting disease from bats.	6.3	57.0	26.5	9.9	0.4
2 I think people contacting bats frequently can get diseases from bats.	0.0	10.7	23.5	65.1	0.7
3 I think food or fruit that bats ate are contaminated.	0.0	4.4	30.9	56.6	8.1
4 I think getting into bat caves or going to near bat roosts increase the risk of getting disease from bats.	0.0	14.3	47.1	37.9	0.7
5 I think contacting bats can make human sick.	0.7	26.5	49.6	20.6	2.6
Seriousness/Threat					
6 I think disease from bats can be serious or life-threatening	0.4	31.3	43.8	24.3	0.4
7 I am concerned about diseases transmitted from bats.	0.0	29.8	27.2	42.3	0.7
8 I think disease from bats to human can be incurable.	1.1	27.9	58.5	12.5	0.0
9 I believe that touching bats with bare hands is not risky. *	6.3	32.0	51.1	9.9	0.7
Perception on bats					
10 I think bats bring disease to human.	0.4	26.8	47.8	22.8	2.2
11 I think excretions of bats such as feces or urine can make me sick.	0.4	8.8	26.1	57.4	7.4
12 I think bats should be protected.	0.0	4.4	22.4	57.7	15.4
13 I think eating bats is good for health. *	23.2	55.1	19.9	1.8	0.0

*Negative Statement

4.1.6. Practices toward bat-borne disease

Experience in specific activities which can lead to contact with bats and potential exposure to bat-borne pathogen in the current one year was summarized in Table 10 and Table 11**.** No ones responded that they had hunted, butchered and prepared bats in this term. Four respondents (1.5%) answered that they had eaten bats. Only one participant (0.04%) had experience of collecting and using bat feces. This respondent used protective measure whenever touching them. In this sample, no ones answered that they had been bitten or scratched by bats. Practices described above were reported by people living in the same village.

Table 10 Practices related to human-bat interactions in the current one year

Statement	Number (n=272)	Percentage (%)
Hunt bats	0	0.0
Butcher/Prepare bats	0	0.0
Eat bats	4	1.5
Weekly	0	-
Monthly	0	-
Several times per year	0	-
Less than several times per year	4	-
Collect bat feces	1†	0.4
Weekly	0	-
Monthly	0	-
Several times per year	1	-
Less than	0	-
Use bat feces as fertilizer	1†	0.4
Weekly	0	-
Monthly	0	-
Several times per year	1	-
Less than	0	-
Bitten or scratched by bats	0	0.0

† collect bat feces and use bat feces were reported by the same participant

Table 11 Information on the respondents with practices (n=5)

No.	Practice	Village	Age (years)	Gender	Education	Family income (bahts)	Knowledge level	Attitude level
1	Collect and use bat feces	A	53	Male	None	10001-20000	Poor*	Good*
2	Eating bats		35	Male	Primary			
3	Eating bats		44	Male	Primary			
4	Eating bats		47	Female	Upper secondary			
5	Eating bats		53	Female	Primary			

*Knowledge and attitude level were categorized based on the criteria from the whole sample (n=272)

4.2. Inferential statistical analysis

4.2.1. Bivariate association analysis

4.2.1.1. Association between general characteristics and knowledge

The results of bivariate analyses are shown in Table 12, Table 13 and Table 14. One respondent with "other" in the educational level and 13 respondents who did not know family income were excluded in the analysis for each variable. The results presented that low positive correlation was found between a number of household members and knowledge score (r_s=0.134, *p*-value=0.027).

Table 12 Correlation between general characteristics and knowledge score (p-value by Spearman's correlation)

Characteristics	Correlation coefficient	*p*-value
Age	-0.061	0.320
Number of household members	0.134	0.027*
Length of living	0.004	0.941

*Statistically significant correlation at *p*-value < 0.05

Table 13 Association between general characteristics and knowledge level (p-value by Chi-square)

Characteristics	n	Level of knowledge				X^2	*p*-value
		Poor		Moderate			
		n	%	n	%		
Gender						0.024	0.877
Male	127	106	83.5	21	16.5		
Female	145	120	82.8	25	17.2		
Marital status						0.025	0.998
Single	86	71	82.6	15	17.4		
Married	144	120	83.3	24	16.7		
Others	42	35	83.3	7	16.7		
Education						0.006	0.936
None/Primary/Lower Secondary	212	177	83.5	35	16.5		
Upper secondary/college/university	59	49	83.1	10	16.9		

Occupation						2.720	0.257
Farmer	80	69	86.3	11	13.8		
Employee/Shop owner	153	128	83.7	25	16.3		
Student/Housewife/Unemployed	39	29	74.4	10	25.6		
Family income/month (Bahts)						0.041	0.839
≤ 20000	210	174	82.9	36	17.1		
>20000	49	40	81.6	9	18.4		

*Statistically significant association at *p*-value < 0.05

Table 14 Difference of knowledge score on socio-demographic characteristics (p-value by Kruskal-Wallis H test and Mann-Whitney U test)

Characteristics	n	Mean rank	*p*-value
Gender[a]			0.871
Male	127	135.68	
Female	145	137.22	
Marital status[b]			0.880
Single	86	137.88	
Married	144	137.30	
Others	42	130.94	
Education[a]			0.975
None/Primary/Lower Secondary	212	136.08	
Upper secondary/college/university	59	135.72	
Occupation[b]			0.815
Farmer	80	139.56	
Employee/Shop owner	153	133.85	
Student/Housewifeunemployed/	39	140.63	
Family income/month (Bahts)[a]			0.836
≤20000	210	130.46	
>20000	49	128.02	

*Statistically significant association at *p*-value<0.05
a, Mann-Whitney U test; b, Kruskal-Wallis H test

Table 15 summarized the results of Chi-square test conducted to examine the association between living environment and the level of knowledge. Experience of seeing bats in or around a house was significantly associated with the knowledge level (p=0.028). The proportion of the moderate level of knowledge was higher among the respondents with that experience than those without it (23.9% vs 13.3%). Table 16 shows the results of Mann-Whitney U test. A significant difference in knowledge score was found in "take care of domestic animals" (p=0.007), "see bats in or around a house" (p<0.001).

Table 15 Association between living environment and knowledge level (p-value by Chi-square test)

Characteristics	n	Level of knowledge				X^2	p-value
		Poor		Moderate			
		n	%	n	%		
Take care of domestic animals						2.210	0.137
Yes	185	158	85.4	27	14.6		
No	87	68	78.2	19	21.8		
Seen animals in/around house							
Wild life						0.733	0.392
Yes	116	99	85.3	17	14.7		
No	156	127	81.4	29	18.6		
Bat						4.850	0.028*
Yes	92	70	76.1	22	23.9		
No	180	156	86.7	24	13.3		
Own fruit trees at home						0.017	0.896
Yes	85	71	83.5	14	16.5		
No	187	155	82.9	32	17.1		
Regulations regarding bats						0.351	0.554
Yes	137	112	81.8	25	18.2		
No	135	114	84.4	21	15.6		

*Statistically significant association at p-value < 0.05

Table 16 Difference of knowledge score on living environment (p-value by Mann-Whitney U test)

Characteristics	n	Mean rank	*p*-value
Take care of domestic animals			0.007*
Yes	185	127.78	
No	87	155.05	
Seen animals in/around house			
Wild life			0.067
Yes	116	126.44	
No	156	143.98	
Bat			<0.001*
Yes	92	160.45	
No	180	124.26	
Own fruit trees at home			0.396
Yes	85	130.55	
No	187	139.20	
Regulations regarding bats			0.996
Yes	135	136.48	
No	137	136.52	

*Statistically significant association at *p*-value < 0.05

4.2.1.2. Association between general characteristics and attitude

Table 17, Table 18 and Table 19 show the results of the bivariate analysis between general characteristics and attitude. One respondent with "other" in the educational level and 13 respondents who did not know family income were excluded in the analysis for each variable.

Spearman's correlation between general characteristics and attitude score showed there was no significant correlation among the variables (Table 17). The results of Chi-square test showed educational level was significantly associated with the level of attitude (p=0.021). Higher educated respondents (upper secondary, college or university) had a higher attitude than those with lower education (none, primary or lower secondary) (62.7% vs 45.8%) (Table 18). The results of Mann-Whitney U test showed a significant difference in attitude score on education (p<0.001) and family income (p=0.003) (Table 19).

Table 17 Correlation between general characteristics and attitude score (p-value by Spearman's correlation

Characteristics	Correlation coefficient	*p*-value
Age	-0.068	0.267
Number of household members	0024	0.697
Length of living	0.067	0.268

*Statistically significant correlation at *p*-value < 0.05

Table 18 Association between general characteristic and attitude level (p-value by Chi-square test)

Characteristics	n	Level of attitude				X^2	*p*-value
		Poor		Good			
		n	%	n	%		
Gender						0.011	0.916
Male	127	64	50.4	63	49.6		
Female	145	74	51.0	71	49.0		
Marital status						0.015	0.992
Single	86	44	51.2	42	48.8		
Married	144	73	50.7	71	49.3		
Others	42	21	50.0	21	50.0		
Education						5.309	0.021*
None/primary/lower secondary	212	115	54.2	97	45.8		
Upper secondary/college/university	59	22	37.3	37	62.7		
Occupation						2.322	0.313
Farmer	80	35	43.8	45	56.3		
Employee/Shop owner	153	83	54.2	70	45.8		
Student/Housewife/Unemployed	39	20	51.3	19	48.7		
Family income/month (Bahts)						1.790	0.181
≤20000	210	108	51.4	102	48.6		
>20000	49	20	40.8	29	59.2		

*Statistically significant association at *p*-value < 0.05

Table 19 Difference in attitude score on socio-demographic characteristics (p-value by Kruskal-Wallis H test and Mann-Whitney U test)

Characteristics	n	Mean rank	*p*-value
Gender[a]			0.754
Male	127	138.09	
Female	145	135.10	
Marital status[b]			0.980
Single	86	136.85	
Married	144	135.73	
Others	42	138.44	
Education[a]			0.001*
None/Primary/Lower Secondary	212	128.03	
Upper secondary/College/University	59	164.64	
Occupation[b]			0.270
Farmer	80	146.71	
Employee/Shop owner	153	129.85	
Student/Housewife/Unemployed	39	141.63	
Family income/month (Bahts)[a]			0.003*
≤20000	210	123.30	
>20000	49	158.72	

*Statistically significant association at *p*-value<0.05
a, Mann-Whitney U test; b, Kruskal-Wallis H test

Table 20 presented the results of Chi-square test between the living environment and attitude. The activity "take care of domestic animals" was significantly associated with the level of attitude (p=0.021). The majority of the respondents who took care of their animals showed good attitude (54.1%), which is higher than those without this activity (39.1%). The results of Mann-Whitney U test showed a significant difference in attitude score on "take care of domestic animals" (p<0.001) and "see bats in or around a house" (p=0.033) (Table 21).

Table 20 Association between living environment and attitude (p-value by Chi-square test)

Characteristics	n	Level of attitude				X^2	*p*-value
		Poor		Good			
		n	%	n	%		
Take care of domestic animals						5.308	0.021*
Yes	185	85	45.9	100	54.1		
No	87	53	60.9	34	39.1		
Seen animals in/around house							
Wild life						0.489	0.484
Yes	116	56	48.3	60	51.7		
No	156	82	52.6	74	47.4		
Bat						0.888	0.346
Yes	92	43	46.7	49	53.3		
No	180	95	52.8	85	47.2		
Own fruit trees at home						0.309	0.578
Yes	85	41	48.2	44	51.8		
No	187	97	51.9	90	48.1		
Regulations regarding bats						1.195	0.274
Yes	135	73	54.1	62	45.9		
No	137	65	47.4	72	52.6		

*Statistically significant association at *p*-value < 0.05

Table 21 Difference in attitude score on living environment (p-value by Mann-Whitney U test)

Characteristics	n	Mean rank	*p*-value
Take care of domestic animals			<0.001*
Yes	185	149.72	
No	87	108.40	
See animals in/around house			
Wild life			0.195
Yes	116	143.65	
No	156	131.18	
Bat			0.033*
Yes	92	150.68	
No	180	129.25	
Own fruit trees at home			0.087
Yes	85	148.58	
No	187	131.01	
Regulations regarding bats			0.076
Yes	135	128.00	
No	137	144.88	

4.2.1.3. Association between knowledge and attitude

Spearman correlation was determined to explore the relationship between knowledge and attitude score (Table 22). The knowledge score presented a low positive correlation with the attitude score (r_s=0.227, p<0.001).

Table 23 shows the result of Chi-square test between knowledge and attitude level. In this study, a significant association was confirmed between knowledge and attitude level (p=0.04). The attitude level was higher in the respondents with moderate knowledge (63.0%) than those with poor knowledge (46.5%).

Table 22 Correlation between knowledge and attitude score (p-value by Spearman's correlation)

Variable	Correlation coefficient	*p*-value
Knowledge score	0.227	<0.001*

*Statistically significant correlation at p-value < 0.05

Table 23 Association between knowledge and attitude level (p-value by Chi-square test)

	n	Attitude level				X^2	*p*-value
		Poor		Good			
		n	%	n	%		
Knowledge level						4.205	0.040*
Poor	226	121	53.5	105	46.5		
Moderate	46	17	37.0	29	63.0		

*Statistically significant association at p-value < 0.05

Table 24 Summary of bivariate analyses between general characteristics, knowledge and attitude (shown by p-value)

	Knowledge				Attitude			
Independent variables	Spearman's correlation	Chi-square test	Kruskal-Wallis H test	Mann-Whitney U test	Spearman's correlation	Chi-square test	Kruskal-Wallis H test	Mann-Whitney U test
Age	0.320				0.267			
Gender		0.877		0.871		0.916		0.754
Marital status		0.998	0.880			0.992	0.980	
Education		0.936		0.975		0.021*		0.001*
Occupation		0.257	0.815			0.313	0.270	
Family income		0.839		0.836		0.181		0.003*
Number of household members	0.027*				0.697			
Length of living	0.941				0.268			
Take care of animals		0.137		0.007*		0.021*		<0.001*
Seen wild animals		0.392		0.067		0.484		0.195
Seen bats		0.028*		<0.001*		0.346		0.033*
Own fruit trees		0.896		0.396		0.578		0.087
Regulations regarding bats		0.554		0.996		0.274		0.076
Knowledge					<0.001*	0.040*		

*Statistically significant association at *p*-value < 0.05

4.2.2. Multivariate association analysis

In order to explore the factors associated with knowledge and attitude, multiple linear regression was conducted. In performing it, one participant who answered that the educational level was "other" and 13 respondents who did not know household income were excluded. Finally, 258 respondents were included in multivariate analysis.

4.2.2.1. Factors associated with knowledge

Independent variables (predictors) put into the multiple regression for knowledge score were a number of household members, activities "take care of domestic animals", "seen wild animals in or around a house" and "see bats in or around a house" and attitude score. Table 25 shows the result of the multiple linear regression, which shows that the predictors explain 6.9% of the variance (R^2 = 0.069, F=4.702, p=0.001). Only "see bats in or around a house" was significantly associated with attitude score (B=0.92; ß=0.19; 95% CI 0.34, 1.49; p=0.002).

Table 25 Multiple linear regression for knowledge score

	B	SE	ß	*t* value	*p* value	95% CI	
						Lower	Upper
Constant	11.30						
Number of household members	0.06	0.08	0.05	0.79	0.431	-0.09	0.22
Take care of domestic animals							
No	Ref						
Yes	-0.59	0.31	-0.12	-1.90	0.058	-1.20	0.02
Seen wild animals in/around house							
No	Ref						
Yes	-0.29	0.29	-0.06	-1.00	0.316	-0.87	0.28
Seen bats in/around house							
No	Ref						
Yes	0.92	0.29	0.19	3.1	0.002*	0.34	1.49

R^2 = 0.069; F=4.702; B, unstandardized coefficient; ß, Standardized coefficient; SE, standard error; CI, confidence interval; *Statistically significant association at p-value<0.05

4.2.2.2. Factors associated with attitude

Independent variables (predictors) put into the multiple regression for attitude score were education, family income, activity "take care of domestic animals" and "see wild animals in or around a house", "see bats in or around a house", "own fruit trees at home", "regulations regarding bats" and knowledge score. Table 26 presents the result of the multiple linear regression. It showed the predictors explained 22.9% of the variance (R^2 = 0.229, F=9.23, p<0.001). Higher educational level (B=2.23; ß=0.17; p=0.004; 95% CI 0.71, 3.75), "take care of domestic animals" (B=3.65; ß=0.31; p<0.001; 95% CI 2.24, 5.07) and knowledge score (B=0.55; ß=0.23; p<0.001; 95% CI 0.28, 0.83) were significantly associated with the attitude score.

Table 26 Multiple linear regression for attitude score

	B	SE	ß	*t* value	*p* value	95% CI	
						Lower	Upper
Constant	32.85						
Education							
Lower	Ref						
Higher	2.23	0.77	0.17	2.88	0.004*	0.71	3.75
Family income per month							
≤20000	Ref						
>20000	1.56	0.83	0.11	1.88	0.061	-0.08	3.20
Take care of domestic animals							
No	Ref						
Yes	3.65	0.72	0.31	5.09	<0.001*	2.24	5.07
Seen wild animals in/around a house							
No	Ref						
Yes	0.36	0.65	0.03	0.56	0.576	-0.91	1.63
Seen bats in/around a house							
No	Ref						
Yes	0.85	0.65	0.07	1.30	0.195	-0.44	2.13
Own fruit trees at home							
No	Ref						
Yes	0.57	0.67	0.05	0.85	0.397	-0.75	1.89
Regulations regarding bats							
No	Ref						
Yes	-0.68	0.63	-0.06	-1.07	0.285	-1.93	0.57
Knowledge Score	0.55	0.14	0.23	4.01	<0.001*	0.28	0.83

R^2 = 0.229; F=9.23; B, unstandardized coefficient; ß, Standardized coefficient; SE, standard error; CI, confidence interval; Education; lower (none, primary and lower secondary), higher (higher secondary, college and university); *Statistically significant association at p-value<0.05

CHAPTER V DISCUSSION

5.1. Descriptive information

5.1.1. General characteristics

Concerning the ownership of domestic animals, almost all respondents have at least one kind of animals (97.4%) and high prevalence was found in animals which can be infected with NiV such as cats (53.7%) and dogs (43.0%). Other susceptible animals such as cattle, pig, horse and goat were not common in the study site (4.0%, 2.2%, 1.1% and 0.4%, respectively). The majority of the respondents answered that they took care of their domestic animals; People in this area commonly had daily interactions with animals.

Our findings show that around one-third of respondents have seen bats in or around their house. However, human-bat interactions via fruits at home or a fruit orchard were unlikely common; only 6 respondents (2.2%) found bats near fruits trees at home and none of the fruit orchard owners saw them at their orchard, although any households were located within several kilometers from the bush where flying foxes were roosting and one-third of them had fruit trees at home. Considering the ability to fly long distance (61), flying foxes may go to other areas to find their food. Regarding bat-domestic animal interactions, no respondents responded that they kept animals near fruit trees at home or a fruit orchard. However, people in this area commonly let their animals such as dogs and cats move around freely in or outside their house. Those animals might reach a fruit consumed and dropped by flying foxes, being exposed to a pathogen from bats, which indicates the possible risk of Nipah virus disease in this area.

5.1.2. Level of knowledge toward bat-borne disease

In this area, basic knowledge of zoonoses was high; almost all respondents correctly answered that animals can transfer disease to a human with the examples of animals and zoonoses (99.6%, 99.3% and 98.2%, respectively). Also, 83.5% of the respondents responded that disease can be transmitted between animals. The respondents frequently provided rabies, dengue fever and/or avian influenza as an example of zoonoses. Thailand is the endemic area of rabies and Dengue fever and

experienced the outbreak of high pathogenic avian influenza both in human and poultry, which can contribute to a high knowledge of zoonotic disease. In contrast, knowledge of bat-borne disease was not prevailing in this study sample. Less than half of the respondents answered that bats can transfer disease to human (30.5%) and animals (43.0%). Moreover, knowledge of rabies from bats was low, with 37.9% of respondents answered rabies can be transmitted by bats. Nevertheless, those proportions were higher compared with the previous reports. A research conducted in Thailand among people at risk of bat exposure reported the proportion of people with knowledge of bat-borne rabies and other diseases as 10% and 17% (17). Besides, the prevalence of knowledge of bat as a source of rabies and other zoonoses was 10% and 10% among people living in rural communities with bat roosts in Guatemala (50). Furthermore, the respondents of this study showed higher knowledge regarding the risk of contact with bats or bat secretions. This trend was consistent with the result of the prevention part; almost respondents answered that people should avoid touching fruits eaten by bats and sick animals. Therefore, the respondents had relatively higher knowledge of bat-borne disease, although there was much room to improve their knowledge.

Regarding Nipah virus disease, no ones responded that they have ever heard Nipah virus disease before. So far, no human and animal case of Nipah virus disease has been reported in Thailand. Besides, only 3.3% answered that they have ever obtained information on bat-borne disease. The respondents likely had few opportunities to get information on Nipah virus disease, resulting in the lack of knowledge of Nipah virus disease.

5.1.3. Level of attitude toward bat-borne disease

In the attitude section, the same trend with the knowledge section was found; The respondents showed high awareness of the risk of disease via direct contact with bats or bat secretions/excretions. The majority of the respondents agreed that frequent contact with bats can cause disease (65.8%), food or fruit eaten by bats were contaminated (64.7%) and bats excretions can make them sick (64.8%).

Some research reported that perception on bat-borne disease was low even people having practices related to human-bat interaction. In Indonesian Borneo, only

1% of bat hunters and 2% of bat vendors showed awareness toward the risk of disease from flying foxes (51). The research conducted among people living in the communities where bat-bushmeat activity was common in Ghana reported that 23% of respondents presented perception on bat-borne disease risk related to their activities (28). In contrast, respondents of this study showed relatively high awareness toward bat-borne disease despite the fact that no fatal bat-borne disease. Considering the high knowledge of zoonotic diseases in this sample, respondents were likely awareness of bat-borne disease in a way similar to other zoonotic diseases from different animals.

5.1.4. Practices toward bat-borne disease

In Thailand, practices related to human-bat interactions such as hunting and eating bats and collecting bat feces are reported in some locates (26). In this research, five respondents reported their activities related to human-bat interactions. The risk of exposure to Nipah virus via direct contact with flying foxes is likely low.

Hunting and consumption of bats have traditional and cultural aspects (24, 28, 51). In the research site, flying foxes have been roosting at the bush since four or five years ago according to the respondents. Thus, residents in this area were unlikely to have any traditional or cultural habits related to flying foxes, resulting in the low prevalence of practices. Besides, the value of bats as food was likely low among residents in this area. Most respondents did not agree that eating bats is good for health, although consumption of bats can be motivated by the belief of its health benefit (26, 28). Moreover, the location of the bush can be one of the reasons. The bush was located in the middle of the community and very close to the local government office. Considering the prohibition of bat hunting in this area, this position could prevent people from hunting flying foxes. Furthermore, the perception of the preservation of flying foxes was high among the respondents. Most respondents agreed that bats should be protected, which could contribute to few activities related to human-bat interactions as well.

In this study sample, only one participant answered the experience of collecting and using bat feces as fertilizer. In general, bat feces are collected in a cave where a tremendous number of bats are living in Thailand. In contrast, in the bush of the research site, feces of flying foxes dropped on soil and not accumulated on the

ground. Therefore, the bush was unlikely a good source of bat feces and neighbors did not collect feces there.

A relationship between prevalence and frequency of practices and knowledge and perception of bat-borne disease is still unclear due to the lack of studies. However, higher education and perception of the risk of disease were suggested possible factors associated with a decrease in bat consumption activities (28). In this study, respondents showed relatively higher knowledge of bat-borne disease and awareness of disease risk compared with previous studies. Those factors possibly affected the low prevalence of practices, although this association was uncertain because of the lack of statistical analysis.

5.2. Analytical information

5.2.1. Level of knowledge toward bat-borne disease

The result of multiple linear regression presents that experience of seeing bats in or around a house was positively associated with knowledge score. This relationship is possibly explained that respondents looked for information on bat-borne disease to understand the health risk due to bats when people saw them in or around their home, although the detail of this association is unclear.

Socio-economic status such as educational background and income level is commonly associated with knowledge of a particular disease (62, 63). However, our findings showed no association between both of them and knowledge score. This can be explained by the scarce experience of getting information on bat-borne disease; only 3.3% of respondents answered that they acquired such information before and no one has ever heard of Nipah virus disease. Therefore, it is likely that lack opportunities to learn bat-borne disease and Nipah virus disease result in no difference in knowledge among people with various educational and economic background.

5.2.2. Level of attitude toward bat-borne disease

An association between socio-economic status and attitude toward disease risk is commonly found. Likewise, an association between high education and increased perception toward bat-borne disease was suggested (28), which indicates that a similar

association can be found in the context of bat-borne disease. Our findings support this idea; higher educational level showed a positive association with attitude score (ß=2.23, p=0.004). Besides, the difference in attitude score on income level was found in bivariate analysis; people with higher income tend to have higher attitude score, although the association between income status and attitude score was not significant in the multiple linear regression model (ß=1.56, p=0.061).

Interestingly, management of domestic animals showed a positive association with attitude score (ß=3.65, p<0.001). People taking care of animals have daily contact with their animals and closer to a risk of zoonotic disease. It is plausible that they have a higher awareness of zoonotic diseases, which could lead them to have higher attitudes toward diseases from other animals.

This study confirms the association between knowledge and attitude toward bat-borne disease (ß=0.55, p<0.001), which suggests that a conventional strategy and concept for health promotion can be applied to improve people's awareness and perception of bat-borne disease, in particular, Nipah virus disease. In this area, human-bat interactions were low and the risk of Nipah virus is unlikely high. However, given that NVD can cause serious impact on public and animals health, health promotion to enhance knowledge and awareness of NVD is highly recommended to prevent people and animals from possible exposure to NiV. Our findings provide the pathway for educational interventions. First, as described above, conventional approaches for improvement of attitude toward disease can be utilized effectively in the context of bat-borne disease including Nipah virus disease as well. Secondly, residents in this area are highly aware of the possibility of zoonotic disease and recognized that direct contact with animals or exposure to their secretions and excretions were major transmission routes of zoonotic disease. Therefore, most people would easily understand transmission route and preventive measures of Nipah virus disease such as avoid contact with body fluid of bats and fruits eaten by flying bats.

CHAPTER VI CONCLUSION

6.1. Conclusion

Nipah virus disease is severe disease and prevention is vital in terms of its significant impact on public and animal health and lack of a specific agent for vaccination and treatment. However, key information for health promotion, i.e., people's knowledge, attitude and practices and the detail of human-animal-bat interface, was poorly understood. Therefore, we conducted a cross-sectional study to figure out the extent of knowledge, attitude and practices toward Nipah virus disease and identify associated factors among people living close to the flying foxes roost in the semi-urban area, central Thailand.

Our findings represented inadequate knowledge and attitude toward bat-borne disease including Nipah virus disease. Most people did not know that bat could transfer disease to human and believed that they would not get disease from bats. On the other hand, people showed their awareness of health risk of direct contact with bats or their secretions/excretions, which likely derived from knowledge of other zoonotic diseases. Moreover, practices related to human-bat interactions were confirmed and the chance of exposure to bat-borne pathogen was possible, although the prevalence of practices was markedly low and the risk of transmission via contact with bats was likely little in this area.

We also found high educational background and knowledge were associated with higher attitude toward bat-borne disease. This finding indicates an implementation of a conventional health promotion approach would be practical to enhance people's attitude toward bat-borne disease including Nipah virus disease. Such promotion is expected to decrease activities related to human-bat interactions and possible exposure to Nipah virus disease. Furthermore, people taking care of their animals showed higher attitude toward bat-borne disease, which can be attributed to high awareness of general zoonoses.

The results of this current research are subject to some limitations and might not apply to other settings. A more epidemiological study is vital to explore people's knowledge, attitude and practices and associated factors to assess the risk of Nipah

virus disease and develop preventive strategies. Nevertheless, this study can serve as a basis for further investigations of human-animal-bat interface for prevention of Nipah virus disease and other bat-borne diseases. Comparative approach between different regions would be instrumental in understanding spatiotemporal variability. Moreover, in the future study, application of One Health approach involving professionals from multiple disciplines including public health, animal health, environmental health and social science is highly recommended, which can significantly contribute to disentangle complicated human-animal-bat interface and figure out the risk of Nipah virus disease.

6.2. Recommendation

Based on the findings of this study, recommendations were made as follows

Public health section

A public health section should implement an educational program focusing on bat-borne disease in the context of Nipah virus disease because of the lack of a concrete idea towards Nipah virus disease. A conventional health promotion approach can be applied. The program should highlight the following points.

- Provide specific information on Nipah virus disease to population, which should be focusing on transmission route, symptoms (seriousness) and preventive measures.
- Information should be provided with other zoonotic disease issues, which makes a program more understandable because of the observed high knowledge of zoonotic diseases.

Animal health section

An animal health section should implement a surveillance program of Nipah virus disease in flying foxes and domestic animals in the area close to flying foxes' colony because the possibility of domestic animal-bat interaction suggested in this study.

Environmental health section

This study revealed possible human-bat and human-domestic animal-bat interaction which could lead people and animals to be exposed to Nipah virus. However, the information on activities of flying foxes was limited to self-reported, and the detail of their activities was still unknown. Thus, to understand human-animal-bat interface more precisely and deeply, a study about bat behaviors should be conducted by a professional from the discipline of environment or ecology.

6.3. Limitation

- Data collection was carried out among the population living in Ban Luang subdistrict, Don Thum district, Thailand. Thus, it is unlikely that the respondents of this study are representative of all persons who are living near a flying fox roost in Thailand, although our findings are expected to be applied to people whose socio-demographic features and living environment are similar to those of our sample population.
- In this study, it was assumed that few people knew Nipah virus disease and its features. Thus questions of knowledge and attitude included those related to general zoonoses and bat-borne disease and were not specific to Nipah virus disease.
- Our findings may have been subject to recall bias because the respondents answered their practices in this current one year and practices related to human-bat interactions occurred infrequently.
- There can be a social desirability bias because bat hunting was prohibited in the research site and this regulation was well-known among the sample population. Therefore, the respondents of this study might not reveal their experience of hunting and consumption of bats. In addition, people might answer questions on knowledge and attitude parts in the matter which would be considered favorable.

- The sample size was calculated based on the prevalence of practices reported in the previous study. The statistical power could be not enough for the statistical analysis on knowledge and attitude.

6.4. Further study

- A questionnaire survey which covers broader areas near a roost of flying foxes, in particular, the area where large-scale animal farms and/or fruit orchards were situated should be included as flying foxes can fly over a long distance. When it comes to Nakhon Pathom Province, many large-scale pig farms are located in this province. Also, production of fruits is common and fruit orchards situated in this area. Therefore, human-bat or livestock-bat interactions can happen, which could result in exposure to bat-borne pathogens. Therefore, further research in Nakhon Pathom province is highly expected to assess the risk of Nipah virus disease.
- A qualitative study should be useful to understand knowledge, attitude and practices as well as associated factors more deeply and precisely. In-depth interview and focus group interview would enable us to obtain critical information to figure out people's knowledge and attitude along with their background factors. Observation is highly recommended to find out human-bat and human-animal-bat interaction more precisely (triangulation of quantitative and qualitative should be conducted).
- A study which utilizes One Health approach involving stakeholders from public health, animal health, environmental health and social science should be conducted to understand human-domestic animal-bat interface and assess the risk of Nipah virus disease in Thailand.

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APPENDICES

APPENDIX I - QUESTIONNAIRE (ENGLISH)

The questionnaire is divided into 4 parts. Please answer each of the questions below. Be assured that your answers will be kept confidential. There is no way we can link your name with your answer on the questionnaires. Please answer by TICKING √ or writing in the given spaces.

Code No._____ Interviewer ID: _____ Interview date_____/____/2018

1) Section A: General Characteristic

1. How old are you? _____ years

2. What is your gender?
☐ 1. Male ☐ 2. Female

3. What is your marital status?
☐ 1. Single ☐ 2. Married ☐ 3. Separated
☐ 4. Divorced ☐ 5. Widowed

4. What is your education you finished?
☐ 1. No education ☐ 2. Primary school ☐ 3. Lower secondary school
☐ 4. Upper secondary school ☐ 5. College/university ☐ 6. Other (Please specify)…

5. What is your current occupation?
☐ 1. Farmer ☐ 2. Employee ☐ 3. Shop owner
☐ 4. Student ☐ 5. Housewife/unemployed ☐ 6. Other (Please specify)

6. How much is your average family income per month?
☐ 1. Less than 10,000 baht ☐ 2. 10,000 to 20,000 baht
☐ 3. 20,001 to 30,000 baht ☐ 4. More than 30,000 baht
☐ 5. Don't know

7. How many people in your house? (include you)
(1) Children (age below 18) _____ person
(2) Adult (equal or over 18) _____ person

8. How long have you lived here? (Don Thum district) _____years

9. Which kinds of domestic animals do you have?
☐ 1. Dog ☐ 2. Cat ☐ 3. Chicken
☐ 4. Cattle ☐ 5. Pig ☐ 6. Goat
☐ 7. Birds ☐ 8. Horse ☐ 9. Other (Please specify)…

10. Do you take care of domestic animals (*i.e.* have physical contact with domestic animal)?
☐ 1. Yes ☐ 2. No

11. Do you see wild animals* in or around your house?
☐ 1. Yes ☐ 2. No

12. Do you see bats in or around your house?
☐ 1. Yes ☐ 2. No

13. Do you own fruit trees at home?
☐ 1. Yes ☐ 2. No

If yes,
13.1. Do you ever see bats around fruit trees at home?
☐ 1. Yes ☐ 2. No

13.2. Do you keep any animals around fruit trees at home?
☐ 1. Yes ☐ 2. No
↓
Please specify _____

14. Do you own fruit orchards?
☐ 1. Yes ☐ 2. No

If yes,
14.1. Do you ever see bats in the fruit orchards?
☐ 1. Yes ☐ 2. No

14.2. Do you keep any animals around the fruit orchards?
☐ 1. Yes ☐ 2. No
↓
Please specify _____

15. Does your community have any regulations regarding bats?
☐ 1. Yes ☐ 2. No

*wild animals: animals which are living outside a house and not tamed or domesticated. An animal that a resident feeds is not categorized as a wild animal even though it is living outside his/her house.

2) Section B: Knowledge toward Nipah virus disease

1. Have you ever received or heard any information about disease transferred from bats?

☐ 1. Yes ☐ 2. No

2. Which of the following source do you use to obtain the information about disease? (can be answered more than one)

☐ 1. Public health officer
☐ 2. Hospital
☐ 3. Television
☐ 4. Internet
☐ 5. Smartphone
☐ 6. Newspaper
☐ 7. Family member
☐ 8. Neighbor
☐ 9. Other (please specify) _____

3. Please answer whether the following statements are true?

(Please answer every question)

No.	Questions	1. Yes	2. No	3. Don't know
General knowledge of infectious disease from animals				
1	Animals can transmit disease to human. If yes, 1.1 Please specify the name of animals which can transmit disease to human. 1.2 Please specify the name of diseases which can be transmitted from animals to human.	☐	☐	☐
		[ ]		
		[ ]		
2	Animals can get sick with diseases transmitted from other animals.	☐	☐	☐
3	Zoonosis develops only when people have direct contact (physical contact) with animals. *	☐	☐	☐
4	Eating raw or not well-cooked animals can cause disease.	☐	☐	☐
Knowledge of bat-borne disease				
5	Bats can transmit disease to human.	☐	☐	☐
6	Bats can transmit disease to other animals.	☐	☐	☐
7	People cannot get disease due to a bat bite or scratch. *	☐	☐	☐
8	Hunting bats might make you sick.	☐	☐	☐

9	Butchering bats might make you sick.	☐	☐	☐
10	Eating raw or not well-cooked bats might make you sick.	☐	☐	☐
11	People cannot get disease by eating fruits that a bat ate. *	☐	☐	☐
12	Disease can be transmitted via bat urine or feces.	☐	☐	☐
13	Rabies can be transmitted by bats.	☐	☐	☐
Knowledge of Nipah virus disease				
14	Have you ever heard Nipah virus disease? If 'No' or 'Don't know', please skip No.15-17	☐	☐	☐
15	Nipah virus can be transmitted by bats and other animals.	☐	☐	☐
16	Nipah virus disease is life-threatening disease.	☐	☐	☐
17	Nipah virus disease can be transmitted from human to human.	☐	☐	☐
Prevention				
18	Hand cleaning with a soap is sufficient to prevent infectious disease. *	☐	☐	☐
19	People should avoid touching fruits that a bat ate.	☐	☐	☐
20	People should avoid contacting sick animals.	☐	☐	☐
21	Wearing glove when touching bats is important to prevent disease transmitted from bats.	☐	☐	☐

*means incorrect

3) Section C: Attitude toward Nipah virus disease

No.	Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Susceptibility						
1	I think there is a risk of getting disease from bats.	☐	☐	☐	☐	☐
2	I think people contacting bats frequently can get diseases from bats.	☐	☐	☐	☐	☐
3	I think food or fruit that bats ate are contaminated.	☐	☐	☐	☐	☐
4	I think getting into bat caves or going to near bat roosts increase the risk of getting disease from bats.	☐	☐	☐	☐	☐
5	I think contacting bats can make human sick.	☐	☐	☐	☐	☐
Seriousness / Threat						
6	I think disease from bats can be serious or life-threatening.	☐	☐	☐	☐	☐
7	I am concerned about diseases transmitted from bats.	☐	☐	☐	☐	☐
8	I think disease from bats to human can be incurable.	☐	☐	☐	☐	☐
9	I believe that touching bats with bear hands is not risky. *	☐	☐	☐	☐	☐
Perception on bats						
10	I think bats bring disease to human.	☐	☐	☐	☐	☐
11	I think excretions of bats such as feces or urine can make me sick.	☐	☐	☐	☐	☐
12	I think bats should be protected.	☐	☐	☐	☐	☐
13	I think eating bats is good for health. *	☐	☐	☐	☐	☐

Note: * means incorrect

4) Section D: Practices toward Nipah virus disease

Note: Practices in the previous one year

No.	Questions	1. Yes	2. No
1	Have you ever touched a bat, its carcass or bat feces? If yes, how often did you use any protective measure such as gloves? ☐ 1. Every time ☐ 2. Often ☐ 3. Sometimes ☐ 4. Never	☐	☐
2	Have you ever hunted bats? If yes, how often? ☐ 1. Weekly ☐ 2. Monthly ☐ 3. Several times per year ☐ 4. Less than several times per year	☐	☐
3	Have you ever butchered/prepared bats? If yes, how often? ☐ 1. Weekly ☐ 2. Monthly ☐ 3. Several times per year ☐ 4. Less than several times per year	☐	☐
4	Have you ever eaten bats? If yes, how often? ☐ 1. Weekly ☐ 2. Monthly ☐ 3. Several times per year ☐ 4. Less than several times per year	☐	☐
5	Have you ever collected bat feces (guano)? If yes, how often? ☐ 1. Weekly ☐ 2. Monthly ☐ 3. Several times per year ☐ 4. Less than several times per year	☐	☐
6	Have you ever used bat feces (guano) as fertilizer? If yes, how often? ☐ 1. Weekly ☐ 2. Monthly ☐ 3. Several times per year ☐ 4. Less than several times per year	☐	☐
7	Have you ever been bitten or scratched by bats? If yes, how many times? ☐ 1. Once ☐ 2. More than once	☐	☐

APPENDIX II - QUESTIONNAIRE (THAI)

แบบสอบถามมีทั้งหมด 4 ส่วน โปรดตอบคำถามแต่ละข้อด้านล่างนี้ โดย**มั่นใจได้ว่าคำตอบของคุณจะถูกเก็บเป็นความลับ กรุณาตอบโดยทำเครื่องหมาย / หรือเติมคำตอบในช่องว่างที่ระบุไว้**

Code No._____ Interviewer ID: _____ Interview date_____/____/2018

1) ส่วนที่ 1: ข้อมูลทั่วไป

1. **อายุ _____ ปี**

2. **เพศ**
☐ 1. **ชาย** ☐ 2. **หญิง**

3. **สถานะการสมรสของคุณคืออะไร**
☐ 1. **โสด** ☐ 2. **สมรส** ☐ 3.**แยกกันอยู่**
☐ 4. **หย่าร้าง** ☐ 5. **ม่าย**

4. **คุณสำเร็จการศึกษาในระดับใด?**
☐ 1. **ต่ำกว่าประถมศึกษา** ☐ 2. **ประถมศึกษา** ☐ 3. **มัธยมศึกษาตอนต้น**
☐ 4. **มัธยมศึกษาตอนปลาย** ☐ 5. **มหาวิทยาลัย** ☐ 6. **อื่น ๆ (โปรดระบุ)…**

5. **อาชีพปัจจุบัน**
☐ 1. **เกษตรกร** ☐ 2. **ลูกจ้าง** ☐ 3. เจ้าของกิจการ
☐ 4. **นักเรียน** ☐ 5. **แม่บ้าน/ ว่างงาน** ☐ 6. **อื่นๆ (โปรดระบุ)**

6. **รายได้ครอบครัวเฉลี่ยต่อเดือน**
☐ 1. **น้อยกว่า** 10,000 **บาท** ☐ 2. 10,000 **ถึง** 20,000 **บาท**
☐ 3. 20,001 **ถึง** 30,000 **บาท** ☐ 4. **มากกว่า** 30,000 **บาท**
☐ 5. **ไม่ทราบ**

7. **จำนวนผู้พักอาศัยในบ้านของคุณ (รวมตัวคุณด้วย)**
(1) **เด็ก (อายุต่ำกว่า** 18 **ปี)** _____ **คน**
(2) **ผู้ใหญ่ (เท่ากับหรือมากกว่า** 18 **ปี)** _____ **คน**

8. **คุณพักอาศัยอยู่ที่ตำบลดอนตูม จังหวัดนครปฐมมานานเท่าไหร่ _____ ปี**

9. คุณมี**สัตว์เลี้ยงชนิดใดบ้าง (ตอบได้มากกว่า** 1 **ข้อ)**
☐ 1. **หมา** ☐ 2. **แมว** ☐ 3. **ไก่**
☐ 4. **โค/กระบือ** ☐ 5. **หมู** ☐ 6. **แพะ**
☐ 7. **นก** ☐ 8. **ม้า** ☐ 9. **อื่น ๆ (โปรดระบุ)…**

10. คุณดูแลสัตว์เลี้ยงด้วยตัวเองหรือไม่ คุณสัมผัสกับตัวสัตว์หรือไม่
☐ 1. ดูแล ☐ 2. ไม่ดูแล

11. คุณเคยพบเห็นสัตว์ป่า*ในบริเวณบ้านหรือรอบๆบริเวณบ้านของคุณหรือไม่
☐ 1. เคย ☐ 2. ไม่เคย

12. คุณเคยพบเห็นค้างคาวในบริเวณบ้านหรือรอบๆบริเวณบ้านของคุณหรือไม่
☐ 1. เคย ☐ 2. ไม่เคย

13. คุณมีต้นผลไม้ที่บ้านหรือไม่?
☐ 1. มี ☐ 2. ไม่มี

ถ้ามีกรุณาตอบคำถาม ข้อ 13.1 และ 13.2

13.1. คุณเคยเห็นค้างคาวอยู่บริเวณต้นผลไม้นั้นหรือไม่?
☐ 1. เคย ☐ 2. ไม่เคย

13.2. คุณเก็บสัตว์เลี้ยงในบริเวณต้นผลไม้นั้นหรือไม่?
☐ 1. เก็บ ☐ 2. ไม่เก็บ
↓
โปรดระบุ_____

14. คุณมีสวนผลไม้หรือไม่?
☐ 1. มี ☐ 2. ไม่มี

ถ้ามีกรุณาตอบคำถาม ข้อ 14.1 และ 14.2

14.1. คุณเคยเห็นค้างคาวในสวนผลไม้หรือไม่?
☐ 1. เคย ☐ 2. ไม่เคย

14.2. คุณเก็บสัตว์เลี้ยงในสวนผลไม้หรือไม่?
☐ 1. เก็บ ☐ 2. ไม่เก็บ
↓
โปรดระบุ_____

15. ชุมชนของคุณมีข้อห้ามเกี่ยวกับค้างคาวหรือไม่
☐ 1. มี ☐ 2. ไม่มี

* สัตว์ป่า: สัตว์ที่อาศัยอยู่นอกบ้านและไม่เชื่องหรือไม่ใช่สัว์เลี้ยง สัตว์ที่ชาวบ้านให้อาหารไม่ถือว่า เป็นสัตว์ป่าแม้ว่าจะอาศัยอยู่นอกบ้าน

2) ส่วนที่ 2: ความรู้เกี่ยวกับโรคไวรัส Nipah

1. ท่านเคยได้ยินข้อมูลใด ๆที่เกี่ยวกับโรคที่เกิดจากค้างคาวหรือไม่
   ☐ 1. เคย ☐ 2. ไม่เคย

2. แหล่งข้อมูลใดต่อไปนี้ที่คุณใช้เพื่อหาข้อมูลเกี่ยวกับโรคติดเชื้อ (สามารถตอบได้มากกว่าหนึ่งข้อ)
☐ 1. เจ้าหน้าที่สาธารณสุข
☐ 2. โรงพยาบาล
☐ 3. โทรทัศน์
☐ 4. อินเทอร์เน็ต
☐ 5. โทรศัพท์มือถือ
☐ 6. หนังสือพิมพ์
☐ 7. สมาชิกในครอบครัว
☐ 8. เพื่อนบ้าน
☐ 9. อื่น ๆ (โปรดระบุ) _____

3. โปรดตอบคำถามต่อไปนี้ตามความเป็นจริง
(โปรดตอบทุกคำถาม)

เลขที่	คำถาม	1. ใช่	2. ไม่ใช่	3. ไม่รู้
ความรู้ทั่วไปเกี่ยวกับโรคติดเชื้อจากสัตว์				
1	สัตว์สามารถแพร่กระจายเชื้อโรคสู่มนุษย์ได้ ถ้าใช่	☐	☐	☐
	1.1 โปรดระบุชื่อของสัตว์ที่สามารถถ่ายทอดโรคแก่มนุษย์ได้	[ ]		
	1.2 โปรดระบุชื่อโรคที่สามารถแพร่เชื้อจากสัตว์สู่คนได้	[ ]		
2	สัตว์สามารถป่วยด้วยโรคติดต่อจากสัตว์อื่น ๆ	☐	☐	☐
3	โรคจากสัตว์สู่คนพัฒนาเฉพาะเมื่อผู้คนสัมผัสโดยตรง(สัมผัสทางกายภาพ)กับสัตว์	☐	☐	☐
4	การรับประทานเนื้อสัตว์ดิบๆหรือไม่สุกอาจทำให้เกิดโรคได้	☐	☐	☐
ความรู้เกี่ยวกับโรคค้างคาว				
5	ค้างคาวสามารถแพร่เชื้อโรคแก่มนุษย์ได้	☐	☐	☐

6	ค้างคาวสามารถแพร่เชื้อโรคแก่สัตว์ชนิดอื่นได้	☐	☐	☐
7	คนไม่สามารถติดโรคเนื่องจากถูกค้างคาวกัดหรือถูกค้างคาวข่วน	☐	☐	☐
8	การล่าค้างคาวอาจทำให้คุณป่วยได้	☐	☐	☐
9	การฆ่าค้างคาวอาจทำให้ป่วยได้	☐	☐	☐
10	กินค้างคาวดิบหรือไม่สุกอาจทำให้ป่วยได้	☐	☐	☐
11	คนไม่ติดโรคจากการกินผลไม้ที่ค้างคาวกินเหลือ	☐	☐	☐
12	โรคสามารถส่งผ่านปัสสาวะหรืออุจจาระของค้างคาว	☐	☐	☐
13	โรคพิษสุนัขบ้าสามารถแพร่โดยค้างคาว	☐	☐	☐
ความรู้เกี่ยวกับการติดเชื้อไวรัส นิปาห์				
14	คุณเคยได้ยินการติดเชื้อไวรัสนิปาห์หรือไม่ ถ้าตอบ “ไม่ใช่” หรือ “ไม่รู้” โปรดข้ามคำถามข้อ 15-17	☐	☐	☐
15	ไวรัสนิปาห์ สามารถติดต่อได้โดยค้างคาวและสัตว์อื่น ๆ	☐	☐	☐
16	เชื้อโรคไวรัสนิปาห์เป็นโรคที่คุกคามต่อชีวิต	☐	☐	☐
17	โรคไวรัสนิปาห์สามารถถ่ายทอดจากคนสู่คนได้	☐	☐	☐
การป้องกัน				
18	การล้างมือด้วยสบู่จะเพียงพอสำหรับป้องกันโรคติดเชื้อ	☐	☐	☐
19	คนควรหลีกเลี่ยงการสัมผัสผลไม้ที่ค้างคาวกิน	☐	☐	☐
20	คนควรหลีกเลี่ยงการสัมผัสกับสัตว์ป่วย	☐	☐	☐
21	การสวมถุงมือเมื่อสัมผัสกับค้างคาวเป็นสิ่งสำคัญเพื่อป้องกันโรคที่ติดต่อจากค้างคาว	☐	☐	☐

3) **ส่วนที่** 3: **ทัศนคติต่อโรคไวรัส** Nipah

ตอบ: 1; **ไม่เห็นด้วยอย่างยิ่ง**, 2; **ไม่เห็นด้วย**, 3; **ไม่มีความเห็น**, 4;**เห็นด้วย**, 5; **เห็นด้วยอย่างยิ่ง**

เลขที่	คำถาม	1	2	3	4	5
ความอ่อนแอ						
1	ฉันคิดว่าฉันมีความเสี่ยงที่จะติดโรคจากค้างคาวได้	☐	☐	☐	☐	☐
2	ฉันคิดว่าคนที่สัมผัสกับค้างคาวบ่อยๆมีโอกาสติดโรคจากค้างคาวได้	☐	☐	☐	☐	☐
3	ฉันคิดว่าผลไม้หรืออาหารที่ถูกค้างคาวกัดกินแล้วจะมีเชื้อโรคจากค้างคาวปนเปื้อนอยู่	☐	☐	☐	☐	☐
4	ฉันคิดว่าการเข้าไปในถ้ำที่มีค้างคาวอาศัยอยู่หรือเข้าไปใกล้รังค้างคาวจะเพิ่มโอกาสหรือความเสี่ยงที่จะติดโรคจากค้างคาวได้	☐	☐	☐	☐	☐
5	ฉันคิดว่าการสัมผัสค้างคาวทำให้คนป่วยได้	☐	☐	☐	☐	☐
ความรุนแรง/ภัยคุกคาม						
6	ฉันคิดว่าโรคจากค้างคาวมีความร้ายแรงหรือเป็นอันตรายถึงชีวิต	☐	☐	☐	☐	☐
7	ฉันรู้สึกกังวลใจเกี่ยวกับเรื่องที่ค้างคาวสามารถนำโรคมาสู่คนได้	☐	☐	☐	☐	☐
8	ฉันคิดว่าโรคที่คนติดมาจากค้างคาวไม่สามารถรักษาให้หายได้	☐	☐	☐	☐	☐
9	ฉันเชื่อว่าการจับต้องค้างคาวด้วยมือเปล่าไม่มีความเสี่ยงที่จะติดโรคจากค้างคาว	☐	☐	☐	☐	☐
การรับรู้เกี่ยวกับค้างคาว						
10	ฉันคิดว่าค้างคาวนำโรคสู่คนได้	☐	☐	☐	☐	☐
11	ฉันคิดว่าของเสียที่ถูกขับออกมาจากค้างคาวเช่น อุจจาระ ปัสสาวะ จะทำให้ฉันป่วยได้ถ้าไปสัมผัส	☐	☐	☐	☐	☐
12	ฉันคิดว่าค้างคาวควรได้รับการคุ้มครอง	☐	☐	☐	☐	☐
13	ฉันคิดว่าการกินค้างคาวดีต่อสุขภาพของเรา	☐	☐	☐	☐	☐

4) **ส่วนที่** 4: **การปฏิบัติต่อโรคไวรัส** Nipah

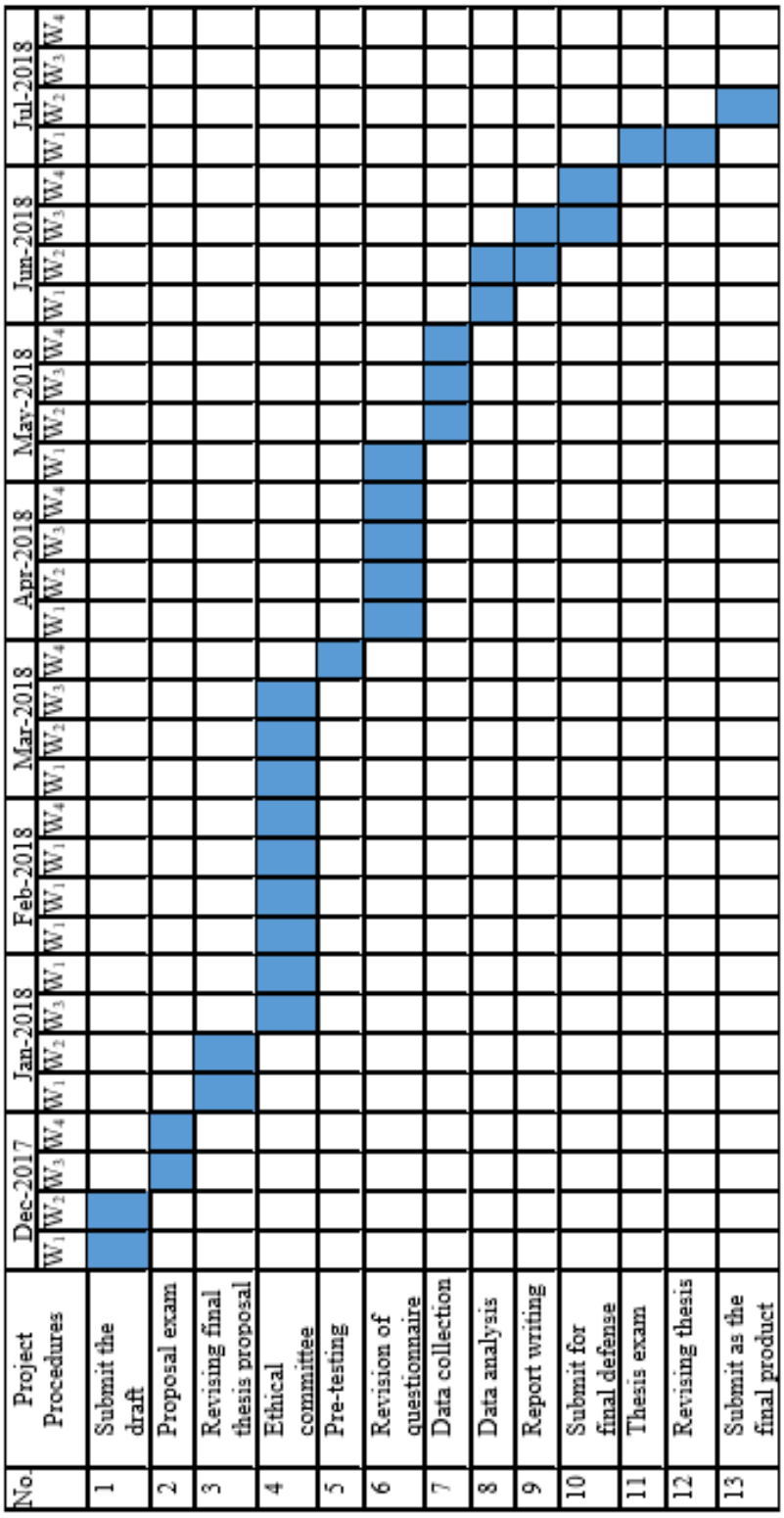
หมายเหตุ: ปฏิบัติในช่วง 1 **ปีที่ผ่านมา**

เลขที่	**คำถาม**	1. **ใช่**	2. **ไม่ใช่**
1	**คุณเคยสัมผัสค้างคาว ซากค้างคาวหรือมูลค้างคาวใช่หรือไม่?** ถ้าใช่ บ่อยแค่ไหนที่คุณใช้อุบกรณ์ป้องกัน เช่น ถุงมือ? ☐ 1. **ทุกครั้ง** ☐ 2. **บ่อยครั้ง** ☐ 3. **บางครั้ง** ☐ 4. **ไม่เคย**	☐	☐
2	**คุณเคยล่าค้างคาวใช่หรือไม่?** **ถ้าใช่ บ่อยแค่ไหน?** ☐ 1. **รายสัปดาห์** ☐ 2. **รายเดือน** ☐ 3. **หลายครั้งต่อปี** ☐ 4. **น้อยกว่านั้น**	☐	☐
3	คุณเคยแล่เนื้อค้างคาวหรือเตรียมเนื้อค้างคาวใช่หรือไม่? ถ้าใช่ บ่อยแค่ไหน? ☐ 1. **รายสัปดาห์** ☐ 2. **รายเดือน** ☐ 3. **หลายครั้งต่อปี** ☐ 4. **น้อยกว่านั้น**	☐	☐
4	**คุณเคยกินค้างคาวใช่หรือไม่** ถ้าใช่ บ่อยแค่ไหน? ☐ 1. **รายสัปดาห์** ☐ 2. **รายเดือน** ☐ 3. **หลายครั้งต่อปี** ☐ 4. **น้อยกว่านั้น**	☐	☐
5	**คุณเคยเก็บมูลค้างคาว** (guano) **ใช่หรือไม่** ถ้าใช่ บ่อยแค่ไหน? ☐ 1. **รายสัปดาห์** ☐ 2. **รายเดือน** ☐ 3. **หลายครั้งต่อปี** ☐ 4. **น้อยกว่านั้น**	☐	☐
6	**คุณเคยใช้มูลค้างคาวมาเป็นปุ๋ยใช่หรือไม่** (guano) ถ้าใช่ บ่อยแค่ไหน? ☐ 1. **รายสัปดาห์** ☐ 2. **รายเดือน** ☐ 3. **หลายครั้งต่อปี** ☐ 4. **น้อยกว่านั้น**	☐	☐
7	**คุณเคยถูกค้าวคาวกัดหรือขีดข่วนใช่หรือไม่**? **ถ้าใช่ โปรดระบุจำนวนครั้ง** ☐ 1. **ครั้งเดียว** ☐ 2. 2 **ครั้งหรือมากกว่า**	☐	☐

APPENDIX III - SELECTION GRID

	Number of eligible persons					
sequence number of household	1	2	3	4	5	6 or more
1	1	1	1	1	1	1
2	1	1	1	1	2	2
3	1	1	1	2	2	2
4	1	1	2	2	3	3
5	1	2	2	3	4	4
6	1	2	3	3	3	5
7	1	2	3	4	5	5
8	1	2	3	4	5	6

APPENDIX IV - SCHEDULE OF ACTIVITIES



APPENDIX V - BUDGET

No.	Objective	Units	No. Units	Time	Cost/time	Total (baht)
1	Photocopy (books, literature, questionnaire, thesis paper, etc.)	Paper	4,000	1	1	4,000
2	Pilot Study: Round trip to Don Thum District, Nakhon Pathom province, Thailand	Person	2	1	200	400
3	Data collection: Round trip to Don Thum District, Nakhon Pathom province, Thailand	Person	2	1	200	400
4	Data collection: Accommodation at Don Thum District, Nakhon Pathom province, Thailand	Person	2	9	600	10800
5	Pay for research assistants	Person	2	9	2000	18000
6	Pay for research participants	Person	286	1	50	14,300
7	Miscellaneous	-	-	-	2,450	2,450
						50,350

APPENDIX VI - ETHICAL APPROVAL

AF 02-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University
Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand,
Tel/Fax: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 081/2018

Certificate of Approval

Study Title No. 029.1/61 : KNOWLEDGE, ATTITUDE, AND PRACTICE REGARDING NIPAH VIRUS DISEASE IN NAKHON PATHOM PROVINCE, THAILAND

Principal Investigator : MR. TAKAHIRO AGARI

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with the International Conference on Harmonization – Good Clinical Practice (ICH-GCP).

Signature: ..... Signature: .....
(Associate Professor Prida Tasanapradit, M.D.) (Assistant Professor Nuntaree Chaichanawongsaroj, Ph.D.)
Chairman Secretary

Date of Approval : 3 April 2018 Approval Expire date : 2 April 2019

The approval documents including

1) Research proposal
2) Patient/Participant Information Sheet and Informed Consent Form
3) Researcher
4) Questionnaire

Protocol No. 029.1/61
Date of Approval - 3 APR 2018
Approval Expire Date - 2 APR 2019

The approved investigator must comply with the following conditions:

1. *The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.*
2. *Strictly conduct the research/project activities as written in the proposal.*
3. *Using only the documents that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).*
4. *Report to the RECCU for any serious adverse events within 5 working days*
5. *Report to the RECCU for any change of the research/project activities prior to conduct the activities.*
6. *Final report (AF 03-12) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.*
7. *Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.*

APPENDIX VII - PERMISSION

ที่ นฐ ๐๐๓๒/ ๑๕๔๑

สำนักงานสาธารณสุขจังหวัดนครปฐม
๑๗๐ ถนนเทศา ตำบลพระปฐมเจดีย์
อำเภอเมือง จังหวัดนครปฐม ๗๓๐๐๐

๘ เมษายน ๒๕๖๑

เรื่อง อนุญาตให้นิสิตหลักสูตรสาธารณสุขศาสตร์บัณฑิตลงพื้นที่เก็บข้อมูล

เรียน คณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

อ้างถึง หนังสือวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย ที่ ศธ ๐๕๑๒.๓๘/ ๐๒๙๐ ลงวันที่ ๑๓ มีนาคม ๒๕๖๑

ตามที่ จุฬาลงกรณ์มหาวิทยาลัย ขอความอนุเคราะห์ให้นิสิตหลักสูตรสาธารณสุขศาสตรมหาบัณฑิต เก็บข้อมูลโดยแบบสอบถามและสัมภาษณ์ ประชากรตำบลบ้านหลวง และตำบลดอนพุทรา เรื่องการส่งเสริมองค์ความรู้ และทัศนคติ การปฏิบัติในการดูแลตนเองจากเชื้อนิปาห์ไวรัส

ในการนี้ สำนักงานสาธารณสุขจังหวัดนครปฐม ได้ประสานงานสาธารณสุขอำเภอดอนตูมแล้ว แจ้งว่ายินดีให้นิสิตหลักสูตรสาธารณสุขศาสตรมหาบัณฑิตลงพื้นที่เก็บข้อมูล

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(นายชัช จันทร์งาม)
นายแพทย์เชี่ยวชาญ (ด้านเวชกรรมป้องกัน) รักษาราชการแทน
นายแพทย์สาธารณสุขจังหวัดนครปฐม

กลุ่มงานทรัพยากรบุคคล
โทร.๐ ๓๔๒๑๓๒๗๙ ต่อ ๑๑๐
โทรสาร ๐ ๓๔๒๕ ๑๕๕๐

VITA

Name; Takahiro Agari

Date/Place of Birth; Osaka, japan. 07/23/1985

Educational background; Bachelor of Veterinary Medicine, Gifu University, Gifu, Japan, 2011