MANUAL FOR

AVIAN INFLUENZA SURVEILLANCE

IN POULTRY FARMS AND POULTRY MARKETS
ALONG BORDER AREAS
UNDER THE ONE HEALTH APPROACH

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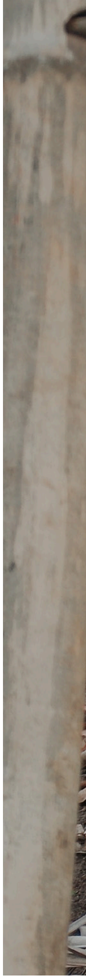


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FORWORD

DR.SOPON IAMSIRITHAWORN

DEPUTY DIRECTOR GENERAL OF DEPARTMENT OF DISEASE CONTROL

MINISTRY OF PUBLIC HEALTH, THAILAND AND
PIONEER OF PROVINCIAL ONE HEALTH PROJECT IN THAILAND

Our hard work towards rapid and effective responses to a number of outbreaks and other emergencies during the last few decades demonstrates the public health and animal health sectors' capacity and commitment to respond to health threats and reduce the burden of infectious diseases in Thailand and in the region. Each outbreak is a chapter that has taught us lessons in recognizing the importance of collaborative efforts and teamwork between different disciplines. Additional support from the various government agencies and academic institutions affirm Thailand's commitment to the One Health approach in building bridges for collaboration between the human, animal and environmental health sectors to respond to outbreaks of new diseases quickly and effectively.

One Health is not mine and One Health is not yours, but One Health is ours. We are working together as a team and a network to protect the health of people in Thailand and across the region as well. Preparedness, detection, and response utilizing multi-disciplinary teamwork is a core component in making the world safer and more secure from avian influenza and other emerging infectious diseases.

One Health team members have come together to collaborate on surveillance, preparedness and response to protect people from emerging health threats, especially avian influenza. Equipped with this critical collaboration, the human health, livestock and wildlife sectors can combine expertise, share information and carry out more effective actions for health security and disease prevention.

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PREFACE

In the worldwide situation in 2020, there were still reports of highly pathogenic avian influenza (HPAI) outbreaks in poultry and non-poultry in Oceania, Europe, Asia and Africa involving different subtypes, namely H5N1, H5N2, H5N5, H5N6, H5N8, H7N7 and H7N9. In 2017, the H7N9 subtype incidence increased significantly in both human and poultry populations, especially prominent in outbreaks occurring in the southern provinces of the People's Republic of China. Some evidence indicated that there were genetic variations in the viruses that cause disease. To prevent the spread of emerging infectious diseases in this region, integrated active surveillance of avian influenza needs to be carried out with multi-sectoral collaboration under the One Health approach, by focusing on risk areas especially along countries' border areas. Active surveillance in poultry farms and poultry markets to timely and accurately identify the causative agent of avian influenza in symptomatic and asymptomatic animals will result in effective disease control implementation. Strengthening surveillance can reduce the spread of disease to other poultry and to human populations.

Quality data obtained from disease surveillance can be analyzed and utilized in many aspects, such as disease distribution analyses, spatio-temporal analyses of disease pathogenesis, risk assessments as well as monitoring the genetic changes of the viruses. Therefore, the Office of International Cooperation, Department of Disease Control, in collaboration with the Bureau of Disease Control and Veterinary Services and the National Institute of Animal Health, Department of Livestock Development, and other supporting agencies, including the Division of Communicable Diseases and the Division of Epidemiology, Department of Disease Control, Faculty of Veterinary Science, Mahidol University, with financial and technical support from the Thailand MOPH and US CDC Collaboration have developed avian influenza surveillance in poultry farms and poultry markets along the border areas under the One Health approach. Pilot surveillance projects have been continuously implemented in border areas of Thailand in four provinces (Chiang Rai, Nakhon Phanom, Mukdahan and Ubon Ratchathani) since 2019.

The main purpose of establishing this manual is to disseminate an integrated avian influenza surveillance method in poultry farms and poultry markets under the One Health concept. The aforementioned approach can be applied to other areas in the country and to other countries in this region. Strengthening surveillance improves health security locally and internationally, which in turn leads to effective responses to and prevention of the widespread impacts of epidemics in the future.

ACKNOWLEDGE

The author gratefully acknowledges Dr. Pornchai Thumrin from the Office of International Cooperation, Department of Disease Control, Ministry of Public Health for his assistance in implementing the poultry surveillance project in the four border provinces of Thailand since 2018. The author would also like to thank Dr. Weerachai Suddee and Dr. Yupawat Tuekngamdee, Department of Livestock Development, Ministry of Agriculture and Cooperatives, Dr. Wan-Sane Tonan, Department of National Parks, Wildlife and Plant Conservation, Ministry of Natural Resources and Environment, and the livestock officers, public health officers and officials in Chiang Rai, Mukdahan, Nakhon Phanom and Ubon Ratchathani provinces for their advice, support and implementation of the project and preparation of this manual. Special thanks go to Dr. Rattanaporn Tangwangwiwat, Division of Communicable Diseases, Department of Disease Control, Ministry of Public Health as well as the officials at the Thailand One Health Network Coordination Unit for supporting the publication of this manual.

Thank you to the Thailand MOPH – U.S.CDC Collaboration (TUC) for supporting the budget and technical advice provided to the team since the beginning of the project. The author expresses deep appreciation to Ms. Janjao Rodchangpheun and Mrs. Punnarai Smithsuwan, staff of the project titled, “Avian Influenza Surveillance among Poultry (AISP) and Live Bird Markets in Border Provinces,” from the Office of International Cooperation, Department of Disease Control, Ministry of Public Health for contributing to the project together and contributing to an enthusiastic environment during the implementation of a lot of work. Finally, the poultry farmers and live bird sellers who have participated in the development of the project are appreciated for their cooperation resulting in the success of this manual as well.

Author

Soawapak Hinjoy

CHAPTER

ONE

AVAIN INFLUENZA SITUATION

Avian influenza is an infectious disease caused by Type A influenza viruses of the Orthomyxoviridae family, which cause infections in humans and many kinds of animals such as horses, pigs, cats, birds, chickens, and others. The disease in animals, especially in poultry, has been occurring for more than 100 years, with occasional outbreaks in countries such as England, Canada, Australia, the United States, Mexico and Italy. Avian influenza viruses are generally not very contagious to humans [1].

1.1 Human Infections with Avian Influenza A(H5) Viruses

The first evidence of avian influenza animal-to-human transmission was a highly pathogenic avian influenza (HPAI) H5N1 subtype found in the Hong Kong Special Administrative Region in 1997. There was a large outbreak on a chicken farm in northwestern Hong Kong and another outbreak in poultry occurred from October to December. Both outbreaks detected the H5N1 subtype in poultry populations as clinical signs and symptoms including fever, headache, dizziness, muscle aches, sore throat, cough, nasal congestion, conjunctivitis and gastrointestinal symptoms were found in humans [2]. Most of the patients had a history of close contact with poultry. Along with laboratory results that compared the genetic characteristics of avian influenza viruses in human and poultry cases, the evidence indicated direct transmission from chickens to humans. Together, the two outbreaks had a total of 18 cases consisting of 8 males and 10 females, with a mean age of 17 years old (ranging from 1 to 60). Half of the patients were under 12 years old. Six of them died and the other 12 cases recovered, for a case fatality rate of 33.3%. It was an important epidemic that is referred to as the first time avian influenza A(H5N1) virus emerged as a zoonotic disease [3].

Another outbreak occurred in Hong Kong in 2003. Avian influenza A(H5N1) virus was detected in two cases within the same family in 2003. The first case was a 9 year-old boy who visited his relatives in Fujian, China, with his mother, sister, and grandfather from January 25th to February 9, 2003. He became ill on February 9 after returning to Hong Kong. The boy completely recovered. The second case was the 33 year-old father of the first case. The father traveled to join the family in Fujian on January 31 and the date of disease onset was February 7. He was admitted to a hospital on February 11 and died on February 17, 2003. In addition, the sister of the first case, an 8 year-old girl, suffered with pneumonia on January 28, 2003 and died on February 4 in Fujian without a laboratory test to identify the causative agent. The other household members including the 30 year-old mother, 10 year-old sister and the grandfather of the first case were also admitted to a hospital after returning from Fujian, but they had mild symptoms and later recovered [1].

In late 2003-2004, avian influenza emerged in Thailand and in neighboring countries. The Division of Epidemiology, Ministry of Public Health, Thailand received reports of a total of 25 cases confirmed with avian influenza A(H5N1) virus, including 17 deaths from 2004-2006. In the last year of the A(H5N1) outbreak, there were three confirmed cases and all of them died (100% case fatality rate). The cases were distributed across three provinces in Thailand namely Phichit, Uthai Thani, and Nong Bua Lam Phu. All three cases were males between 17-59 years old. All had high fever with respiratory infection symptoms including cough, dyspnea, and pneumonia. Some of the cases had diarrhea. The first two deaths showed that the disease progressed quickly, while the third case was slower. The duration from the date of onset to death was between 9 - 28 days. History of exposure included direct contact with sick or dead chickens, handling sick chickens or carcasses of dead chickens to be thrown away or buried without the use protective suits, and taking care of sick or dead chickens [1].

According to the epidemiological data of avian influenza A(H5N1) virus, it was found that the major transmission route of infection was from poultry to humans. There is some evidence of possible human-to-human transmission, but the results cannot be confirmed. For example, a cohort study compared healthcare workers caring for people infected with avian influenza A(H5) viruses to health care workers who did not take care of people with avian influenza. The study found that 3.7% of the group of healthcare workers caring for infected people showed positive serological tests for A(H5) viruses, while 0.7% of the group without close contact had positive serological tests; a difference that is statistical significant [4]. Another study revealed that six of 51 household contacts of persons with avian influenza showed serological positive results for avian influenza A(H5) viruses [5]. It was interesting that one of the household contacts did not have a history of exposure to poultry. Aside from that, in January 2004, an avian influenza outbreak was observed in Vietnam [6]. The outbreak was a family cluster and the index case was a 31 year-old male. The next cases were his 23 year-old and 30 year-old sisters. The last case of this cluster was the first case's wife. Both sisters were confirmed to be infected with the H5N1 subtype. The exposure was at the end of December 2003 during preparation of a wedding ceremony where the first case and one of his sisters slaughtered ducks for food. As for the other sister and his wife, neither of them had any history of touching poultry; however, they were close contacts and took care of their sick brother and husband. In this regard, the World Health Organization (WHO) considered that there might be a possibility of human-to-human transmission of avian influenza A(H5N1) virus [7-9]. In September 2004, Thailand reported a cluster of avian influenza within a family of an 11 year-old girl, her mother, and her aunt. The girl had an exposure history of touching dead chickens raised in the house before she became sick. The mother traveled from another province to take care of her daughter. Later, the mother became sick. The aunt, who lived in the same house with the girl, brought the carcasses of the dead chickens to be buried, and she became sick within the following nine days. Both the girl and the mother died. The mother had no history of touching any poultry at all [10]. Therefore, it was possible that the mother could have been infected with the avian influenza A virus via transmission from her daughter.

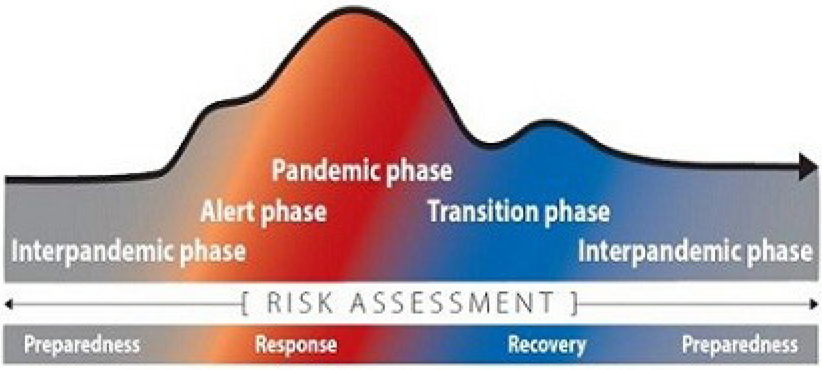
According to the worldwide disease situation from 2003 to July 10, 2020 [11], there were reports of human cases of avian influenza A(H5N1) virus from 17 countries around the world. There were a total of 862 cases with 455 deaths, accounting for a 52.8% case fatality rate as shown in Table 1.

Table 1 Cumulative number of confirmed human cases for avian influenza A(H5N1)
reported to WHO, 2003-2020

Country	2003-2009		2010-2014		2015-2019		2020		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Azerbaijan	8	5	0	0	0	0	0	0	8	5
Bangladesh	1	0	6	1	1	0	0	0	8	1
Cambodia	9	7	47	30	0	0	0	0	56	37
Canada	0	0	1	1	0	0	0	0	1	1
China	38	25	9	5	6	1	0	0	53	31
Djibouti	1	0	0	0	0	0	0	0	1	0
Egypt	90	27	120	50	149	43	0	0	359	120
Indonesia	162	134	35	31	3	3	0	0	200	168
Iraq	3	2	0	0	0	0	0	0	3	2
Laos	2	2	0	0	0	0	1	0	3	2
Myanmar	1	0	0	0	0	0	0	0	1	0
Nepal	0	0	0	0	1	1	0	0	1	1
Nigeria	1	1	0	0	0	0	0	0	1	1
Pakistan	3	1	0	0	0	0	0	0	3	1
Thailand	25	17	0	0	0	0	0	0	25	17
Turkey	12	4	0	0	0	0	0	0	12	4
Viet Nam	112	57	15	7	0	0	0	0	127	64
Total	468	282	233	125	160	48	1	0	862	455

The World Health Organization assessed the risk of avian influenza A(H5N1) virus using data from the global situation together with the genetic changes of the virus, epidemiological data and clinical symptoms. Currently, WHO classifies avian influenza A(H5N1) virus in the alert phase of the WHO Pandemic Influenza Risk Management Interim Guidance [12]. This phase advises agencies at the national and international level to increase surveillance and monitor the situation closely as shown in Figure 1.

Figure 1 Risk Assessment of Pandemic Influenza by the World Health Organization



1.2 Human Infections with Avian Influenza A(H7) Viruses

The major subtypes of avian influenza A(H7) viruses are H7N1, H7N2, H7N3, H7N4, H7N5, H7N6, H7N7, H7N8, and H7N9. Avian influenza A(H7) viruses are found worldwide, mostly in poultry and wild birds. They are mostly classified as low pathogenicity avian influenza (LPAI) viruses, in which some infected poultry show asymptomatic symptoms. In the past, there were few cases of human infection with H7 viruses and those were reported in people in close proximity to infected poultry, especially during H7 poultry outbreaks. Some of the human cases only presented with conjunctivitis and upper respiratory tract infection symptoms. The H7N2, H7N3 and H7N7 subtypes that caused the disease in humans were classified as LPAI, with the infected people showing mild to moderate symptoms. However, H7N3 and H7N7 subtypes are classified as HPAI, where an infected person may show symptoms ranging from mild to severe [13-14].

However, in 2013, the first human cases of H7N9 infection were reported in the People's Republic of China. Most of the cases had a history of direct contact with poultry or exposure to environments surrounded with poultry, especially in live bird markets. There were a few clusters suspected of human-to-human transmission. The first wave of the outbreak occurred from February to May 2013, with 135 cases, 43 deaths, and 32% case fatality rate with additional cases found in the summer [15]. Then, cases were reported again in October of the same year with 319 cases, 134 deaths, and a 42% case fatality rate. The third wave of the outbreak occurred from October 2014 to February 2015, with 114 cases and 27 deaths, accounting for a 24% case fatality rate. In total from the three outbreaks, there were a total of 568 cases with a 36% case fatality rate. Most of cases were male (73%), with an average age of 56 years. The distribution of human cases during this period is shown in Figure 2 [16].

Figure 2 Distribution of confirmed human cases infected with avian influenza A(H7N9) virus by area, from February 2013 to February 2015

The symptoms of the disease are not specific. Avian influenza A(H7N9) cases have shown symptoms of acute respiratory infection. A few have shown mild symptoms and have presented with influenza-like illness (ILI) symptoms, often found in young and early adults. Elderly patients have tended to show severe symptoms with complications [15]. As of October 15, 2020, the worldwide avian influenza A(H7N9) situation reflected a total of 1,568 laboratory-confirmed cases [11]. According to Thailand's current surveillance data, as of November 2020, there have been no reports of human cases of avian influenza A(H7N9) infection in Thailand [17]. Although there have been no H7N9 cases and no further avian influenza A(H5N1) outbreaks, Thailand is preparing to cope with those and other avian influenza subtypes. Several measures have been put in place for all provinces, including border areas under the same standards [18], to strengthen surveillance systems by detecting signs of outbreaks in four groups: 1) cases of severe respiratory infections 2) cases with pneumonia after returning from abroad 3) pneumonia cases found in a cluster of two or more people within the same community and 4) health care workers suffering from pneumonia. Furthermore, various measures have been implemented as follows:

1. Surveillance and detection of new strains of avian Influenza virus in laboratories of public health, livestock, wildlife and academic sectors.

2. Clinical practices for suspected cases of avian influenza are standardized to fit the same guidelines for influenza and infection prevention and control according to the standards of preventing avian influenza virus infection.

3. Regular education for people to prepare them for the potential of an avian influenza epidemic. Topics include maintaining healthy behaviors, washing hands, wearing masks, resting at home if sick, avoiding contact with animals, washing hands after touching animals if contact with animals is unavoidable, and not selling or eating sick animals

4. Health care facilities prepare antiviral drugs (both administered orally and via injection) and prepare personal protective equipment

5. Preparation for screening at the points of entry of the country by adhering to the recommendations of the World Health Organization

“IN ADDITION, THE GLOBAL SITUATION HAS ALSO SHOWN THAT OTHER AVIAN INFLUENZA SUBTYPES, SUCH AS H7N7 AND H9N2, CAUSE SEVERE SYMPTOMS AND EVEN DEATH, BUT MOST INFECTIONS ARE USUALLY MILD OR ASYMPTOMATIC.”

1.3 Animal Infections with Avian Influenza A Viruses

Avian influenza in poultry ranges from animals not showing any signs of illness to severe, nearly 100% poultry deaths. It depends on the virulence of the virus, poultry immunity, environment, and co-morbidities. In most cases, infected poultry show anorexia, neurological disorders, dull pigmentation of the crest/wattle, or sudden death without showing any symptoms. The viruses can infect poultry, including chickens, ducks, turkeys, quails, domestic birds and migratory birds. They can also infect mammals such as dogs, and cats. Avian influenza A(H5N1) virus is considered to be highly pathogenic in Asia. The first outbreak of the disease was reported in 1997 in Hong Kong and it was the first time that human cases were reported, resulting in deaths. Tens of millions of poultry were destroyed. Subsequently, the disease spread widely, raising concerns over the regional crisis of poultry disease and causing serious economic and social impacts. The vast animal destruction to control and eradicate the disease damaged the economy and global food security.

From the recent report of the World Organisation for Animal Health (OIE), October 2 -22, 2020 [17], HPAI incidence was reported on two continents as follows: Asia (in Israel) and Europe (in Kazakhstan and Russia).

The first reported avian influenza outbreak among poultry in Thailand was reported on January 23, 2004 in a layer farm at Ban Laem Subdistrict, Bang Plama District, Suphanburi Province. The Department of Livestock Development implemented various measures to control and end the avian influenza outbreak, and has since continued surveillance of the disease to this day. The efforts led to a rapid decrease in the incidence of disease. Currently, Thailand has not reported avian influenza in poultry for more than ten years. However, active surveillance for avian influenza has been continually implemented to monitor the situation [19].

A summary of avian influenza outbreaks in Thailand from the outbreak in 2004 to the last outbreak in November 2008 [19] is as follows:

1. Outbreak Round 1 (January - May 2004)

1.1 First occurrence of avian influenza in Thailand

a. The first avian influenza A(H5N1) virus was found on January 23, 2004 in a layer farm at Bang Plama District, Suphanburi Province.

1.2 The last occurrence of avian influenza in Outbreak 1

b. Avian influenza virus was found on May 24, 2004 at a chicken farm in the Department of Animal Science, Faculty of Agriculture, Chiang Mai University.

<u>Summary of the avian influenza outbreak from January to May 2004</u>

1) A total of 190 clusters of avian influenza were found across 141 sub-districts, 89 districts, and 42 provinces.

2) The areas with the most reported disease were the lower northern region with 55 clusters (28.9%), followed by the eastern region with 37 clusters (19.5%) and the central region with 24 clusters (12.6%). There were no reports of cases in the lower southern regions.

3) The types of poultry that were positive for avian influenza virus: local chickens (63.7%), broilers (11.6%), layer hens (10.5%), ducks (6.3%), quails (4.7%), and other types of poultry (3.2%).

2. Outbreak Round 2 (July 2004 - April 2005)

2.1 Second occurrence of avian influenza

a. Avian influenza type A virus was found on July 3, 2004 in a layer farm at Phak Hai District, Phra Nakhon Si Ayutthaya Province.

2.2 The last occurrence of avian influenza in Outbreak 2

b. Avian influenza virus was found on April 12, 2005 in fighting cocks at Tai Talat Subdistrict, Mueang District, Lopburi Province.

<u>Summary of the avian influenza outbreak from July 2004 - April 2005</u>

1) A total of 1,539 clusters of avian influenza were found across 784 sub-districts, 264 districts, and 51 provinces.

2) The areas with the most reported disease were the lower northern region with 631 clusters (41.0%), followed by the central region with 594 clusters (38.60%). The lowest number of clusters, 3, was reported in the northern region (0.2%).

3) The types of poultry that were positive for avian influenza virus: local chickens (57.6%), ducks (28.8%), broilers (5.3%), layer hens (4.7%), quails (2.0%), and other types of poultry (1.5%).

3. Outbreak Round 3 (July - November 2005)

3.1 Third occurrence of avian influenza

a. Avian influenza type A virus was found on July 1, 2005 in a quail farm at Sala Kao, Mueang District, Suphanburi Province.

Summary of the avian influenza outbreak from July - November 2005

1) A total of 75 clusters of avian influenza were found across 55 sub-districts, 27 districts, and 11 provinces.

2) The areas with the most reported disease were the central region with 37 clusters (48.1%) followed by the lower northern region with 25 clusters (33.3%), the western region with 11 clusters (14.7%), the eastern region with 2 clusters (2.7%) and the northeastern region with 2 clusters (2.7%).

3) The types of poultry that were positive against avian influenza virus: local chickens (76.3%), quails (7.9%), ducks (6.6%), broilers (5.3%), layer hens (2.6%), and other types of poultry (1.3%).

4. Outbreak Round 4 (January - December 2006)

In 2006, there were two clusters of avian influenza A(H5N1) virus across two sub-districts of two districts in two provinces, which included:

a. Area 1, Village 11, Noen Makok Subdistrict, Bang Mun Nak District, Phichit Province. Avian influenza was found in local chickens on July 23, 2006.

b. Area 2, Village 13, Ban Klang Subdistrict, Mueang District, Nakhon Phanom Province. Avian influenza was found in layer hens on July 28, 2006.

5. Outbreak Round 5 (January - December 2007)

In 2007, there were 4 clusters of avian influenza A(H5N1) virus across four sub-districts of four districts in four provinces, which included:

a. Area 1, Village No. 5, Plai Chumpon Subdistrict, Mueang District, Phitsanulok Province. Avian influenza was found in layer ducks on January 15, 2007.

b. Area 2, Village 8, Phan Prao Subdistrict, Si Chiang Mai District Nong Khai Province. Avian influenza was found in layer hens on January 23, 2007.

c. Area 3, Village 3, Mongkhon Thamnimit Subdistrict, Sam Go District, Ang Thong Province. Avian influenza was found in local chickens on January 31, 2007.

d. Area 4, Village 9, Bang Sai Yai Subdistrict, Mueang District, Mukdahan Province. Avian influenza was found in local chickens on March 18, 2007.

6. The last outbreak (January 1 - November 30, 2008).

In 2008, avian influenza was found across four sub-districts, of four districts in four provinces, which included:

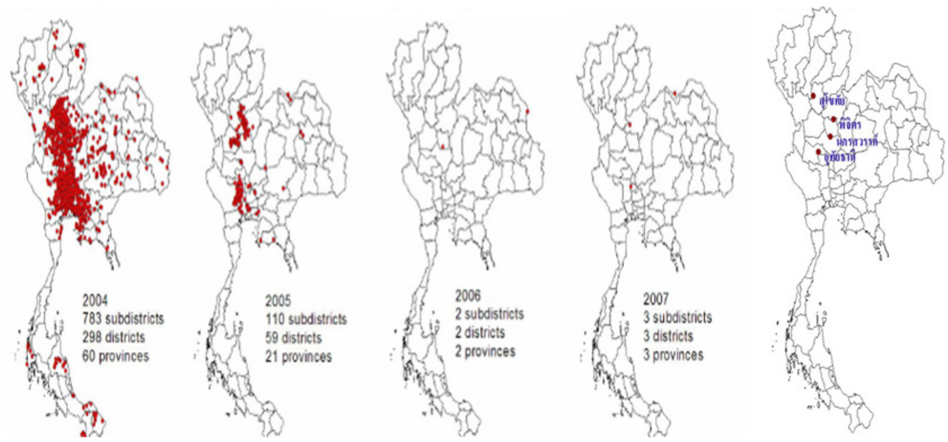
a. Sak Lek Subdistrict, Sak Lek District, Phichit Province. Avian influenza was found in local chickens on January 8, 2008.

b. Phikun Subdistrict, Chumsaeng District, Nakhon Sawan Province. Avian influenza was found in a broiler farm on January 18, 2008.

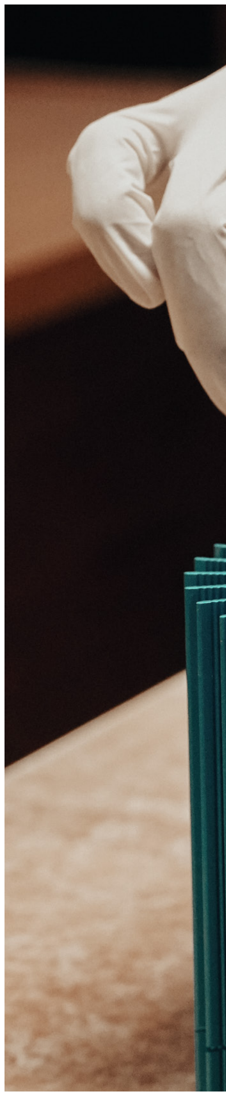
c. Thung Saliam Subdistrict, Thung Saliam District, Sukhothai Province. Avian influenza was found in local chicken on October 27, 2008.

d. Thung Pho Subdistrict, Nong Chang District,

Figure 3 Map of avian influenza outbreaks in poultry, Thailand, 2004-2008



In Thailand, avian influenza was first detected in wild birds since 2004. There has not been any detection since 2008. From the collection of wild bird samples from the Department of National Parks, Wildlife and Plant Conservation from 2004 to 2008, there were 20 species of birds that were detected with avian influenza virus including the Asian openbill, red-whiskered bulbul, little cormorant, pigeon, black drongo, scaly-breasted munia, zebra dove, common myna, great myna, lesser whistling duck, black-collared starling, red collared dove, wood sandpiper, cattle sparrow, cattle egret, Eurasian tree sparrow, sea birds, kentish plover, pied myna and plain-backed sparrow in 23 provinces (Nakhon Sawan, Suphanburi, Nakhon Pathom, Phra Nakhon Si Ayutthaya, Pathum Thani, Saraburi, Samut Prakan, Samut Songkhram, Lopburi, Ang Thong, Kamphaeng Phet, Bangkok, Buriram, Nakhon Phanom, Ubon Ratchathani, Surin, Prachinburi, Chachoengsao, Phang Nga, Phuket, Ranong, Kanchanaburi and Ratchaburi). Other wildlife that have been reported to be infected with avian influenza viruses includes tigers at the Sriracha Tiger Zoo, which might have become infected by eating contaminated raw chicken meat [20-21].



1. Local officers collecting poultry samples.

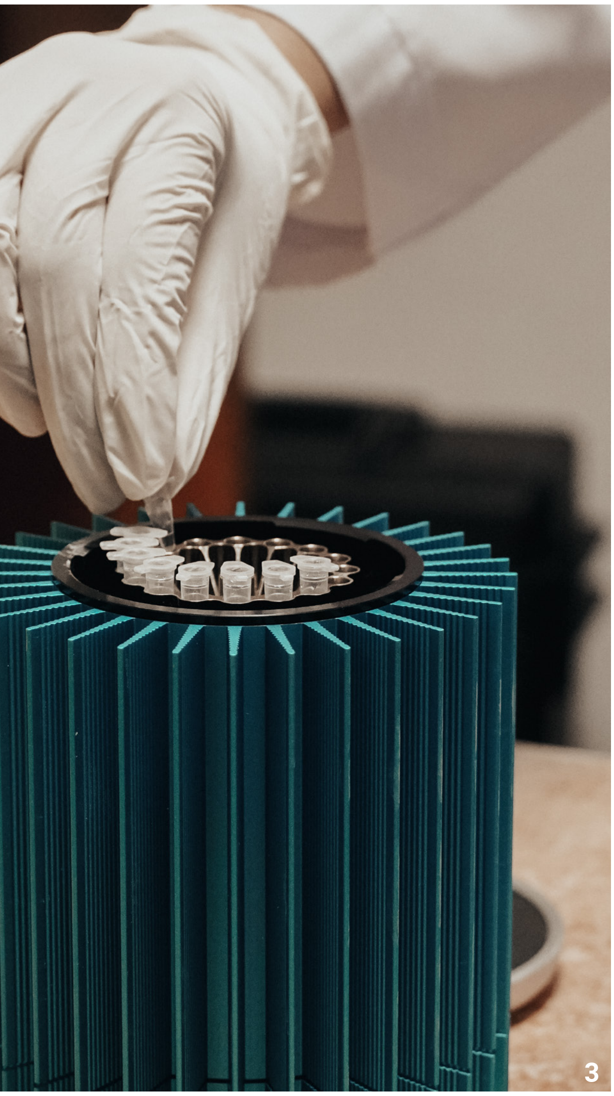
2. Monthly visits among multisectoral units working together.

3. Piloting the implementation of portable PCR machine to detect causative agents at field sites

4. Laboratory produce for PCR

Current avian influenza situation in poultry

Avian influenza A(H5N8) virus is a highly pathogenic avian influenza virus that can spread quickly through migratory birds in Asia and Europe. This virus is the cause of death in both wild birds and domestic poultry [22], but it has not yet been found to affect human health [23]. Avian influenza A(H5N8) virus cannot infect ferrets, which is important to note because ferrets are often used as models in animal trials to study influenza infection in humans [24-26].



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The H5N8 subtype has not been reported in humans, and there is a low probability of humans being infected. However, monitoring and surveillance of the H5N8 subtype need to continue in human and animal populations [22] as WHO urges more countries to test for it in humans. This is due to the spread of this infection in poultry in many countries around the world in particular, European countries, where at least 24 countries have detected an H5N8 outbreak since 2016, [27]. The HPAI A(H5N8) virus was detected in 2014 in wild birds and poultry for consumption in China, Germany, Italy, Japan, the Netherlands, Korea, Russia, England, Iceland and the United States. The H5N8 subtype was detected sporadically in poultry in both the US and Canada in mid-2015 and was also found in Taiwan, China, Hungary and Sweden. By June 2016, several countries in Europe and Asia, including Australia, Croatia, Denmark, Germany, Hungary, India, Israel, the Netherlands, Poland, Russia and Switzerland confirmed the presence of H5N8 in poultry flocks. The most recent investigations are related to the deaths of wild birds and the likelihood of spreading the infection along the migratory routes.

From 2014 until now, the World Organisation for Animal Health continues to report outbreaks of H5N8 avian influenza in poultry flocks in many countries. In 2020, the virus spread in 15 countries. In the beginning of 2020, outbreaks were found in several European countries including Poland, Slovakia, Hungary, Romania, Greece, Germany and Bulgaria, as well as Nigeria, South Africa, Israel, and Saudi Arabia in the Middle East. Then, it spread to different regions in several other countries including Iraq, Russia, Kazakhstan, China, South Korea and England from the middle to end of the year [28-30]. Regular proactive surveillance to monitor the transmissibility and virulence of avian influenza virus in poultry farms and wild birds can increase early detection and prevent spreading of avian influenza to other groups of the global population.

REFERI

1. Thongcharoen, P. Influenza. Bangkok: C&S; 1998.
2. Phatinawin, L. Worldwide situation of Avian Influenza A virus. Weekly Epidemiological Surveillance Report. 2014; 35 (2S).
3. Narupanjirakul, U and Chittaganpitch, M. Avian Influenza Virus. Annual Epidemiological Surveillance Report. 2006 pp. 120-123.
4. Buxton Bridges C, Katz JM, Seto WH, et al. Risk of influenza A (H5N1) infection among health care workers exposed to patients with influenza A (H5N1), Hong Kong. J Infect Dis. 2000;181(1):344-8. doi: 10.1086/315213. PMID: 10608786.
5. World Health Organization. 2015, September 27. Avian influenza A(H5N1) – update 14: Two additional human cases of H5N1 infection laboratory confirmed in Viet Nam, Investigation of a family cluster. Retrieved from http://www.who.int/csr/don/2004_02_01/en/
6. World Health Organization. 2015, September 27. Avian influenza A(H5N1) -update 15: Additional confirmed human case in Thailand; China announces suspected spread of infection in poultry; investigation of possible human-to-human transmission. Retrieved from http://www.who.int/csr/don/2004_02_02/en/
7. World Health Organization. 2015, September 27. Avian influenza A(H5N1) -update 19: Investigation of possible human-to-human transmission in Viet Nam: new data are reassuring. Retrieved from http://www.who.int/csr/don/2004_02_06/en/
8. World Health Organization. 2015, September 27. Avian influenza A(H5N1) -update 21: Global surveillance guidelines, Investigation of possible human-to-human transmission: data on second sister in family cluster in Viet Nam. Retrieved from http://www.who.int/csr/don/2004_02_11/en/
9. Ungchusak K, Auewarakul P, Dowell SF, et al. Probable person-to-person transmission of avian influenza A (H5N1). N Engl J Med. 2005;352(4):333-340.
10. World Health Organization. 2020, November 7. Avian Influenza Weekly Update. Retrieved from https://www.who.int/docs/default-source/wpro---documents/emergency/surveillance/avian-influenza/ai-20201015.pdf?sfvrsn=30d65594_78
11. World Health Organization. 2015, September 27. Current WHO global phase of pandemic alert: Avian Influenza A(H5N1). Retrieved from http://www.who.int/influenza/preparedness/pandemic/h5n1phase/en/
12. The European Centre for Disease Prevention and Control. 2015, September 27. A rapid assessment on the emergence of the H7N9 virus in China. Retrieved from http://ecdc.europa.eu/en/publications/Publications/Forms/ECDC_DispForm.aspx?ID=1087
13. World Health Organization. 2015, September 27. Human Infection with Avian Influenza A(H7N9). Retrieved from http://www.wpro.who.int/emerging_diseases/AvianInfluenza/en/
14. World Health Organization. 2015, September 27. Avian influenza in humans. Retrieved from http://www.who.int/influenza/human_animal_interface/avian_influenza/en/
15. The European Centre for Disease Prevention and Control. 2015, September 27. Epidemiological update: Human infection with avian influenza A(H7N9) virus, China. Retrieved from http://ecdc.europa.eu/en/press/news/_layouts/forms/News_DispForm.aspx?ID=1167&List=8db7286c-fe2d-476c-9133-18ff4cb1b568&Source

=http%3A%2F%2Fecdc%2Eeuropa%2Eeu%2Fen%2Fhealthtopics%2Favian_influenza%2FPages%2FNews_and_Epidemiological_Updates%2Easpx#sthash.aWJhSTur.dpuf

16. World Organisation for Animal Health. 2020, November 7. Update on avian influenza in animals (types H5 and H7). Retrieved from https://www.oie.int/en/animal-health-in-the-world/update-on-avian-influenza/2020/
17. Ministry of Public Health, Thailand. 2015, September 27. Implementing measures to prevent and control Avian Influenza A (H7N9) Virus H7N9. Retrieved from http://health.kapook.com/view61644.html
18. Pasavorakul O. Prevention, Control and Eradication of Highly Pathogenic Avian Influenza – H5N1: Thailand Experience. Bangkok: Bureau of Disease Control and Veterinary services, Department of Livestock Development, Ministry of Agriculture and Cooperatives; 2013.
19. Sirimongkolrat, C. and Chinson, P. Scientific document chapter 1: The solution of bird flu in Thailand from 2004-2008. Bangkok: Bureau of Disease Control and Veterinary services, Department of Livestock Development; 2008; pp 1-3.
20. Sasipreeyajan, J. Important diseases in chicken. Edition 1. Bangkok: Thana Place Company Limited; 2010.
21. Songserm, T. Avian Influenza in animals in Faculty of Veterinary Medicine Textbook Project Kasetsart University. Edition 1. Bangkok: Sirichai Printing Company Limited; 2011.
22. World Health Organization. 2020, December 16. Assessment of risk associated with influenza A(H5N8) virus. Retrieved from https://www.who.int/influenza/human_animal_interface/avian_influenza/riskassessment_AH5N8_201611/en/
23. Sims L, Harder T, Brown I, et al. Highly pathogenic H5 avian influenza in 2016 and 2017 – observations and future perspectives. Rome: EMPRES Focus On, November, No. 11.
24. Richard M, Herfst S, van den Brand JMA, et al. Low Virulence and Lack of Airborne Transmission of the Dutch Highly Pathogenic Avian Influenza Virus H5N8 in Ferrets. PLoS ONE. 2015; 10(6): e0129827.
25. Kaplan BS, Russier M, Jeevan T, et al. Novel Highly Pathogenic Avian A(H5N2) and A(H5N8) Influenza Viruses of Clade 2.3.4.4 from North America Have Limited Capacity for Replication and Transmission in Mammals. mSphere. 2016;6;1(2): pii: e00003-16.
26. Pulit-Penaloza JA, Sun X, Creager HM, et al. Pathogenesis and Transmission of Novel Highly Pathogenic Avian Influenza H5N2 and H5N8 Viruses in Ferrets and Mice. J Virol. 2015; 89(20):10286-93.
27. Schnirring L. 2020, December 17. WHO urges vigilance for human cases in wake of H5N8 outbreaks. Retrieved from https://www.cidrap.umn.edu/news-perspective/2017/01/who-urges-vigilance-human-cases-wake-h5n8-outbreaks
28. World Animal Health Organization. 2020, December 16. Avian Influenza Portal. Retrived from https://www.oie.int/en/animal-health-in-the-world/update-on-avian-influenza/2020/
29. Kumenov A. 2020, December 17. Kazakhstan: Avian flu kills nearly 1 million poultry. Retrived from https://eurasianet.org/kazakhstan-avian-flu-kills-nearly-1-million-poultry
30. The Poultry Site. 2020, December 17. UK reports two outbreaks of highly pathogenic H5N8 bird flu. Retrieved from https://www.thepoultrysite.com/news/2020/12/uk-reports-two-outbreaks-of-highly-pathogenic-h5n8-bird-flu.

AVIAN INFLUENZA SURVEILLANCE IN POULTRY FARMS AND POULTRY MARKETS ALONG BORDER AREAS

CHAPTER TWO

2.1 Types of Surveillance

2.2 Event-based Surveillance System along Border Areas

Emerging infectious diseases (EIDs) are comprised of those infectious diseases whose incidence in humans has increased in the past two decades and threaten to increase in magnitude in the future. Since 2003, devastating epidemics of HPAI A(H5N1) have drastically affected poultry flocks in Thailand and other countries. There have been severe consequences on the economies of affected countries and on the livelihoods of poor farmer. In response to the HPAI epidemics, millions of poultry have been culled to stop transmission from poultry to humans. Experience gained from the HPAI epidemic responses underscores the importance of investing in effective disease surveillance at the human, animal and ecosystem levels, enabling Thailand to better respond to a range of existing and emerging infectious diseases.

Border areas between countries are at risk of avian influenza due to the transport of goods (including animals) by cargo trucks and ships via ground ports and seaports, and along the Mekong River. People who enter live poultry markets, poultry farms, and slaughterhouses can become infected with avian influenza virus and can become the source of transmission when walking through points of entry. Hence, border areas are at high risk of disease transmission between countries. In response to any novel avian influenza subtypes, collaboration between the human health and animal health sectors within the region need to be improved to better respond to the range of existing and emerging infectious diseases (EIDs). Early detection of avian influenza in high-risk animal populations is also vital for limiting EID spread and leading effective responses to avian influenza in the Mekong Subregion.

2.1 Types of Surveillance

Surveillance is defined as **"the process of collecting, analyzing and interpreting health information continuously and systematically."** Information from surveillance is necessary for planning, setting measures and evaluating health performance. The information can also be disseminated to other relevant partners for acknowledgment and for integration of timely disease control and prevention interventions. It can be concluded that surveillance focuses on the production of information to be used in a timely manner in response to signals of abnormal events (surveillance for action), with disease and health surveillance at the heart of the work in solving disease and health problems. Because surveillance is an ongoing activity, there must be systematic coordination. Surveillance is a joint activity that gathers technical expertise with contributions from many subsets of the health field. It is not just a record of morbidity and mortality, but also closely monitors influencing factors in hosts, agents and the environment to follow disease outcomes. Therefore, the importance of effective epidemiological surveillance [1] should be placed on:

1) Promptly detecting disease or health threats affecting the community,

2) Monitoring changing disease patterns that may harm the community,

3) Monitoring the conditions of the exposed animals/persons or those populations at risk to promptly provide advice on prevention and control of the spread of disease,

and

4) Measuring the importance of health problems by considering local contexts in order to have timely and effective information for action plans.

Disease surveillance can be categorized according to the nature of its operational activities and the selection of target populations for surveillance [1-3] into four categories:

1. Passive Surveillance

The term "passive" indicates the nature of the activities in the surveillance system. The agency conducts surveillance in a health care setting (hospital or medical/health facility) where reporting systems are often part of the routine work awaiting patient cases. The report will be sent in an electronic format to the epidemiological surveillance network for analysis to detect disease abnormalities in the area. Summaries of the disease situation will be sent to the relevant agencies. Passive surveillance does not require a lot of investment because its operation is part of the routine work at the health service facility. Passive surveillance is also able to monitor the situation of many diseases and various health problems. However, passive surveillance also has some limitations, such as the incomplete data on the reported number of cases, the information transferred to each agency may be delayed, and some important variables may be lacking in completeness and accuracy.

2. Active Surveillance

"Active" surveillance implies actively pursuing surveillance in obtaining data. The data collector will closely monitor the disease or problem and the surveillance data are recorded and collected immediately. Most of them are designed to monitor disease-specific problems, such as those in epidemic situations that require complete numbers of cases and other variables.

For example, during avian influenza surveillance among human populations, when an outbreak of avian influenza in poultry has been reported, local health officers will conduct active case finding for suspected cases of avian influenza in humans. Health volunteers may assist by going out to visit villagers' homes to ask if people have fever associated with respiratory symptoms such as cough, sore throat, or runny nose. If suspected cases are detected, samples will be collected for laboratory testing and further investigation.

Implementing active surveillance can serve to collect more complete information faster, but it will cost more to coordinate and recruit personnel to conduct the surveillance. This is not sustainable for long-term surveillance. It can be more suitable for monitoring disease that follow a seasonal pattern or monitoring diseases that increase during specific periods, especially during an epidemic period. Some people do not come to health care facilities so active case finding for additional patients should be undertaken in the community. Therefore, the implementation of active surveillance further enhances the completeness of the data obtained from passive surveillance at critical stages such as disease outbreaks.

3. Sentinel Surveillance

Sentinel surveillance refers to surveillance in a selected population or service unit as a representation of the target population. It is used to monitor the disease situation in representative groups of the population. For example, in surveillance of influenza virus subtypes in 10 hospitals (sentinel sites), the hospitals are used to be representative of all hospitals in Thailand [4]. Sentinel surveillance can be both passive and active depending on the design. An important principle of sentinel surveillance is not requiring information collection of everyone in the population, but selecting a representative group of the population using a standardized method according to academic principles. Based on the level of risk, population selection can be performed by either probability sampling method or purposive sampling method. The variation of the monitored problem can be compared between the sites and during the time period.

Sentinel surveillance requires additional operating expenses, both in manpower and budget [1-3]. Sometimes this type of surveillance involves laboratory testing, such as testing for the influenza virus subtype that causes the outbreak in the area, resulting in more complete information. The obtained data can be analyzed and interpreted to identify the problem situation and resolve it timely.

4. Special Surveillance

The term "special" reflects that surveillance is intended to address specific matters, such as surveillance of the cause of death during a monsoon or surveillance at the time of large-scale sporting events or global conferences. This type of surveillance follows specific situations and trends for disease or health threats occurring [1-3]. When an unusual event or occurrence is detected, the information from the surveillance system can be used to determine measures to resolve the problem and respond to the local situation, and prevent the disease from spreading in other areas.

2.2 Event-based Surveillance System along Border Areas

Event-based surveillance is a form of disease surveillance, which uses initial data in the form of news from multiple sources, and then systematically manages the news material to rapidly inform facts of unusual health events. The key to event-based surveillance is community involvement as a source of information, monitoring and analyzing preliminary data to observe any changing trends of events in the community, setting assumptions for risk factors, and conducting preliminary investigations of these unusual health events in the community [5].

In the beginning, community participatory surveillance was used to monitor the health of livestock in rural areas where access to routine surveillance systems is limited. Later, the approach was expanded to other populations, especially vulnerable populations like livestock farmers. A variety of community participatory surveillance tools have been developed, such as the use of mobile phones and hotlines based on local contexts of the area so that the tools can lead to an effective response to that event.

Information in the community that contributes to further investigation can be both from syndromic reports or reporting of group illnesses in the community. Most of the information obtained is classified as "suspected" rather than disease-specific, like information reported in routine surveillance systems. Therefore, the suspected disease or event is a warning signal to investigate whether the event is true or false. This procedure makes the surveillance system more sensitive in detecting disease or health-threatening events in animal and human populations. There is currently ongoing development and expansion of technology to manage and collect information. The information obtained from event-based surveillance can be stored in a variety of technology applications. It is part of the enormous volume of data from many sources known as "Big data" [6]. Big data analysis and synthesis will also be beneficial for the detection of diseases and abnormal events occurring in both local and international communities.

Sources for event-based surveillance [5] can be classified as follows:

1) Personnel sources, such as officials in the surveillance network, health or animal health volunteers, community leaders, eyewitnesses, etc. Most of the information is reported on individual illness/death or nuisances that may be risk factors or indications for disease.

2) Public media sources such as newspapers, radio, television, or the Internet. Most of the information published is from news of the outbreak or the disaster.

3) Official data sources from surveillance systems, such as reporting cases in the epidemiological surveillance systems including individual cases/deaths, disease situation reports, and disease investigation reports.

4) Other official sources of information include incident notifications/reports from the state agency and local government registration systems. Various established sources from organizations such as laboratory reports of animal surveillance systems, reports from hospitals, data from the food and drug surveillance system, meteorological information, pollution control and environmental information, death registrations, other registration information from municipalities, registration from the police reports, etc. can be important sources of event-based surveillance.

All news received should be immediately analyzed by comparing it to the previous disease situation reports. If there were more cases than the threshold, or if there are obvious abnormal events, the event needs to be verified to raise necessary alarms. Public health responses including disease investigation, medical treatment, risk communication with relevant parties, and implementation of specific disease control measures have to be carried out.

A response to urgent news should take place within 24 hours and public health emergencies of international concern must be reported to WHO within 48 hours [5]. Event-based surveillance can enhance the efficiency of the routine systems. It can make it possible to detect new events or events of a small number of cases that are defined in the inclusion criteria to complement the routine surveillance system. In addition, event-based surveillance can help detect diseases or events that occur in people who do not receive health services at healthcare facilities.

The obvious advantages of event-based surveillance include a lower operational budget compared to other surveillance systems. It also has the benefit of increasing sensitivity in the detection of diseases and health threats. If community involvement can be established and cover all segments of the population, it can enhance the effectiveness of surveillance including hard-to reach populations such as undocumented migrant workers, and groups living in isolated areas among others [6]. It also increases communication channels between government officials and communities to strengthen their networks to connect disease prevention and control information to the target groups. Overall, the benefits of event-based surveillance are as follows [7]:

1) Routine surveillance agencies in the area, such as district health promotion hospitals and district livestock offices, are notified of news on diseases and health threats in certain areas to timely detect outbreaks and prevent the spread of disease.

2) More cooperation between government officials and communities can facilitate disease investigation in the area to be more convenient and reach the entire community to more easily and efficiently find the cause of the disease or event.

3) Feedback of information to the community can help people in the community recognize the importance and benefit of the surveillance system. This will facilitate coordination and build cooperation from the community when disease prevention and control activities are implemented in that area.

The Mekong Basin Disease Surveillance (MBDS) network was established in 1999 with funding from the Rockefeller Foundation and was formally established in 2001 with the signing of a Memorandum of Understanding of the six health ministers in the Greater Mekong Subregion: Cambodia, China (Yunnan and Guangxi), Lao PDR, Myanmar, Thailand and Vietnam [8]. The key objectives of MBDS are: 1) to strengthen border epidemic management and response by exchanging surveillance information, joint disease reporting and outbreak investigations, 2) to develop international epidemiological surveillance experts, and 3) to improve international communication channels and facilitate communication between the human and animal sectors for faster epidemic detection and control. The MBDS is a model for building cooperation on surveillance and disease control along cross-borders. It has been operating for more than 10 years and has strengthened the development of public health capacities for local, national and global officials in the field of surveillance, prevention and control. In addition, the area and scope of work in cross-border surveillance have been expanded to obtain timely information [9]. The information obtained can help rapid response teams fully support surveillance activities.

The MBDS has cross-border activities in 16 areas among multisectoral agencies of six countries, both in surveillance and joint outbreak investigation of diseases. In addition, there are 18 diseases that share surveillance data among the MBDS countries. The national MBDS coordinator and the foreign adjacent provincial coordinator routinely exchange surveillance data to detect signals that can lead to outbreaks. Of the 18 surveillance diseases (Figure 4) [10], 10 are classified as daily reported diseases that include

1) influenza H1N1,
2) influenza H5N1,
3) acute flaccid paralysis,
4) SARS,
5) cholera/severe diarrhea,
6) encephalitis,
7) tetanus,
8) meningitis,
9) diphtheria,
10) public health emergencies of international concern (PHEIC) reported diseases.

The weekly reported diseases are
11) leptospirosis,
12) chikungunya,
13) dengue fever,
14) typhoid fever, and
15) measles. The monthly reported diseases are 16) malaria, 17) pneumonia, and the less commonly reported diseases are 18) HIV/AIDS and tuberculosis. There is an agreement on the exchange of information to ensure timely, accurate and appropriate information exchange. For this exchanging of surveillance information, cross-border provincial-level operations of all countries operate under national policies. According to human surveillance data in the MBDS surveillance program, there are certain diseases that can be used to detect outbreaks of zoonotic disease [11]. This has led to strengthening surveillance in both the public health and animal health sectors. There is a regional collaboration strategy whereby human and animal health departments can meet and discuss information exchange guidelines to prevent and control the spread of zoonotic diseases.

Figure 4 A template of cross-border surveillance information exchange

XXXXX Provincial Health Office, Country

XXXXXX province
MBDS Cross-Border Coordinator
No. XX /Country Name

MBDS Cross – Border Reporting Between
XXXXX (Country Name)/ XXXXX (Country Name)

Report: ☐ within 24 hours; ☐ weekly no: ☐ Month: ☐ Quarterly no:
Date: DD / MM - DD / MM, YYYY

ID	Diseases	Cumulative from 01st week to 52nd week 2011		Current week / month / quarter		Date founded	Affected Areas villages	Risk factors/Presumable causes	Remark
		Cases	Deaths	Cases	Deaths				
1	H1N1/ H5N1								
2	AFP								
3	SARS								
4	Cholera /Severe Diarrhea								
5	Encephalitis								
6	Tetanus								
7	Meningitis								
8	Diphtheria								
9	PHEIC								
10	Leptospirosis								
11	Chikungunya								
12	Dengue fever								
13	Typhoid fever								
14	Measles								
15	Malaria								
16	Pneumonia								
17	HIV/AIDs								
18	Tuberculosis								

Remark: Bold letters are border districts

Reported by: XXXXX

24 Hours Report
Weekly Report
Monthly Report
Quarterly Report

Surveillance information along the border and exchanging surveillance information at the provincial level of each country is an important activity for timely responses to outbreaks. Such information can be exchanged according to the official communication channel as stated in the MBDS mechanism. However, there are still gaps in the communication of sharing surveillance data among countries including different communication technologies, insufficient number of personnel to perform their duties, and different operating policies from country to country. For example, some countries require a long process to report laboratory-confirmed cases, which may cause a delay in reporting for disease detection [12]. While some countries can report suspected cases or syndromic cases based on various symptoms, it is easier to exchange information that takes less time to report.

To increase the timeliness in reporting of some diseases and syndromes to the system immediately, the MBDS presented its "Event-Based Surveillance (EBS) Mobile Application for Regional Collaborative Platform" [13]. The Event-Based Surveillance (EBS) Mobile Application was initiated by Canada's Global Partnership Program in Cambodia, Lao P.D.R, Myanmar, and Vietnam (CLMV countries). This application was developed to support the sharing of public health related event-based surveillance information in a timely manner, which includes evidence-based reporting at cross-border provinces of MBDS countries. This mobile application is a real-time reporting system using images and locations of all emergency events. It was developed for the Android operating system and applicable to mobile phones, tablets and similar devices. The reported information is shared with an email alert system to stakeholders. The expansion to Thailand's cross-border provinces is supported by the Rockefeller Foundation with the Mukdahan Provincial MBDS Cross Border Coordinator of Thailand and local Information and Communications Technology having started implementation of the "Regional Collaborative Platform" (EBS Mobile Application) in the designated areas [14]. The initial activities included discussions about the activity timeline, and the development, modification, and training for real-time reporting applications to other cross-border provinces with the MBDS Secretariat.

Connecting Organizations for Regional Disease Surveillance (CORDS - www.cordsnetwork.org) aims to control outbreaks at the source of infection to keep communities safe from the spread of disease between animals and humans. One of the key strategies is to increase the strength of community-incident reporting. With the support of the Rockefeller Foundation, CORDS member networks assess and implement EBS with a focus on cross-border areas and exchange of information on events occurring in humans and animals. The aforementioned tools were developed in terms of systems, processes, tools used to collect data, guidelines for event verification and responses, and guidelines for cooperation between agencies in surveillance of disease at cross-border areas.

References:

1. Centers for Disease Control and Prevention (CDC). Public health surveillance. In Principles of epidemiology in Public Health Practice 3rd ed. Atlanta. 2006; p 1-73.
2. Thacker SB, Birkhead GS. Surveillance. In: Gregg MB (ed) Field Epidemiology. New York: Oxford University Press, Inc. 2008; p 48-64.
3. World Health Organization (WHO). The surveillance of communicable diseases. WHO Chronicle 1968;22:439-444.
4. Pittayawonganon C. 2021, January 22. A surveillance system of Influenza like illness, Division of Epidemiology, Department of Disease Control, Ministry of Public Health. Retrieved from http://interfetpthailand.net/ili/index.php?page=about&p=qa
5. Ardkhean W, Saritapirak N, Iamsirithaworn S. 2019, June 23. Development of event-based surveillance for SRRT at district level. Department of Disease Control, Ministry of Public Health. Retrieved from file:///C:/Users/USER1/Desktop/EBS2558.pdf.
6. Smolinski MS, Crawley AW, Olsen JM, Jayaraman T, Libel M. Participatory Disease Surveillance: Engaging Communities Directly in Reporting, Monitoring, and Responding to Health Threats. JMIR Public Health Surveill 2017; 3(4): e62.
7. International Federation of Red Cross and Red Crescent Societies. 2019, July 13. Community-Based Surveillance: guiding principles. Retrieved from https://reliefweb.int/report/world/community-based-surveillance-guiding-principles-march-2017.
8. Moore M and Dausey DJ. Local cross-border disease surveillance and control: experiences from the Mekong Basin. BMC Res Notes. 2015;8: 90:https://doi.org/10.1186/s13104-015-1047-6.
9. Phommasack B, Jiraphongsa C, Oo MK, et al. Mekong Basin Disease Surveillance (MBDS): a trust-based network. Emerg Health Threats J. 2013;6:doi: 10.3402/ehtj.v6i0.19944. Epub 2013 Jan 25. PMID: 23362411; PMCID: PMC3557908.
10. Mekong Basin Disease Disease Surveillance. 2021, January 17. MBDS 18 Prioritize Disease. Retrieved from http://mbdsnet.org/mbds-cross-border-information/
11. Vung DN. Animal-Human Health Interface and community-based surveillance in Vietnam-a strategy under Mekong Basin Disease Surveillance Cooperation (MBDS). BMC Proc. 2011;10;5(Suppl 1):P113. PMCID: PMC3019429.
12. The Rockefeller Foundation. 2021, January 17. Final Evaluation of the Rockefeller Foundation's Disease Surveillance Networks Initiative in Asia. Retrieved from https://www.rockefellerfoundation.org/wp-content/uploads/Disease-Surveillance-Network-Asia-Evaluation-Report-2010.pdf
13. Danquah L, Sulo J, Mersini K., et al. Assessment of event-based surveillance in cross border areas of six regional networks, International Journal of Infectious Diseases. IJID. 2019; 79: doi.org/10.1016/j.ijid.2018.11.100
14. Mekong Basin Disease Disease Surveillance. 2021, January 17. MBDS Foundation Activities. Retrieved from http://mbdsnet.org/enewsletter_august_2020/

CHAPTER THREE

A

GUIDELINES FOR AVIAN INFLUENZA INVESTIGATIONS IN HUMANS AND ANIMALS

3.1 Avian Influenza Investigations in Humans

3.2 Avian Influenza Investigations in Animals

Avian influenza is an infectious disease in poultry, especially chickens, but can infect human populations in which clinical symptoms range from mild to severe. Although there has never distinctly been evidence of person to person transmission in the past, scientists are aware that genetic mutation of avian influenza viruses and viral reassortment may enable person to person transmission might to occur, an event which is likely to cause a pandemic.

The H5N1 avian influenza outbreak in Asia in 2004 resulted in devastating numbers of sick, dead, and destroyed poultry, as well as fatal cases in humans. It consequently affected public health, trade and the economy of the countries. Although outbreaks have not been found in animals or humans in some countries, outbreaks are still being reported sporadically. Therefore, there is still a high risk of avian influenza in the region regarding the high probability of exposure between humans and various types of poultry such as domestic birds, wild birds, live poultry in markets and ducks/chickens in commercial and backyard farms. The movement of live poultry or poultry products, the traveling of tourists and people, and the presence of avian influenza in poultry in neighboring countries have led the region to strengthen surveillance systems and prepare personnel and officials for laboratory testing and investigation.

3.1 Avian Influenza Investigations in Humans

Human cases are classified according to the case definitions [1] as follows:

Suspected case

1. Patients with fever greater than 38°C with one of the following symptoms:

Cough, muscle pain, unusual breathing (dyspnea or difficult breathing), or if

2. The doctor suspects pneumonia or avian influenza

And has a history of one of the following risks:

- During the 14 days before illness, exposure with poultry.

- During the 14 days before illness, having lived in an area where there was an unusually high number of dead poultry or there was detection of avian influenza virus in poultry populations or the environment.

- During the 14 days before illness, having lived or traveled from an area affected by avian influenza.

- During the 14 days before illness, taking care of, or having close contact with another patient with flu-like symptoms or pneumonia

- During the 14 days before illness, having direct contact with other mammals.

- During the 14 days before illness, admission to or visiting a patient in a hospital in an area where an avian influenza epidemic occurred.

- Severe pneumonia cases or unidentified cause of death.

- Pneumonia in healthcare workers, public health personnel, or laboratory staff

- A cluster of pneumonia cases

Probable case

Suspected case with respiratory failure or death.

Confirmed case

Suspected patients with a definite diagnosis according to standardized laboratory tests, where the causative agent of avian influenza, such as H5 or H7 was confirmed using one of the following methods:

- For a single sample specimen, RT-PCR method has to confirm a positive result from two primers or probes, or at least two samples collected from a patient that were collected from different locations such as a throat swab and nasopharyngeal aspirate, or at least two samples collected from a patient that were collected at different intervals, or

- Detection of avian influenza virus via viral culture, or

- Detection of 4-fold rise in titer between acute and convalescent sera phase performed via neutralization test

Patient Under Investigation (PUI)

A patient where more clinical information, historical exposure to risk factors in the area, and laboratory results are still needed before the patient can be classified clearly.

Excluded case

A patient that has already been investigated and who is not defined as any of the types of cases above.

Criteria to report cases should include suspected cases so that the process of verification and investigation can start. Indications for investigation include:

- Patients suspected of avian influenza or patients with acute severe pneumonia/death,

- Two or more pneumonia cases with an epidemiological linkage,

- Pneumonia cases among medical personnel,

- Five or more people with flu-like symptoms in the same village over a period of 10 days

When a case for further investigation has been identified, local officers should:

- Arrange and prepare teams to conduct epidemiological investigations and implement initial preventive measures,

- Report the current situation within 24 hours to the authorities and relevant organizations,

- Implement a preliminary risk assessment of the situation and notify other sectors to take appropriate action.

Sample collection and transporting samples for laboratory testing

1. Samples for viral culture and genomic detection

Appropriate samples for viral culture and genomic detection include nasopharyngeal aspirate, nasopharyngeal swab, throat swab and nasal swab. Samples should be collected as soon as possible within 1-3 days of the onset of disease symptoms. They should be collected before the patient receives antiviral drugs. If the laboratory results show negative for cases that have pneumonia and a clear history of exposure, different types of specimens should be sampled and collected from the respiratory tract every day.

Sample collection

- Nasopharyngeal aspirate is collected using a plastic tube connected to an aspirator and inserted into the nasopharynx. Approximately 2-3 mL of the sample are placed in a sterile tube. If there is not enough specimen from the plastic tube, viral transport media can used to wash the remaining cells stuck on the plastic tube into the sterile tube.

- Nasopharyngeal swabs are collected by inserting a swab into the nostril up to the nasopharynx and held there for 2-3 seconds. Then, the swab is gently turned in the same direction and pulled out, and the tip is dipped into viral transport media. The personnel collecting the sample can cut off the excess wire from the sampling tube.

- Throat swabs are collected by a wooden swab with a plastic handle at the posterior pharynx. The tip of the swab is placed into viral transport media and the swab handle can be broken to cover the tube completely.

- Nasal swabs are collected by inserting the swab into the nostril parallel to the nasal palate, and held for a few seconds. Then, the personnel collecting the sample slowly rotates the swab, removes it and pulls it out. The swab is placed into viral transport media and the swab handle can be broken to cover the tube completely.

Note:

Do not use a swab containing calcium alginate or a wooden handle swab because they may contain substances that inhibit some types of virus or inhibit PCR reactions. The swab should be a Dacron (Polyester) or Rayon swab and the handle should be made of wire or plastic.

Transporting samples

Samples of secretions or swabs in containers must be tightly corked, wrapped with labeling tape specifying patient identification, type of sample, and date of collection in a plastic bag. Then, it is collected in a box equipped with icepacks and sent to the laboratory immediately. If the samples cannot be sent immediately, it should be stored in the refrigerator at 4°C. Do not put it in the freezer of a refrigerator. If the samples need to be stored for more than 48 hours, keep it at -70°C.

2. Samples for detection of specific antibodies against avian influenza (antibody detection)

Serum is collected by taking approximately 3-5 mL of blood from a vein, inserted into a sterile tube, which is closed tightly, and set aside at room temperature for the blood to clot. Then the tube is centrifuged to divide the serum into a sterile tube, stored in a freezer at -20°C to prepare delivery to the laboratory. The paired-serum sample should be collected 10-14 days after the first blood draw.

Note:

If the PCR test is negative or the respiratory secretion sample cannot be obtained, serum may be collected for the detection of specific antibodies against avian influenza virus by micro-neutralization assay. Most antibodies will be detected 10-14 days after the date of symptom onset. Therefore, antibody testing is not appropriate for diagnosis in deciding treatment. It is rather used for confirming cases of pneumonia that have definite exposure history, where no virus was detected by isolation or genetic testing methods.

Practices for investigations

1. Strengthening pneumonia and influenza surveillance by asking the exposure history of all hospitalized patients with influenza:

- Direct exposure or indirect contact with the feces or secretions of sick/dead poultry and non-sick poultry in the 7 to 14 days prior to the onset of illness.

- Living in an area or a village that raises poultry in the 14 days before the date of onset.

- Close contact with another pneumonia patient in the 14 days prior to the date of onset.

- Traveling from a country or area affected by avian influenza in the 14 days prior to illness.

If the patient has a history of at least one of the above, public health officers in that health care facility have to report and investigate the disease. The rapid response team in the area has to implement disease control measures in the community immediately without waiting for laboratory results.

2. All samples from pneumonia deaths must be collected and sent for laboratory testing for avian influenza viral infection.

3. Steps for investigation of suspected avian influenza virus in human [2]

- Verify and coordinate with both public and private organizations to explore abnormal poultry deaths in the communities

- Check surveillance reports to explore other suspected cases of avian influenza in the area

- Monitor all members who live in the same household as suspected case every day for at least 14 days after the last date of living with the case. If they have a fever, the local public health officer has to verify and report it to the office of disease prevention and control immediately. This is to verify the possibility of person-to-person transmission.

- Prepare a case investigation form (Example form 2) and meet with the investigation team to modify the investigation form to suit the actual situation

Example form 2: Case investigation form for suspected avian influenza cases in humans

Section 1

General information

Name.. Sex ☐ Male ☐ Female

Age.................................Yrs

Nationality ....

Occupation...

Place of Occupation...................................... Subdistrict.................................District..............................

Province......................................Telephone number ....

Current address No.......................Name of community.................................Road.....................................

Subdistrict.................................District ....

Province ....Home telephone.................................Mobile Telephone...............................

Name of given information... ☐ Patient

☐ Relative Specify relationship................................. ☐ Others, Specify.................................

1. History of risk exposure

1.1 During the 14 days prior to illness, you have been exposed to poultry (in farm/in household/wild), such as handling, slaughtering, burying or eating raw, etc.

☐ No ☐ Yes, Specify type of exposure ....

1.2 During the 14 days prior to illness, you had direct contact with pigs or other mammals that were abnormally sick or had an unknown cause of death

☐ No ☐ Yes Specify (Date of exposure) ....

☐ Type of animal(s) .

1.3 During the 14 days prior to illness, you have stayed in an area where poultry were abnormally sick or an area where the causative agent of avian influenza in poultry or the environment was detected

☐ No ☐ Yes

1.4 During the 14 days prior to illness, you have lived or traveled from an epidemic area.

☐ No ☐ Yes , Specify

Country.................................City/ Province.................................District ....

Date of departure.................................Date of arrival.................................

Purpose of trip ....

Is there a history of hospitalization or visiting patients while traveling in the country?

☐ No ☐ Yes, Date of admission................................. Name of hospital.................................

1.5 During the 14 days prior to illness, did you provide care or have close contact with a person with influenza/avian influenza/pneumonia-like symptoms?

☐ No ☐ Yes Specify relationship ....

1.6 Unknown cause or death of severe pneumonia case ☐ No ☐ Yes

1.7 Are you health care worker or laboratory personnel? ☐ No ☐ Yes, Specify.................................

1.8 Are there other patients that have flu-like illness or a cluster of severe pneumonia?

☐ No ☐ Yes, Specify details of other patients

Name.. Date of onset ....

Signs and symptoms ....

Diagnosis... Hospital..

Relationship with the patient ....

Example form 2: Case investigation form for suspected avian influenza cases in humans

2. History of clinical information

2.1 Date of onset: Date............Month..................................Year..................................

2.2 The first place of admission..................................Date..................................

☐ Inpatient ☐ Outpatient

2.3 Underlying diseases ☐ No ☐ Yes. please specify

☐ Chronic lung diseases such as COPD, chronic bronchitis, chronic bronchiectasis, asthma

☐ Heart diseases such as congenital heart defects, coronary artery disease, congestive heart failure

☐ Chronic liver diseases such as cirrhosis ☐ Kidney disease/ kidney failure

☐ Diabetes ☐ Hypertension ☐ Immunodeficiency ☐ Anemia (Thalassemia, sickle cell anemia)

☐ Disabilities ☐ Pregnant..........................weeks

☐ Obesity

height................cm weight....................kg (BMI =................)

☐ Undergoing cancer treatment, type of cancer

☐ Others ....

Smoking ☐ No ☐ Yes if yes

☐ current smoker cigarettes/ day

☐ former smoker, quit date..................................

Alcohol drinking ☐ No ☐ Yes if yes

☐ current alcohol drinker, frequency.................per day

☐ former alcohol drinker, quit date.................

Flu shot ☐ No ☐ Yes, the last vaccination

2.4 Clinical signs and symptoms since onset date

Clinical signs and symptoms	Onset date		Day after onset date											
	0		1		2		3		4		5		6	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Fever (...... °C)														
Cough														
Sore throat														
Running nose														
Productive cough														
Difficulty breathing														
Dyspnea														
Muscle ache														
Headache														
Diarrhea														

Others, please specify..

Respirator ☐ No ☐ Yes, beginning date..................................

Anti-viral drug treatment ☐ No ☐ Yes, please specify drug name.

Dosage.................................. Starting date.................................Completion date...............................

Example form 2: Case investigation form for suspected avian influenza cases in humans

3. Laboratory information

3.1 CBC

1st: Date ....

	Results Hb	....	%	Hct	....	%	WBC	.... cell/ml
	Neutrophil	....	%	Lymphocyte	....	%	Atypical lymphocyte	.... %
	Monocyte	....	%	Eosinophil	....	%	Platelet count	.... cell/ml
2nd:	Date							
	Results Hb	....	%	Hct	....	%	WBC	.... cell/ml
	Neutrophil	....	%	Lymphocyte	....	%	Atypical lymphocyte	.... %
	Monocyte	....	%	Eosinophil	....	%	Platelet count	.... cell/ml

3.2 Sputum gram stain: Date .... Results ....

3.3 Sputum AFB 1st: Date .... Result ....

2nd: Date .... Result ....

3rd: Date .... Result ....

3.4 Sputum culture: Date .... Result ....

3.5 Blood culture: Date .... Result ....

3.6 CXR 1st: Date .... Result ....

2nd: Date .... Result ....

3rd: Date .... Result ....

3.7 Rapid test (for influenza): product name ....

Date .... Results.................... ....

3.8 Renal function test: Date .... BUN........... .... Cr .... GFR ....

3.9 Liver function test: Date .... SGOT......... .... SGPT .... ALP ....

Total Bilirubin .... Direct Bilirubin..................... ....

Total Protein .... Albumin .... Globulin ....

4. Specimen collection for laboratory testing ☐ No ☐ Yes, Specify...................................

- ☐ Nasopharyngeal swab — Date of collection...
- ☐ Throat swab/ Oropharyngeal swab — Date of collection...
- ☐ Nasopharyngeal swab + Throat swab/ Oro-pharyngeal swab in VTM — Date of collection...
- ☐ Nasopharyngeal aspirate with sterile technique — Date of collection...
- ☐ Nasopharyngeal wash with sterile technique — Date of collection...
- ☐ Phlegm with sterile technique — Date of collection...
- ☐ Tracheal suction — Date of collection...
- ☐ Blood 1st Date .... 2nd Date ....
- ☐ Sent to...Date sent...Test for ....

5. First diagnosis ....

Final diagnosis ....

6. For deaths, post-mortem examination ☐ No ☐ Yes, results ....

Name of investigator... Organization...

Telephone... Date of investigation...

Section 2: Follow up chart for sick persons during admission

Signs and symptoms	Starting date		Following days																							
	0		1		2		3		4		5		6		7		8		9		10		11		12	
	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Fever (……………………°C)																										
Cough																										
Sore throat																										
Running nose																										
Productive cough																										
Difficulty breathing																										
Dyspnea																										
Muscle ache																										
Headache																										
Diarrhea																										
Highest- Lowest body temperature																										
Highest pulse																										
Oxygen sat																										

Abnormal results of laboratory examination		
Test	**Date of collection**	**Results**
CBC		
CXR		
Sputum gram stain		
Sputum culture		
Blood culture		
Others		

Causative agent of pneumonia	Date of collection	Results
Influenza A		
Influenza B		
Adeno virus		
Adeno virus		
Corona virus (1st test)		
Corona virus (2nd test)		
Chlamydia		
Mycoplasma		
Legionella		
Others		

3.2 Avian Influenza Investigations in Animals

Steps for investigation of suspected avian influenza virus in animals

1. If animals suspected of infection with avian influenza virus are reported [3], the source data needs verification by acquiring additional information to confirm an outbreak. Even if only one case is detected, the case will be identified as an occurrence of an outbreak. The investigation team needs to be deployed immediately in order to avoid the disease from spreading. Aims of the epidemiological investigation are to:

- Verify the diagnosis

- Obtain data on the occurrence and distribution of the disease for place, time and people in order to analyze disease outbreak patterns

- Study factors related to the source of infection and modes of transmission

- Apply gained knowledge to prevent the disease from occurring again in the same area.

2. Determine the composition of the investigation team by through joint cooperation between the livestock and health sectors, in which the health sector can assist in active case finding among exposed persons and persons with suspected symptoms in the area.

3. Hold a meeting with the investigation team to plan roles, responsibilities and activities to be undertaken before and during the investigation.

4. Coordinate with the central unit if additional advice is needed.

5. The collection of samples for laboratory testing must be coordinated with the laboratory first.

6. The disease investigation team must prepare the following issues:

- Prepare knowledge of avian influenza from the information contained in this manual, textbooks, journals and reliable sources from electronic media

- Prepare a case investigation form (Example form 3) [4] and meet with the investigation team to modify the investigation form to suit the actual situation

- Prepare materials to collect samples for laboratory testing including gloves, plastic bags, cotton swabs, alcohol, blood collection tubes, syringes, paper, stickers, permanent-ink pens, knives, scissors, forceps and personal protective equipment.

- Prepare other materials if necessary, during the field investigation.

7. Provide specific recommendations and measures to control the outbreak and educate people in communities to understand the control measures.

8. Analyze and summarize the results of the investigation with epidemiological linkages between occurrence of the disease in human and animal populations.

9. Distribute the summary report of the preliminary investigation to policy makers of the local and central levels.

Monthly collection of specimens at live bird markets

Well-trained local veterinary officers

Sample collection at wet markets

Example form 3: Case investigation form for suspected avian influenza cases in animal

1. Place of disease occurrence

Name of farm................................... Name of owner..

No. of farm address........................ Sub district..................... District...........................

Province............................. Phone number...

2. Type of farm

☐ Layer chicken ☐ Broiler chicken ☐ Layer duck ☐ Broiler duck

☐ Goose ☐ Birds (specify) .... ☐ Others (specify) ....

3. Characteristics of farm

☐ Contracted farming (specify name of company)..

☐ Independent farm (specify name of agency)..

☐ Smallholder farm

☐ Others (specify)...

4. Location

☐ Rice field ☐ Fruit garden ☐ Forest ☐ Abandon area

☐ Agricultural area (specify) .... ☐ Urban area ☐ Others (specify).................................

5. Geographical area

☐ Natural water resources nearby (specify name and location).......................................

☐ Adjacent to a main road (specify name) ....

☐ Adjacent to a minor road

☐ Adjacent to a local road

6. Total number of poultry in the farm/household, number of sick poultry and number of dead poultry

☐	Layer chicken (No.)	Sick (No.)................	Death (No.).....................
☐	Broiler chicken(No.).........................	Sick (No.)................	Death (No.).....................
☐	Local chicken breed (No.).................	Sick (No.)................	Death (No.).....................
☐	Fighting cock (No.)...........................	Sick (No.)................	Death (No.).....................
☐	Layer duck (No.)..............................	Sick (No.)................	Death (No.).....................
☐	Broiler duck (No.)............................	Sick (No.)................	Death (No.).....................
☐	Goose (No.)	Sick (No.)................	Death (No.).....................
☐	Bird (specify.....................................) (No.)	Sick (No.)................	Death (No.).....................

Example form 3: Case investigation form for suspected avian influenza cases in animal

7. Number of farms or smallholder farm within a 5 km radius

☐ Commercial farm (No.) .... Approximate number of poultry ....

☐ Smallholder farm (No.) .... Approximate number of poultry ....

8. Type of farm (select more than one choice)

☐ Raise poultry over fish pond ☐ Roaming poultry

☐ Raise on ground floor under the house ☐ Layer farm ☐ Dirt floor

☐ Bedding farm (specify litter materials) ☐ Tile roof ☐ Leaf roof

☐ Galvanized iron roof ☐ Hanging ceiling fan

☐ Evaporation ☐ Others (specify..................................)

9. Animal feed

☐ Commercial feed

☐ Company (specify)..

☐ Retail store (specify) ....

☐ Others (specify)..

☐ Mixed feed at farm

☐ Source of ingredients (specify)..

☐ Composition (specify) ....

☐ Others (specify) ....

10. Disinfection for farmers, visitors, vehicles, equipment while checking in and out from the farm

☐ No ☐ Yes

☐ Delivery method ☐ Spray ☐ Dip ☐ Other ....

☐ Frequency ☐ Every time ☐ Sometimes

☐ Type of disinfectant...

11. Vaccination program

Date	Type of vaccine	Age at administration	Source of vaccination

Example form 3: Case investigation form for suspected avian influenza cases in animal

12. Clinical symptoms of sick poultry

☐ Acute death ☐ Dark purple crest/ wattle ☐ Swollen face

☐ Eye secretion ☐ Thigh hemorrhages ☐ Swollen sinus

☐ Difficulty breathing ☐ Neurological signs such as convulsion, twisting of the neck

☐ Diarrhea ☐ Others (specify) ……………………………………..…………………….…………

13. Date local officers received the disease occurrence

DDMMYY………..………/…………………..………/……………………………….

14. Record of sick poultry (a timeline listing date of onset to current date)

Age range	Date of onset	Number of sick poultry	Number of dead poultry	Management of carcass/sick poultry such as cull, bury, burn, sell, others (specify)

Remarks:
- In the case of smallholder farms, officials record cumulative numbers in that village
- In the case of commercial farms, officials record numbers in that specific farm

15. History of transporting animals, carcasses, eggs, animal products, and equipment into the farm within 21 days since date of case detection (in question #14)

Date received	Type of product received					Number	Source	Type of transportation	
	Animal	Carcass	Egg	Animal feed	Others			Company's truck or agency (Specify)	Personal car (Specify owner)

Example form 3: Case investigation form for suspected avian influenza cases in animal

16. Disinfectants were provided on the vehicles

☐ No ☐ Yes (specify type of disinfectants)……………………………………..………………………

17. History of sending animals, carcasses, eggs, animal products, and equipment from the farm to an outside destination within 21 days since date of case detection (in question #14)

Date received	Type of product exported					Number	Source	Type of transportation	
	Animal	Carcass	Egg	Animal feed	Others			Company's truck or agency (Specify)	Personal car (Specify owner)

Example form 3: Case investigation form for suspected avian influenza cases in animal

18. In a radius of 5 km around the farm, has an avian influenza outbreak been reported before?

☐ No ☐ Yes

☐ Specify location of the past occurrence ....

☐ Date of the past occurrence ....

☐ Type of sick animal .... Number of sick animal ....

☐ Results of laboratory investigation ....

19. In a radius of 5 km around the farm, is there a poultry slaughterhouse?

☐ No ☐ Yes

☐ Distance from the slaughterhouse to the location of the outbreak .... km

☐ Type of slaughterhouse

☐ Export slaughterhouse ☐ Slaughterhouse for domestic consumption

☐ Slaughterhouse for local areas

20. In a radius of 5 km around the farm, are there live poultry shops including birds, chickens, ducks located near-by?

☐ No ☐ Yes,

Distance from the live poultry shop to the location of the outbreak ....km

21. Source of water for animals in the farm

[ ] Rainwater [ ] River, canal [ ] Groundwater [ ] Tap water

[ ] Others (specify) ....

22. Can birds enter areas for raising poultry?

☐ No ☐ Yes,

Type of birds (specify)..........................

23. Have birds in question #22 shown clinical symptoms or died?

☐ No ☐ Yes,

Approximate number of sick or dead birds ....

24. In a radius of 5 km around the farm, are there any sources of habitats or natural food sources for birds?

☐ Migratory birds (specify) ....

☐ Domestic birds (specify) ....

☐ Wild birds (specify) ....

☐ Waterfowl/Kingfisher (specify) ....

☐ No

Example form 3: Case investigation form for suspected avian influenza cases in animal

25. Around the location of the disease occurrence, are there any of the following animals?

☐ Pig ☐ Cat ☐ Dog ☐ Horse ☐ Others ……………..

26. One week before the disease was detected, was there any exposure between the sick animals and other animals in questions #22 and #23?

☐ No ☐ Yes

Type of animals (specify) …………………..

27. Have humans residing around the area reported any clinical symptoms?

☐ No ☐ Yes

Date of report ……………………………………..

Number of human cases……………………………

Clinical symptoms (specify)……………………………………………

28. Assumptions of disease causation with justification

………

………

………

29. Suggestions/ Comments

………

………

………

Spot map of the disease occurrence

GPS location: X-axis.......................................Y-axis.................................

Reporter……….………………………………

Position……….………………………………

Organization……….………………………………

References:

1. Buathong R and Siriarayapon P. A guideline for surveillance and investigation of human avian influenza virus. In Luangon W., Avian influenza practice manual for healthcare and public health personnel (Revised version). 2015: Nonthaburi; Bureau of Emerging Infectious Diseases, Department of Disease Control: 49-54.
2. Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health. 2022, January 22. A guideline for disease reporting dangerous communicable diseases and surveillance disease under Communicable Disease Act. B.E. 2558 (2015). Retrieved from http://aidsboe.moph.go.th/app/bookup/uploads/2020-03-091342395787.pdf
3. Bureau of Disease Control and Veterinary Services, Department of Livestock Development, Ministry of Agriculture and Cooperatives. In Luangon W., Avian influenza practice manual for healthcare and public health personnel (Revised version). 2015: Nonthaburi; Bureau of Emerging Infectious Diseases, Department of Disease Control: 55-57
4. Chiangmai Provincial Livestock Office, Department of Livestock Development, Ministry of Agriculture and Cooperatives. 2022, January 22. Avian influenza investigation form. Retrieved from http://pvlo-cmi.dld.go.th/HTML/Download%20%E0%B9%81%E0%B8%9A%E0%B8%9A%E0%B8%9F%E0%B8%AD%E0%B8%A3%E0%B9%8C%E0%B8%A1.html

Wet markets are sites to focus on active surveillance

CHAPTER

FOUR

RISK ASSESSMEN CONTROL MEASU FOR AVIAN INFLU OUTBREAKS

4.1 Risk Assessment

4.2 Risk Characteristics

4.3 Control Measures for Avian Influenza Outbreaks

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Situation assessments can be done by collecting different sources of information like retrieving information from investigation reports and observing the source of the outbreak. The key parameters to be considered in the assessment of the situation are the possibility of the pathogen being transmitted to vulnerable populations and the consequences of the disease. An appropriate time for the risk assessment to be performed is within 24 to 48 hours after receiving the report and when the event has been verified. The risk assessment can guide decision-making for the incident commanders on prioritized measures, the workflow on what to do first, and planning guidelines for risk communication to vulnerable populations.

4.1 Risk Assessment

The most important activity that officials need to take up after receiving the report from the investigation team is the situation assessment to support policy makers in taking further action. The results of the risk assessment can differ for each organization and the results can be adjusted depending on the changing circumstances and the obtaining of additional information. Therefore, the risk assessment refers to the systematic process of collecting, evaluating and storing information that leads to categorizing the level of risk. It also leads to managing and reducing the negative impacts that come from those risks. In summary, the risk management cycle [1] is as follows:

- Assess the risk: There are three main areas to be assessed including 1) threats, 2) exposures, and 3) the social and environmental contexts. Those areas will be separated into levels of risk.

- Recommend relevant measures for disease control. Prioritize the recommendations for such measures with justification of the chance of success if those measures are implemented. Ensure the measures are practical and applicable to the local context and the measures should not have a wide negative impact on society and the population.

- Follow-up and evaluation: Need to have continual action.

- Communication: communicate effectively to ensure that incident commanders, incident managers, stakeholders and the affected communities understand and support disease control measures that will be implemented in the communities.

- After action review: Evaluate all procedures that were performed at the end of the response phase.

Risk assessments can help practitioners in each level define countermeasures and implement urgent measures in disease control and as a result, carry out effective management [2]. The risk assessment team should come from multisectoral units involved in the event including experts and local officers who understand the community's context well. This will increase the efficiency of the risk assessment and can determine the control measures for the actual practice. The risk assessment team has to set a list of questions for this event by considering "What are the most important questions that need to be answered?" This will help the team to more clearly define the scope of information that should be collected and then lead the assessment process. The questions of the risk assessment are similar to research questions, focusing on 1) Who is affected? 2) What is the likely threat? and 3) How, when and why are those population affected by those threats?

The three key components that are assessed are threats, exposures, and the social and environmental contexts. The assessments in all three components can provide an overview of risk. The three components should be evaluated simultaneously and some of the information used in the assessment may be overlapping among the three components.

Threat assessment:

- Should be able to identify the cause of the disease.

- Review the information and relevant documents to determine the possibility of any potential threats.

- Rank all suspected threats of causing the disease from highest to lowest probability.

If laboratory results reveal about the causes of the disease, procedures to cope the disease would be more manageable. However, the causes are often unknown at the beginning of the disease outbreak. Thus the threat assessment usually begins with brainstorming to consider the probability and ranking of the probabilities that each suspected threat could be the cause. The brainstorming process includes gathering information on clinical symptoms, epidemiological data (distribution of the diseases in animal/human populations, in respects to place and time), and any conditions if the disease was found in the community.

Exposure assessment:

An assessment of the exposure to threats (diseases), both at the individual level (individual in the case of animals) and population level (or herd of animals). The important things that should be assessed include:

- The number of people, animals or herds that are likely to have been exposed to the disease.

- The number of people, animals or herds that are exposed to the disease and that are susceptible to the disease or showing signs of illness (for example, lack of immunity to pathogens).

Information that will help answer these two questions are:

- Mode of transmission (e.g. contact via large droplets, direct contact or contact between animals and human)

- Dose of pathogens

- Period of exposure to pathogens

- Incubation period

- Morbidity rate, mortality rate, case fatality rate

- Basic reproductive number

- Herd immunity in populations exposed to the disease

For zoonotic diseases, the number of reservoir animals, species of animal, distribution of animal populations, and animal population density in the affected area are important factors in the exposure assessment.

Social and environmental context assessment:

Physical and environment assessments, such as climate, cultivation, land use for farming, livestock or industry, water resources in the area, mass transportation, infrastructure of medical, public health and animal health services, endemic disease in the area and the traditional and culture in the local contexts. In most cases, human health and animal health sectors do not take social and environmental issues to assess risks. This may result in a narrow view of a threat analysis or oversight of that risk.

These important questions should be answered:

- What are effects of the environment, health conditions, behavior, society and culture and access to health care services in the area that may increase the risk of the population?

- What factors, in terms of context and environment, are relevant to reducing exposure in populations?

4.2 Risk Characteristics

When the assessment team has completed an assessment of threats, exposures, and social and environmental context, the next step is considering the level of risk (risk characteristics). The risk profile determination process is based on a team of experts. In addition to that, there is a tool (as shown in Figure 3) that will help the assessment team to clearly consider likelihood and impact. In most cases, the health risk assessment is a qualitative assessment. The variables used in the risk assessment table are not numeric units, but they include broad definitions of the likelihood of occurrence and the impact from the severity of the risk. The definition can be adjusted to fit it to the context of the area.

Definition of “likelihood” can be divided into 5 levels:

1. Very low: it rarely happens, except in special circumstances. The probability is less than 5%.

2. Relatively low: the probability is between 5% and 29%.

3. Relatively high: it can occur at certain times. The probability is about 30% to 69%.

4. High: The probability that an event will happen is about 70% to 94%.

5. Extremely high: it is expected that an event is quite certain. The probability is greater than 95%.

Definition of “impact” can be divided into 5 levels:

1. Very little: it is limited to the affected population. It has very little impact on daily life or services. The ordinary response is sufficient to counter the risk. It has almost no effect on the budget and on stakeholders.

2. Less impact: it will exist in small populations or specific persons who are in risk populations. The impact is limited to a narrow range of daily life and services. There may be an additional budget requirement and expansion of efforts of the stakeholders to implement disease control measures in the community.

3. Moderate: it affects more risk groups of the population. It has a moderate impact on daily life and services. The recruitment of additional sources of budget is required, including involving a wider range of stakeholders.

4. Significant: It has a larger impact on the population and has a large impact on changes in daily life and services. Recruitment of more funding sources and more coordinating with other sectors are necessary. There is a need to issue more disease control measures.

5. Severe: it affects most of the population and causes a tremendous change to daily life and services. It requires the allocation and gathering of manpower and financial support to issue disease control measures.

The evaluation of the impact requires comprehensive information including estimates of morbidity rate, mortality rate, and long-term health impacts.

Figure 3 A tool for risk assessment

Color	Overall risk	Measures
	Low	Responding to common practice standards or previously implemented requirements, such as regular monitoring of a surveillance system.
	Moderate	In response to that incident, roles and responsibilities must be clearly identified including the identification of guidelines for monitoring or control measures such as increasing surveillance measures.
	High	There must be a structure of the command and management system among the senior authority and there should be various choices of control measures, along with clarification of the potential impact of each of them.
	Very high	There must be an immediate response of senior authority regardless of the event as that event could take place at any given moment. The structure of the command and management system must be in place and ready to use to issue advanced control measures.

The information obtained from the investigation can reveal facts of the event, thus making the risk assessment more accurate [1]. Disease control measures can be implemented to contain the disease and effectively limit the spread of the epidemic.

4.3 Control Measures for Avian Influenza Outbreaks

If the animal health sector reports a suspected case or confirmed case of avian influenza in animal populations, the public health sector needs to take action immediately as follows [3]:

1. Local public health offices implement a daily survey on the situation of cases with pneumonia and influenza from the surveillance system and summarize the daily disease situation to the provincial, regional and central public health offices.

2. Set up a working group consisting of responsible persons from the Ministry of Agriculture and Cooperatives, Ministry of Public Health, and other agencies as deemed appropriate by the provincial governor.

3. Rapid response teams in the area equipped with the assigned personnel are to be on duty for 24-hour emergency activities and receive notifications of suspected animal infections, investigations of cases suspected of avian influenza and provide advice on the diagnosis and guidelines to take care of suspected cases.

4. Prepare the budget, materials, support for investigation activities, and control of disease in patients and communities including staff remuneration, vehicles, equipment for personal protection, medicine and test kits for screening etc.

5. Before every operation, provide suggestions on how to protect to personnel who cull suspected animals:

- While working, the personnel must use standard infection prevention equipment by wearing long sleeves, trousers and plastic aprons, a hat to cover hair, rubber gloves, goggles, a mask to cover nose and mouth, and boots.

- The operating time should not be more than three continuous hours. If the work cannot be completed within three hours, the personnel should have a break to wash their bodies and hands.

- Each time they finish work, the personnel should wash their hands, clean their bodies, and change into new clothes.

- To destroy germs contaminated while using equipment including clothing and shoes, they should use chlorine or sodium hypochlorite as disinfectant.

- If the personnel have a fever or symptoms of respiratory failure, they must seek medical attention and inform their history of animal contact to the staff at the health care facilities.

6. Make a list of personnel involved in culling and the related officers who had exposure to suspected infected animals to follow up on their symptoms for at least 7 days.

7. Provide education to all villagers on the transmission of disease. During the specific period of an abnormal amount of sickness and death among chickens or other poultry, the villagers need to assume that those animals died from avian influenza. There is no need to wait for laboratory results. The villagers need to avoid touching those chickens and cannot allow taking those chickens to be slaughtered for food. The vulnerable group of pre-school and school-age children need to be especially reminded of this caution.

8. For some people, it is impossible to avoid close contact with poultry, as some people are responsible for the culling of sick poultry. The public health officers should educate them on the importance of wearing protective clothes, a surgical mask, gloves, and goggles that prevent secretions from animal splashing into their eyes. They must provide education for washing hands and taking a shower after completing the work, and not using unwashed hands to touch the nose or face to protect them from disease transmission.

9. Raise awareness among villagers, personnel responsible for culling, butchers and livestock officers to seek medical attention immediately if they exhibit fever within 10 days after having history of direct contact with sick or dead poultry.

10. Ask people not to take sick animals or suspected infected animals to be slaughtered for eating because that process of preparing poultry meat may lead to transmission.

11. Provide information to parents in affected areas to supervise their children not to play in sand of the slaughtered area that may be contaminated with manure of infected poultry. Parents need to ensure that children wash their hands every time after playing on the suspected area with contamination of avian influenza virus.

If the public health sector reports a suspected case or confirmed case of human avian influenza, the animal health sector needs to take action immediately as follows [4]:

1. The provincial animal epidemic investigation team, in collaboration with the provincial public health disease investigation team, immediately conducts a field investigation. If the case provides a history of exposure to poultry or resides in the surrounding areas where poultry is raised, the joint investigation team between the animal and health sectors has to identify the source of infection from poultry populations and risk factors, etc. Veterinary officers collect both samples of oropharyngeal swabs and serum in the amount of five poultry per patient households and/or the source of poultry of which the patient was exposed, and other poultry in surrounding areas under the consideration of the veterinarians if those poultry are at risk of contracting the disease.

3. Clean and disinfectant the patient's household and including other areas surrounding areas where

poultry are raised using effective disinfectants that are recommended by the Department of Livestock Development, under consideration of the veterinarian if the poultry are at risk of contracting the disease

4. Family members in the same households of suspected/confirmed avian influenza cases need to avoid contact with other poultry and not enter any other poultry farms.

If the laboratory results confirm avian influenza in poultry, the following measures [4] need to be carried out:

1. The Director-General of the Department of Livestock Development immediately reports the laboratory results of avian influenza to the Ministry of Agriculture and Cooperatives.

2. The Director-General of the Department of Livestock Development reports the occurrence of avian influenza outbreak to the World Organisation for Animal Health (OIE) within 24 hours.

3. The Provincial Governor issues an announcement to determine the epidemic area according to the law enforcement of the local context.

4. Suspected poultry are culled and sampled carcasses collected for transport to the laboratory for confirmation. This procedure must be done within 12 hours from receiving notification of the results. Culling poultry proceeds especially for the households or farms that report the disease, and other poultry raised in surrounding areas are under consideration of the veterinarians to also be culled if at risk of contracting the disease. Local officers have to report according using the agreed upon forms of each context every week until the outbreak has stopped.

5. Investigation teams from the regional and central levels should help the local teams for further investigation if the outbreak has the potential of spreading to other areas or if additional epidemiological information is needed.

6. Clean and disinfect the hot spot area using effective disinfectants that are recommended by the Department of Livestock Development and continual implementation of disinfecting in those areas until the outbreak has stopped.

7. Poultry within a radius of 10 kilometers around the outbreak spot have to be isolated and not allowed for movement for at least 30 days or until the disease has stopped. For standardized farms approved for biosecurity farms, poultry in the farms need to be sampled. For example, 20 oropharyngeal swabs of poultry in each house in the amount of five houses per farm, and the laboratory confirmation show negative results before allowing for movement.

8. Active surveillance of suspected avian influenza symptoms among poultry populations are to be continuously conducted within a radius of 10 kilometers around the area of the outbreak.

9. Laboratory surveillance within a radius of 10 kilometers around the area of the outbreak should be implemented with the following sample collection method:

a. Oropharyngeal swab samples should be collected in all households in the affected village and other poultry in surrounding areas under consideration of the veterinarians are also collected if those poultry are at risk of contracting the disease by random sampling five poultry per household raising poultry (if the household raises less than five poultry, all poultry are collected for samples). Samples in poultry in the same area will be collected again 21 days apart from the first collection.

b. Oropharyngeal swab samples should be collected at random in every village within 10 kilometers around the area of the outbreak, for example 20 poultry per village.

10. Standardized farms within a 10-kilometer radius must strictly apply biosecurity measures, clean and disinfectant around and inside each house of farm at least 2-3 times a week by using effective disinfectants recommended by the Department of Livestock Development.

11. The animal sector should coordinate with relevant agencies, especially the provincial health sector to immediately conduct active surveillance to detect clinical symptoms of respiratory infection of people in communities to monitor disease in people. The coordination should proceed along with relevant agencies such as the Ministry of Natural Resources and Environment for disease monitoring in wild birds, and the Ministry of Interior for local public relations and in other capacities on a case-by-case basis.

12. Public relations and provide education to farmers and the general public to better perceive and understand disease prevention, disease monitoring and procedures of pathogen inactivation to prevent panic among the general public as well.

2. The poultry in the patient's household and/or other poultry in surrounding areas are put under the veterinarian consideration for isolation if the poultry are at risk of contracting the disease.

References:

1. World Health Organization. 2019, July 13. Rapid risk assessment of acute public health events. Retrieved from http://whqlibdoc.who.int/hq/2012/WHO_HSE_GAR_ARO_2012.1_eng.pdf.

2. UNISDR, 2017: Words into Action Guidelines National Disaster Risk Assessment: National Disaster Risk Assessment: Hazard Specific Risk Assessment: Biological Hazards Risk Assessment. United Nations International Strategy for Disaster Reduction, Geneva, Switzerland.

3. Buathong R and Siriarayapon P. A guideline for surveillance and investigation of human avian influenza virus. In Luangon W., Avian influenza practice manual for healthcare and public health personnel (Revised version). 2015: Nonthaburi; Bureau of Emerging Infectious Diseases, Department of Disease Control: 49-54.

4. Bureau of Disease Control and Veterinary Services, Department of Livestock Development, Ministry of Agriculture and Cooperatives. In Luangon W., Avian influenza practice manual for healthcare and public health personnel (Revised version). 2015: Nonthaburi; Bureau of Emerging Infectious Diseases, Department of Disease Control: 55-57 and 124-127.

Annex 1:

An Example of Active and Sentinel Surveillance of Avian Influenza

In 2018, the Thailand Department of Disease Control (DDC) and Department of Livestock Development (DLD) enlisted government employees to conduct pilot-scale surveillance of human and poultry in four border provinces. Poultry farms and live bird markets along border areas are at increased risk for infection so the collaboration aimed to strengthen avian influenza surveillance in poultry populations and enhance joint investigations of human and animal sectors to determine the frequency of avian influenza transmission to humans.

Objectives

1) To determine the frequency of avian influenza transmission to humans among poultry populations in border provinces.

2) To assess the risk factors for avian influenza among poultry farms, live bird markets, poultry farmers and traders, including describing the relationship between infections in animals and humans.

Target areas

The six pilot areas of the four border provinces were:

1. Chiang Khong District, Chiang Rai Province
2. Chiang Saen District Chiang Rai Province
3. Wiang Kaen District Chiang Rai Province
4. Mueang District, Nakhon Phanom Province
5. Mueang District, Mukdahan Province
6. Sirindhorn District, Ubon Ratchathani Province

Methodology

Monthly surveillance was implemented with cooperation from the local livestock offices. Samples from poultry were divided into the following four groups:

1. Random sampling was implemented to collect oropharyngeal swabs in poultry that were raised in farms and backyard poultry in sub-districts located in border districts of the four provinces. In each district, samples from two villages were randomly collected and samples from four households in each village were randomly collected for a total of eight households in each district. Local livestock offices identified the sampling households to determine four households raising ducks and four households raising chickens for sample collection. Five samples of oropharyngeal swabs from poultry were collected per household by placing one swab in one sample tube (one ml VTM vials). Therefore five sample tubes would represent one household. In summary, samples from eight households were collected for laboratory testing of avian influenza virus, totaling 40 samples per district each month.

2. Random sampling was implemented for the collection of oropharyngeal swabs in poultry in live poultry markets in sub-districts located in border districts of four provinces. In each live poultry market, three live poultry shops in the poultry markets were randomly collected. Local livestock offices identified the sampling live poultry shops to determine two shops selling live ducks and one shop selling chickens for sample collection. If there were no ducks, live chickens from three shops in the live poultry market were provided. Five samples of oropharyngeal swabs from live poultry were collected per live poultry shop by placing one swab in one sample tube (one ml VTM vials). So, five sample tubes would represent one live poultry shop. In summary, samples from three live poultry shops were collected for laboratory testing of avian influenza virus, totaling 15 samples per district each month. For repeat laboratory confirmation, duplicate sampling collection in two of the three live poultry shops (live duck shop and live chicken shops), totaling 10 samples were sent to be tested at another reference laboratory (at Mahidol University).

3. Random sampling was implemented for poultry carcasses in animal quarantine of livestock offices in border districts of the four provinces. In each animal quarantine area, two poultry carcasses were randomly collected for laboratory testing of avian influenza virus per district each month.

4. Random sampling was implemented for poultry trachea in fresh markets in border districts of the four provinces. In each fresh market, samples from two poultry processing shops were randomly collected. Five samples of poultry tracheas were collected per one poultry processing shop by placing one sample of trachea (the trachea section was cut into one cm per trachea) in sample tubes (two ml VTM vials). Therefore, samples from two poultry processing shops were collected for laboratory testing of avian influenza virus, totaling 10 samples per district each month.

Remarks;

- If there were no samples in items 2, 3 and 4, the sample in item 1 would be collected to 75 VTM tubes (15 samples) to be transported to the Veterinary Research and Development Center, National Animal Health Institute, and 10 VTM tubes (2 samples) for transport to the Faculty of Veterinary Science, Mahidol University per district, each month.

- If more backyard poultry samples needed to be collected, chicken to duck samples were collected in the ratio of 1: 1.

Sample collection and transport for laboratory confirmation

1. Sample identification was labeled as shown by the codes. All sample tubes had to be clearly marked with permanent ink and were put in the sample box in a zip lock bag. Then, the zip lock bag would be put in a foam box with ice or ice packs that could maintain a temperature of about 4° C for at least 48 hours.

2. Poultry carcasses are placed in a foam box with ice or ice packs to maintain a temperature of approximately 4° C for at least 48 hours.

3. A person from the provincial or district livestock office or the animal quarantine station who collected the specimens, had to send all samples to the Veterinary Research and Development Center in the area within 24 hours upon arrival.

4. The sample submission forms were filled out sent along with the sample as follows:

a. Monthly sample collection form attached to the sample box (as shown in Example form 4).

b. Data entered into the Excel form and submitted to the Bureau of Disease Control and Veterinary Services

b. Data entered into the Excel form and submitted to the Bureau of Disease Control and Veterinary Services via email and the Veterinary Research and Development Center in the area every month.

5. The veterinary research and development center sent samples to Mahidol University by coordinating with the Office of International Cooperation, Ministry of Public Health within 24 hours upon arrival to Mahidol University.

Example form 4: Monthly collecting form used for the project of avian influenza surveillance in poultry farms and poultry markets along the border areas under the One Health approach

Section I For local officers to fill in

Month and year of specimens' collection.......MM/YYYY........................

Area of specimen collection (Province)..District..

Place of specimen collection

1. Farm/household Date of collection...

#1 Address.............................Subdistrict.......................District...........................

Code................................Type of specimen..........(Chicken/Duck)

#2 Address.............................Subdistrict.......................District.........................

Code.................................Type of specimen.........(Chicken/Duck)

Are there any sick animals on farm/household? ☐ Yes ☐ No

If yes, please specific number of sick animals...

Clinical signs/ symptoms

☐ Sudden death ☐ Respiratory symptoms ☐ Neurological signs ☐ Diarrhea

☐ Foamy eyes ☐ Darkening of the head and wattles ☐ Swollen face

☐ Swollen sinus ☐ Thigh hemorrhages ☐ Others specify...................................

2. Live bird market Date of collection...

#1 Name of owner..Code................. Type of specimen.........(Chicken/Duck)

#2 Name of owner...Code............... Type of specimen...........(Chicken/Duck)

#3 Name of owner..Code................. Type of specimen.........(Chicken/Duck)

Are there any sick animals at the live bird market? ☐ Yes ☐ No

If yes, please specific number of sick animals...

Clinical signs/ symptoms

☐ Sudden death ☐ Respiratory symptoms ☐ Neurological signs ☐ Diarrhea

☐ Foamy eyes ☐ Darkening of the head and wattles ☐ Swollen face

☐ Swollen sinus ☐ Thigh hemorrhages ☐ Others specify.....................................

Example form 4: Monthly collecting form used for the project of avian influenza surveillance in poultry farms and poultry markets along the border areas under the One Health approach

3. Fresh market Date of collection....................................

Name of market........................... Location...............Village.................Subdistrict...............District.............

#1 Name of shop...Code................. Type of specimen.........(Chicken/Duck)

#2 Name of shop...Code................. Type of specimen.........(Chicken/Duck)

Place of laboratory examination

1. Organization...Date of sending specimens..................................

Total number of specimens collected...

2. Organization..Date of sending specimens..................................

Total number of specimens collected...

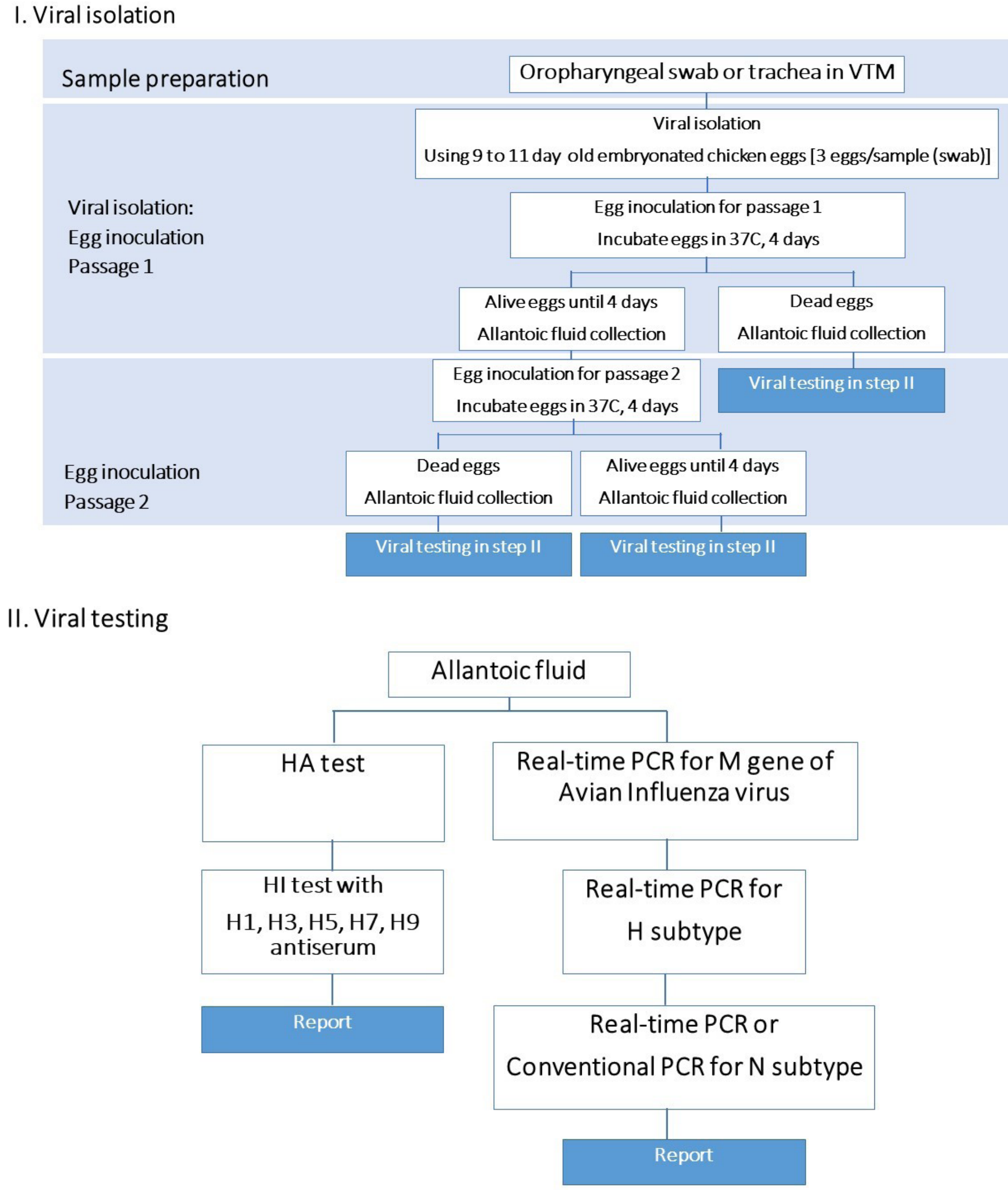
Name of data entry...Telephone number..

Collection and transport of specimens: secretions or mucous membranes from the oral pharynx

Before collecting specimens, local veterinarians have to contact the focal points at least one-day prior to coordinate with the laboratory as a pre-notification to prepare reagents and necessary equipment for specimen collection. On a monthly basis, the central distributors distribute tubes containing the specimen stabilizer for viral transport medium (VTM) for specimen collection. The VTM tubes need to be kept at a temperature of 4° C throughout the duration of collecting specimens from animals. The person who collects the specimen is required to adhere to preventive measures by wearing personal protective equipment (PPE), including wearing gloves, goggles and masks.

Oropharyngeal swabs are used to collect epithelial cells in the pharynx and oral walls via cotton swabs adhering to cells. The cotton swab with the cells from oropharyngeal tissues is dipped into the 1 mL VTM tube using the aseptic technique. The tip of the cotton swab above the tube is broken and discarded as infectious waste. The local officers write the specimen name or code, and date of specimen collection on the side of the tube. While the specimen is being transported, the temperature must be kept at 4° C and the duration between transportation and sending for laboratory tests should not be more than 24 hours. For avian influenza viral laboratory tests, relevant laboratories should follow the procedures (Figure 5) recommended by the Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE).

Figure 5 Laboratory procedure for avian influenza testing at the Veterinary Research and Development Center, Department of Livestock Development, Ministry of Agriculture and Cooperatives, Thailand



Reporting the results of laboratory testing

The National Institute of Animal Health or Veterinary Research and Development Center, and Mahidol University reported the laboratory results to the Bureau of Disease Control and Veterinary Services, and surveillance offices/prevention and control offices at the Department of Disease Control within 14 days of when the samples arrived at the laboratory. The laboratory results were sent to the local offices by e-mail. If the laboratory results were found to be positive for avian influenza virus or suspected avian influenza infection in animals, the investigation teams under multilateral cooperation using the One Health approach, had to verify and investigate immediately by using an epidemiological investigation report form for poultry disease. All variables in the collection and investigation forms were entered into the statistical program.

Summary of Activities/Accomplishments:

1. Monthly meetings

to follow up project activities and progress were to share information about the influenza situation in both human and animal populations. Stakeholder meetings were organized monthly.

2. Value chain analysis

Trainings were held to prepare local officers to conduct the poultry trade network study and value chain analysis to develop the capacity of the staff of the avian influenza surveillance network, provide knowledge, and provide understanding of the poultry trade network study and value chain analysis by an experienced person.

3. DGHP-AISP Workshop

Workshops on avian influenza surveillance and response among border provinces were integrated into the avian influenza surveillance among poultry and live bird markets in border provinces project (DGHP-AISP) with the detection of avian influenza project (Flu-DAI), to strengthen knowledge and the network. In addition, the participants shared their experience in fieldwork and discussed barriers to improve further operations. Avian influenza academic lectures and database utilization for avian influenza outbreak preparedness and response were held to synergize the implementation of measures for avian influenza outbreak preparedness and response. In addition, the project coordinator informed the participants about future plans and activities.

4. Table Top Exercise on EOC

The Table Top Exercise Workshop for Avian Influenza Outbreak Preparedness and Response in Border Provinces included lectures about avian influenza knowledge and a simulation exercise for avian influenza outbreak preparedness and response to practice the procedures of the Emergency Operations Center [EOC] for avian influenza outbreak

5. Field Visit

The Field visits were conducted to discuss the surveillance objectives and plans with local stakeholders in four pilot provinces. All local stakeholders agreed to participate in the surveillance, and provided positive feedback that could be adjusted to the local context.

6. Yearly surveillance reports at four sites

from September 2019 to August 2020 from the animal part showed that the total number of collected specimens came from 745 chickens, 298 ducks and 1 quail categorized into 864 specimens of oropharyngeal swabs from backyard farms, 144 specimens of tracheal sections and 36 swabs from live bird markets. However, there were no specimens from live poultry markets in Chiang Saen and Wiang Kaen districts sent to the laboratories from March – August 2020 because the live poultry markets in Chiang Rai were closed due to the measures to prevent and control COVID-19. The Veterinary Research and Development Centers reported that all specimens showed negative results for avian influenza virus. The Faculty of Veterinary Medicine, Mahidol University and the National Institute of Animal Health reported that one specimen from Wiang Kaen District showed positive results for LPAI H9N2. The local Department of Livestock Development officers investigated the vendors and educated community members in Wiang Kaen District. The accumulated information was added to the monthly report and the data of avian influenza events around the world were updated in the project's newsletter. The focal points from the animal and human units continue to exchange and update avian influenza data.


213 countries
2 international conveyances

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Soawapak has a background in veterinary medicine. After graduating with a doctorate in public Health from Johns Hopkins Bloomberg School of Public Health, she has worked as a veterinary officer, and is now a specialist in the concentration of zoonotic diseases and epidemiology, at the Department of Disease Control (DDC), Ministry of Public Health (MoPH), Thailand.

She is currently the Director of Office of International Cooperation, DDC, MoPH. She is enthusiastic in developing such collaborations in public health research on zoonotic diseases, emerging and re-emerging infectious under the One Health concept in Thailand and in the international level. She is also interested in working to apply field epidemiology and advanced statistical approaches in understanding disease transmission and developing effective public health control and prevention strategies with a perspective on global health security.


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