OSIR

Outbreak, Surveillance, Investigation and Response

Volume 13, Issue 2
June 2020

www.osirjournal.net

ISSN: 2651-1061

The Outbreak, Surveillance and Investigation Reports (OSIR) Journal was established in 2008 as a free online publication in order to encourage and facilitate communication of health information and disease reporting across Asia and the Pacific. In September 2018, the journal is retitled as the "Outbreak, Surveillance, Investigation & Response" while maintaining the same abbreviation as OSIR.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Tiwanond Road, Talad Kwan Subdistrict, Muang District, Nonthaburi 11000, Thailand

Tel: +662-5901734, Fax: +662-5918581, Email: osireditor@osirjournal.net

Website: <**http://www.osirjournal.net**>

Volume 13, Issue 2, June 2020

Contents

Editorial:

Original Articles:

Invited Perspective Article:

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Editorial

BACK TO THE BASICS

Khanchit Limpakarnjanarat, FETP 1980

Supamit Chunsuttiwat, FETP 1982

Kumnuan Ungchusak, FETP 1984

The year 2020 marks the 40th Anniversary of the Field Epidemiology Training Program (FETP) in Thailand. Since 1980, when the first cohort of 5 FETP trainees was started, a total of more than 250 epidemiologists have been trained or are under current training. With this COVID-19 pandemic situation, more than 100 alumni and trainees have contributed to the response in Thailand. We have our presence at several critical points of the response; from guiding work in the frontline at points of entry, participating in the Surveillance Rapid Response Teams (SRRT), serving as the main workforce in the Emergency Operating Center (EOC), to taking part in developing a Clinical Practice Guideline (CPG) and numerous other guidelines for our field workers. Our senior alumni have contributed significantly to policy and strategy development at the National Center of COVID-19 Situation Administration (CCSA).

Since early January 2020, Thailand has utilized available resources to respond to the COVID-19 pandemic. At the time of writing this article in early May 2020, Thailand reported 2,966 cases and 54 deaths. So far, the country has been able to mitigate the impact of the situation to the level that our health system can handle the need for hospitalization and use of intensive care units. Many strategies to slow down the spread have been implemented successfully based on six essential public health infrastructures that the country has built up over the past four decades.

1. The International Health Regulations (IHR) 2005 core capacity preparedness: Thailand has invested in workforce development in areas of epidemiology under the Field Epidemiology Training Program (FETP) and the mid-level epidemiological capacity building program to equip the Surveillance Rapid Response Team (SRRT); points of entry and the Emergency Operating Centers at national, regional, provincial and district levels with the full delegation of authority to each level.
2. Primary Health Care: Over one million village health volunteers around the country form a key component of our strong surveillance network at the village level.
3. Universal Health Coverage (UHC): The UHC program is our main safety net for case management and referral system. It provides a budget to cover testing and care for suspected and confirmed cases. Case management has expanded to include various innovative case containment models such as mobile negative pressure rooms, cohort wards and hospitals. State and local quarantines have been established for isolation and observation of travellers from COVID-19 affected countries.
4. National Laboratory System: As an important component of IHR (2005) core capacities, the national laboratory network initiated the development of diagnostic tests for SARS-CoV-2 infection, and laboratory testing has been quickly expanded to more than 140 laboratories in public and private sectors nationwide.

5. Hospital Infection Control network: Airborne Infection Isolation Rooms are made available in all provincial and regional hospitals around the country. Most academics and many private hospitals have participated in the response to this outbreak. Triage in respiratory clinics is a routine practice in hospitals at all levels.
6. Legislation: The Communicable Disease Act (2018) is the principal legislative tool for COVID-19 response. In addition, the Emergency Decree (2005) was also activated with full enforcement early in the response.

We have witnessed the whole-of-society response through the exercise of authorities and mobilization of resources from all ministries in the public and private sectors at regional, provincial, district, to village levels, essentially to implement the national strategies in COVID-19 response. This extent and intensity of cooperation has never been experienced before.

The fight is still not over. Challenges remain as the lockdown measures are systematically released with restoration of domestic and international travel, return of migrant labour, reopening of businesses and schools, and reinstallation of social activities, etc. We believe as far as the whole-of-society cooperation in the country is strongly maintained, we will continue to slow down the transmission of SARS-CoV-2 to the level that our health system can accommodate.

In this issue, FETP and partners have summarized haphazard investigations by different places of clusters such as clusters among tourists, clusters in restaurants, and clusters of Islamic Missionaries. In addition, designing competent chatbot countering to COVID-19 pandemic and empowering risk communication in the emergency response system are described in this issue. We believe these articles will be useful for a better understanding of the COVID-19 situation and response.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Contact Tracing and Awareness-Raising Measures for Travelers Arriving in Thailand from High Risk Areas of Coronavirus Disease (COVID-19): A Cluster of Imported COVID-19 Cases from Italy, March 2020

Suphanat Wongsanuphat[1]*, Charuttaporn Jitpeera[1], Duangjai Konglapamnuay[2], Chuthawan Nilphat[1], Supiya Jantaramanee[1], Rapeepong Suphanchaimat[1,3]

1 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 Laem Chabang Hospital, Ministry of Public Health, Thailand

3 International Health Policy Programme, Ministry of Public Health, Thailand

*Corresponding author, email address: suphanat.wong@gmail.com

Abstract

Coronavirus Disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Since before a global pandemic was declared by the World Health Organization, many countries have been implementing stringent screening protocols on international travelers. In Thailand, a 'Health Beware Card' (HBC) was provided to all travelers at ports of entry. On 5 Mar 2020, the Department of Disease Control (DDC) of the Thai Ministry of Public Health received a notification that there was a COVID-19 confirmed case who traveled from Lombardy, Italy. A joint investigation team commenced an investigation to describe epidemiological characteristics, and identify contacts and possible source cases. Totally three confirmed cases of COVID-19 and one asymptomatic infection were identified in this investigation. The index case was a 41-year-old Thai male. He notified local health providers immediately after the onset of symptoms as per HBC recommendations. Contact tracing led to the identification of three additional cases: two were peers who traveled together with the index case to Italy and one was a close friend. The attack rate among people visiting Italy in this cluster was 50%. Contact tracing was a key control measure to stop the spread of COVID-19, and awareness-raising measures limited local transmission from imported cases. For people traveling from a disease-infected zone, mandatory quarantine and laboratory screening must be enforced.

Keywords: Coronavirus Disease, COVID-19, travelers, contact tracing

Introduction

On 31 Dec 2019, the Chinese Center for Disease Control and Prevention notified the World Health Organization (WHO) about clusters of pneumonia cases with unknown source in Wuhan, Hubei.[1] The disease was later identified as a Novel Coronavirus, and officially named as coronavirus disease (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).[2,3] Afterwards, the infection from China had been imported to many countries, including Thailand.[4] Thus, on 3 Jan 2020, the Department of Disease Control (DDC) under the Ministry of Public Health, Thailand, initiated screening measures for COVID-19 infection among travelers in all direct flights coming from Wuhan, China. These measures were expanded to all flights from other high-risk areas on 28 Feb 2020 and later to all international travelers, regardless of countries of origin.[5-7]

Surveillance measures at all international airports were carried out by screening of body temperature with thermoscan cameras. Health beware card (HBC) and health advices were provided to all travelers at the airports by health control officers, since 3 Jan 2020. The HBC included information about early isolation, detection and self-declaration when seeking care at health facilities (Figure 1).

During February and March 2020, COVID-19 was spreading throughout Europe, and Italy was one of the worst affected countries in the region.[8] The

Figure 1. Health Beware Card (HBC) provided to international travelers by the Department of Disease Control, Ministry of Public Health, Thailand, 2020

number of COVID-19 cases in Italy rose rapidly, reaching 4,500 cases within a few weeks after the first cases were notified in mid-February 2020.[9] The most affected areas were Lombardy and Veneto Regions in the northern Italy.[10,11] In Thailand, approximately, as of early March 2020, there were about 40 confirmed cases. The majority of the cases were travelers from China and Thai citizens who had a history of contact with the infected travelers. At that time, there had not been a report of imported cases from Europe or any other regions aside from Asia.

On 5 Mar 2020 in Thailand, the DDC received notification, from Office of Disease Prevention and Control 6, of a confirmed COVID-19 case who had traveled from Lombardy Region in Italy to his home in Chonburi Province. Thus, a joint investigation team comprised of DDC epidemiologists and local health staffs conducted an investigation during 5 to 10 Mar 2020 to describe clinical and epidemiological characteristics of COVID-19 case(s), identify contacts and possible source cases, and provide recommendations for effective disease control.

Methods

Descriptive Study

A descriptive study was conducted from 5 to 10 Mar 2020. Following the national guideline on investigation of COVID-19, a confirmed case was defined as a patient under investigation (PUI) who had tested positive for genetic materials of SARS-CoV-2 by PCR from two reference laboratories, or by viral genetic sequencing technique or culture. All persons who had contact with the index case after onset of symptoms were identified.[12] Contacts were divided into two main categories: high and low risk. A high-risk contact was a person: (i) who had physical contact or talked with the index case within a 1-meter distance for more than 5 minutes, or (ii) who lived together or stayed with the index case within a 1-meter distance in a confined setting, or (iii) who was a health care worker (HCW) attending to the index case and did not wear adequate personal protective equipment (PPE).[13] A low-risk contact was a person: (i) who was a HCW attending to the index case with adequate PPE, or (ii) who traveled in the same vehicle with the index case for a short period of time and did not fulfill the criteria of a high-risk contact (Figure 2). A possible source case was a contact that had fever or upper respiratory tract symptoms within two weeks prior to the index case's symptom onset.

A semi-structured questionnaire was used to interview with the index case. Demographic characteristics, present and past illnesses, risk factors, possible source cases and contacts were collected. All contacts of the cases were also interviewed to obtain information on demographic characteristics, underlying diseases, and clinical symptoms. Medical records of the index case and contacts were reviewed.

Laboratory Investigation

Throat and nasopharyngeal swabs were collected from all high-risk contacts on the fifth day after

contact with a confirmed case. The specimens were sent to two laboratory centers: the National Institute of Health (NIH) and the Thai Red Cross Emerging Infectious Disease Health Science Centre (TRC-EID). Both laboratories used reverse transcription polymerase chain reaction (RT-PCR) to identify SARS-CoV-2 as per the WHO protocol.[14]

Ethical Considerations

Ethical clearance was not required since this study was part of the routine outbreak investigation of the national response to infectious diseases.

Results

Upon investigation and contact tracing, total three confirmed cases of COVID-19 and one asymptomatic infection were identified in this investigation, including the index case and his three close contacts (Mr. C, Mr. D and Ms. F). The majority of cases (3/4: 75%) had a history of visiting the northern Italy. The attack rate among people who traveled to Italy was 50% (3/6).

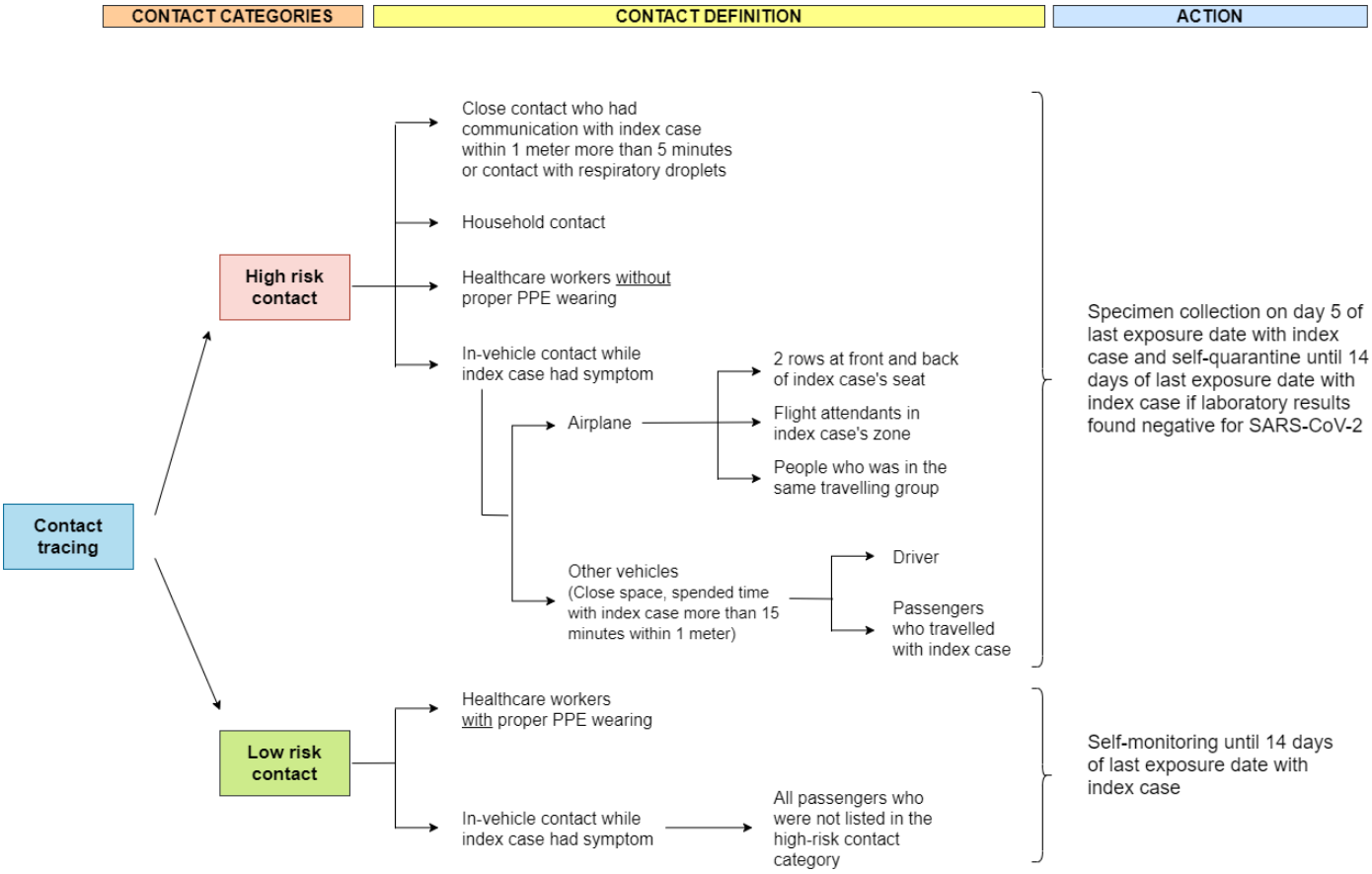

Figure 2. Categories of contacts, contact definition and actions taken for on different categories of contacts

Description on the Index Case

The index case was a 41-year-old Thai male, and worked as a project manager at a construction site in Sriracha District, Chonburi Province, Thailand. He and two colleagues (Mr. A and Mr. B) visited Lombardy Region in the northern Italy from 22 Feb to 2 Mar 2020 for business. During his stay in Italy, on 28 Feb 2020, he developed myalgia, yet no fever or respiratory symptoms. He did not seek treatment in Italy. Upon his arrival at Suvarnabhumi Airport in Bangkok, Thailand, he could pass through the thermoscan screening. However, he was in self-quarantine at his apartment as recommended by the HBC that he received upon arrival.[15] On 3 Mar 2020, since he had a low-grade fever and sore throat, he visited a nearby private hospital, and also reported his travel history. He was directly sent to the acute respiratory infection (ARI) clinic in that hospital. His body temperature was 37.8 ◦C and respiratory rate was 20 per minute without any signs of shortness of breath or dyspnea. According to the national guideline, he was classified as a 'patient under investigation' (PUI) for COVID-19, and throat and nasopharyngeal swabs were collected at the ARI clinic. Both of his specimens were sent to two laboratories, NIH and TRC-EID, and later showed positive for SARS-CoV-2, identifying him as the first imported case of COVID-19 in Thailand.

Travel History in Italy

On 22 Feb 2020, the index case, Mr. A and Mr. B arrived at Milan in Lombardy Region. He did not notice anyone presenting with upper respiratory tract symptoms on the flight to Italy. On 23 Feb 2020, he met other three Thai colleagues (Mr. C, D and E) who arrived at Italy since 18 Feb 2020. Mr. C, Mr. D and Mr. E had travelled to Picenza, which is located about 70 kilometers from Milan, by a private van on 19 to 21 Feb 2020 (Figure 3).

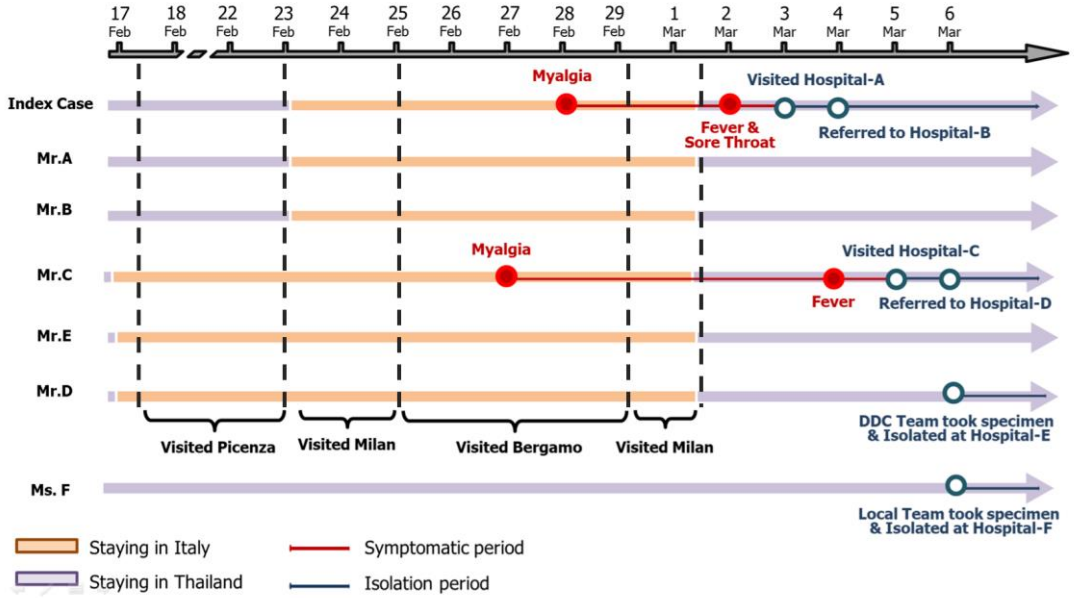

Figure 3. Timeline of Thai people (Mr. A, B, C, D and E) who travelled in Italy with the index case and one additional close contact (Ms. F)

On 23 Feb 2020, the index case, Mr. A and Mr. B took a sightseeing tour in Milan. On 24 Feb 2020, all six of them visited a factory in Milan. A few local staff guided them to visit the factory. No employees in that factory seemed to have signs of illness during their visit. On 25 to 29 Feb 2020, they all traveled to Bergamo in Lombardy Region, which is about 70 kilometers from Milan and was identified as a high-risk area of COVID-19 by the Ministry of Health, Italy.

Throughout their stay in Italy, they traveled with a local driver in a private van provided by the company. The index case usually sat next to Mr. C and Mr. D at the rear of the van. All of them stayed in a single room each. They reported that they did not visit any crowded places, use public transportation during rush hours, or have close contact to any local people with upper respiratory tract symptoms in Italy. They also reported that most of the local people did not wear face masks.

Contact Tracing

On the flight from Italy to Thailand, with transit in Dubai, there were approximately 500 passengers onboard. The investigation team attempted to contact high-risk passengers (n=60, seating within a 2-row distance from the index case) and onboard staff. On 6 Mar 2020 (one day after notification), we notified the airline company about the index case. However, due to administrative limitations, contact information on high-risk passengers and aircrew was not obtained and could not be traced back. In addition, four airport officials working at Suvarnabhumi Airport were screened. All of them tested negative for SARS-CoV-2 (Figure 4).

One close contact during self-quarantine was identified since the index case met Ms. F at his apartment for souvenir giving for about two hours on 2 Mar 2020. Both of them wore masks during the meeting. During that time, the index case felt like he had a low-grade fever, and thus, Ms. F gave her water bottle and some medicines to him. However, Ms. F could not remember whether she had used the water bottle again.

In the private hospital that the index case visited on 3 Mar 2020, 12 close contacts were identified who were HCWs at the screening area and the ARI clinic, and categorized as high-risk contacts. On 4 Mar 2020, he was referred to a public hospital where no high-risk contacts were identified.

Throughout the investigation, out of total 550 contacts (including passengers on the same flights), 76 (13.8%) of them were identified as high risk. However, only 48 (8.7%) out of 550 contacts could be traced. All of uncontactable groups were passengers and airline staff on the same flights of the index case and the taxi drivers. Of these 48 contacts, 23 (48%) were identified as high risk, and nasopharyngeal swabs were collected (Table 1).

Of 23 contacts tested, Mr. C, Mr. D and Ms. F were found to have SARS-CoV-2. The attack rate (AR) among all contactable high-risk contact and all contact were 13% (3/23) and 6% (3/48). Interestingly, the AR among the index case's contacts who traveled to Italy was 40% (2/5). Most of the cases in this study (3/4) had only mild symptoms and only one of them was asymptomatic (Table 2).

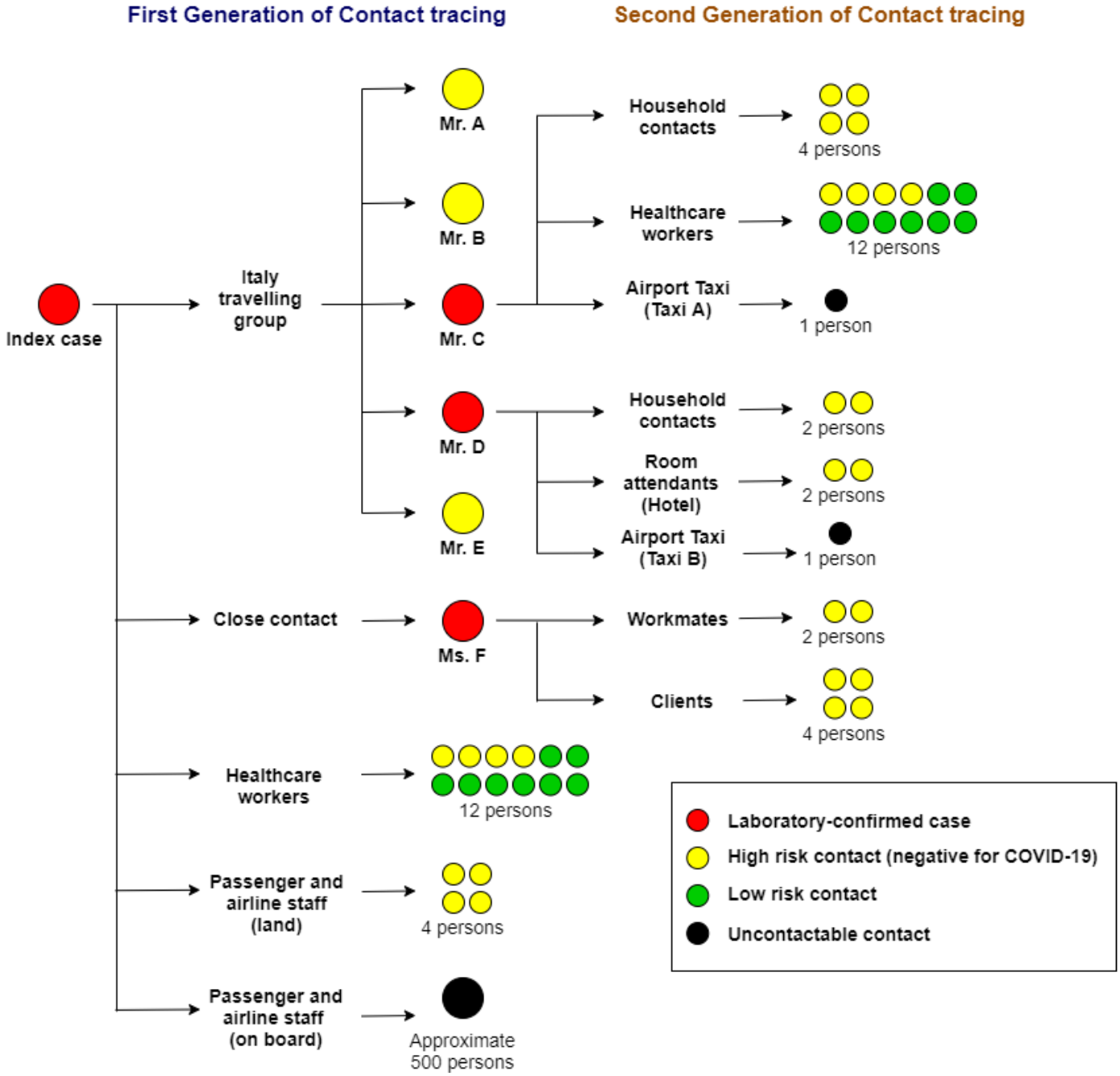

Figure 4. Generation tree of contacts

Mr. C reported that he had myalgia since 27 Feb 2020. Upon his arrival in Thailand, he stayed with his wife and three children. He reported that he strictly isolated himself in his room and wore a face mask almost all the time. On 4 Mar 2020, he developed fever without any respiratory symptoms. On the following day, he visited another private hospital. Twelve HCWs were identified as close contacts, and four out of twelve were labeled as high-risk since they wore only face masks when taking care of Mr. C. On

the following day, after testing positive for SARS-CoV-2, he was referred to another public hospital where no additional high-risk contacts were found.

Mr. D, after arriving home, had a short talk with his wife and his nephew for about 10 minutes. All of them wore a face mask. Then he drove to a hotel to quarantine himself. Two hotel staff members were identified as high-risk contacts. After he learned about the index case, he visited a screening unit of the DDC, and provided a specimen for testing. He was admitted in a public hospital after testing positive for SARS-CoV-2.

Ms. F, after meeting with the index case, travelled to her hometown in another province. On 5 Mar 2020, she met with two colleagues and four clients. She reported that she always wore face mask when she met other people. All of them were identified as high-risk contacts and had tested negative for SARS-CoV-2.

Table 1. Type, total number, proportion of high-risk contacts and corresponded attack rate

Case	Type of contact	Total contact	High-risk contact (% of total contact)	Identifiable contact (% of total contact)	Identifiable (% of high-risk contact)	Confirmed Case	Attack rate*
Index case	Colleague	5	5 (100%)	5 (100%)	5 (100%)	2	40%
	Airplane (Milan - Dubai)	~250	~25 (10%)	0 (0%)	0 (0%)	-	-
	Airplane (Dubai-Bangkok)	~250	~25 (10%)	0 (0%)	0 (0%)	-	-
	Airport Staff (Land staff)	4	2 (50%)	4 (100%)	2 (100%)	0	0
	Friend	1	1 (100%)	1 (100%)	1 (100%)	1	100%
	Hospital-A	12	3 (25%)	12 (100%)	3 (100%)	0	0%
	Hospital-B	0	-	-	-	-	-
Mr. C	Family	4	4 (100%)	4 (100%)	4 (100%)	0	0%
	Hospital-C	12	4 (33%)	12 (100%)	4 (100%)	0	0%
	Hospital-D	0	-	-	-	-	-
	Taxi-A	1	1 (100%)	0 (0%)	0 (0%)	-	-
Mr. D	Family	2	2 (100%)	2 (100%)	2 (100%)	0	0%
	Hotel staff	2	2 (100%)	2 (100%)	2 (100%)	0	0%
	Taxi-B	1	-	0 (0%)	0 (0%)	-	-
Ms. F	Workmate	2	2 (100%)	2 (100%)	2 (100%)	0	0%
	Client	4	4 (100%)	4 (100%)	4 (100%)	0	0%
Total		550	76 (13.8%)	48 (8.7%)	23 (30.2%)	3	6.3%

*Note: * Attack rate among total contacts*

Discussion

We identified total four confirmed cases of COVID-19 in March 2020 since the emergence of the novel infection and pandemic. The index case was the first confirmed case in Thailand which imported from Italy. Three additional cases were confirmed, including two cases who traveled together with the index case in Italy and one case who was likely to be infected by the index case in Thailand.

Three out of four confirmed cases had a history of visiting the northern Italy. During that time, Lombardy Region was identified as a high-risk area of SARS-CoV-2 infection. Despite that, the index case reported that few people wore face masks in public

places. In addition, the index case and Mr. C developed symptoms after five days they arrived in Italy. This is consistent with the estimated incubation period of COVID-19.[16] Therefore, it was likely that the index case and his colleagues had contracted SARS-CoV-2 in the Lombardy Region of Italy.

Evidence suggests that SARS-CoV-2 virus can be spread from an asymptomatic case or a patient with mild symptoms, which is known as the 'pre-symptomatic'.[17,18] It was inconclusive if Mr. C and Mr. D were infected from his colleague or from the same common source. For Ms. F, even though she spent only two hours with the index case and wore a mask during the meeting, she was still infected. A possible route of transmission could have been through an indirect contact from an infected surface, such as the bottle of water or the Italian souvenirs. Evidence suggests that SARS-CoV-2 can survive up to four hours on copper, up to 24 hours on cardboard and up to two to three days on plastic and stainless steel.[19,20] In addition, a face mask alone might not be able to perfectly protect a person against direct transmission of the virus unless other hygienic behaviors (for example, social distancing) are exercised in parallel.

Table 2. Characteristics of laboratory-confirmed COVID-19 cases (n=4)

Name	Age	Gender	Underlying disease	Onset of symptom	Symptom	Severity	Treatment
Index	41	Male	-	28 Feb 2020	Myalgia, Fever, Sore Throat	Mild	Oseltamivir, Chloroquine and Lopinavir/Ritonavir
Mr. C	40	Male	Dyslipidemia	27 Feb 2020	Myalgia, Fever	Mild	Supportive; no antimicrobial/anti-viral medicine
Mr. D	39	Male	-	6 Mar 2020	Cough, Dry throat	Mild	Supportive; no antimicrobial/anti-viral medicine
Ms. F	41	Female	-	-	Asymptomatic	Asymptomatic	Supportive; no antimicrobial/anti-viral medicine

This study highlighted the merits of the HBC and how it can serve as a complementary measure, along with the thermoscan, to raise awareness among travelers. The information on HBC not only helps raising awareness among travelers, but also facilitates early detection of potential cases and subsequent outbreak investigations.

The HBC also enables HCWs to recognize the risk of infection from care-seeking patients, which can leads to appropriate use of PPE.[15,21,22] To avoid transmission to HCWs, a systematic management of confirmed cases and persons suspected with COVID-19 needs to be in place. This includes a proper triage system, adequate and appropriate PPE for frontline workers, and a well-rehearsed practice of transferring cases from private hospitals to public hospitals with appropriate isolation facilities. All of these activities need seamless cooperation between the central authorities, such as the DDC, and health facilities.[23]

Contact tracing is an important public health response to control COVID-19.[24,25] We identified three more infected cases from the index case, and all of them were colleagues and close contacts. This finding suggested public health authorities to pay attention on contact tracing, regardless of the symptoms of cases or contacts.[26] This study found zero transmission among family contacts. This finding was attributed to cooperation of cases following HBC recommendations, and family members who supported the cases' self-quarantine to mitigate the spread of transmission.[27]

This study had some limitations. Firstly, the investigation team could not identify about 62 high-risk contacts, including two taxi drivers, and passengers and aircrew on the flight from Milan to Dubai and Dubai to Bangkok due to difficulty in obtaining the list of passengers from the airline. This might miss an opportunity to detect other potential cases who could cause further disease spreading. However, the team recommended the airline to inform their staff and passengers about an infected case on those flights. Secondly, some interviewees might not fully disclose their travel or medical history

due to a fear of being stigmatized. However, the team highlighted that the interviews were performed for the sake of outbreak control and all the information obtained were confidential. Thirdly, information bias on travel was inevitable. However, this bias might be limited as the period of exposure to disease onset was within two weeks.

Public Health Recommendations

Firstly, contact tracing measures must be strengthened to halt further transmission of the disease. Though in theory, the 2015 Disease Communication Act ratifies authoritative power for disease control officers to obtain access to the passenger list from the airline, in practice there are some operational constraints. To tackle this, supporting legal mechanisms, such as practical guidelines and mutual agreement between the DDC officers and the airline should be developed in order to expedite the access of data for disease control. Secondly, for disease control agency, health education through HBC at port of entry health control office should be provided to all passengers from risk areas regardless of the presence of symptoms. Lastly, soon after this event, the government imposed more stringent measures for all incoming travelers; Thais and foreigners were obliged to impose quarantine and be tested for SARS-CoV-2. These measures should be continued, as well as the reduction of international inbound flights and tighter in-transit rules imposed.

Conclusion

This article provides comprehensive details of an outbreak investigation on a cluster of imported COVID-19 cases from Italy with an attack rate of 50%. The index case declared his travel history and symptoms early and sought appropriate care as recommended by the HBC. Awareness raising measures followed by timely contact tracing could reduce the transmission of disease. Proper screening and health care management system for PUIs and high-risk contacts at health facilities should be strengthened.

Acknowledgement

The authors would like to express gratitude to the officers from the Office of Disease Prevention and Control 6 and the Chonburi Provincial Health Office for their support and help for outbreak investigation.

Suggested Citation

Wongsanuphat S, Jitpeera C, Konglapamnuay D, Nilphat C, Jantaramanee S, Suphanchaimat R. Contact tracing and awareness-raising measures for travelers arriving in Thailand from high risk areas of Coronavirus Disease (COVID-19): a cluster of imported COVID-19 cases from Italy, March 2020. OSIR. 2020 Jun; 13(2):38-47.

References

1. World Health Organization. Pneumonia of unknown cause – China [Internet]. World Health Organization. 2020 [cited 2020 May 5].

   <https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/>

2. CCTV. [CCTV News Report] Wuhan's unexplained viral pneumonia epidemic pathogen was initially determined to be a new coronavirus (in Chinese) [Internet]. 2020 [cited 2020 May 5].

   <http://m.news.cctv.com/2020/01/09/ARTI9Vp9Lra4Tvltz3r7es96200109.shtml>

3. World Health Organization. Naming the coronavirus disease (COVID-19) and the virus that causes it [Internet]. World Health Organization. 2020 [cited 2020 May 5].

   <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it>

4. World Health Organization. COVID-19 situation reports [Internet]. World Health Organization. 2020 [cited 2020 May 5].

   <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/>

5. Tourism Authority of Thailand. Thai health authorities act rapidly to screen out pneumonia cases from China [Internet]. 2020 [cited 2020 May 5].

   <https://www.tatnews.org/2020/01/thai-health-authorities-act-rapidly-to-screen-out-pneumonia-cases-from-china/>

6. Tourism Authority of Thailand. TAT update: Suvarnabhumi Airport steps up COVID-19 surveillance [Internet]. 2020 [cited 2020 May 5].

<https://www.tatnews.org/2020/03/tat-update-suvarnabhumi-airport-steps-up-covid-19-surveillance>

7. World Health Organization. Novel Coronavirus (2019-nCoV) situation reports [Internet]. World Health Organization. 2020 [cited 2020 May 5]. <https://www.who.int/thailand/emergencies/novel-coronavirus-2019/situation-reports>
8. Saglietto A, D'Ascenzo F, Zoccai GB, Ferrari GMD. COVID-19 in Europe: the Italian lesson. The Lancet. 2020;395(10230):1110–1.
9. Anadolu Ajansı. COVID-19: Study suggests Italy death toll much higher [Internet]. Anadolu Ajansı. 2020 [cited 2020 May 5].

   <https://www.aa.com.tr/en/europe/covid-19-study-suggests-italy-death-toll-much-higher/1789603>
10. Anzolin E. First Italian dies of coronavirus as outbreak flares in north [Internet]. Reuters. 2020 [cited 2020 May 5]. <https://www.reuters.com/article/us-china-health-italy/coronavirus-outbreak-grows-in-northern-italy-16-cases-reported-in-one-day-idUSKBN20F0UI>
11. Winfield N. Italy's Lombardy region was unprepared for the influx of coronavirus cases that hit as early as January, making the virus particularly deadly for its residents [Internet]. Business Insider. 2020 [cited 2020 May 5]. <https://www.businessinsider.com/italy-lombardy-region-unprepared-coronavirus-cases-january-2020-4>
12. Department of Disease Control, Ministry of Public Health T. Guideline for COVID-19 investigation (Updated 23 March 2020) in Thai [Internet]. Department of Disease Control, Ministry of Public Health, Thailand. 2020 [cited 2020 May 5].
    <https://ddc.moph.go.th/viralpneumonia/file/g_srrt/g_srrt_250363.pdf>
13. Department of Disease Control, Ministry of Public Health T. Personal Protective Equipment recommendation for COVID-19 (Updated 20 April 2020) in Thai [Internet]. Department of Disease Control, Ministry of Public Health, Thailand. 2020 [cited 2020 May 5].

    <https://ddc.moph.go.th/viralpneumonia/file/g_health_care/g07_ppe_200463.pdf>
14. Department of Medical Sciences, Ministry of Public Health T. Manual of COVID-19 laboratory detection in Thai [Internet]. Department of Medical Sciences, Ministry of Public Health, Thailand. 2020 [cited 2020 May 5]. <https://www3.dmsc.moph.go.th/post-view/680>
15. Tourism Authority of Thailand. TAT's travel recommendations regarding Thailand's Coronavirus Disease 2019 control measures [Internet]. 2020 [cited 2020 May 5].

    <https://www.tatnews.org/2020/02/tats-travel-recommendations-regarding-thailands-coronavirus-disease-2019-control-measures/>
16. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application. Annals of Internal Medicine. 2020 May;172(9):577–82.
17. World Health Organization. Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (COVID-19) outbreak [Internet]. World Health Organization. 2020 [cited 2020 May 5]. <https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak>
18. Wei WE, Li Z, Chiew CJ, Yong SE, Toh MP, Lee VJ. Presymptomatic Transmission of SARS-CoV-2 — Singapore, 2020;69(14):411–5.
19. N van Doremalen, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. N Engl J Med. 2020;2–5.

20. World Health Organization. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations [Internet]. World Health Organization. 2020 [cited 2020 May 5]. <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>

21. Niu Y XF. Deciphering the power of isolation in controlling COVID-19 outbreaks. Lancet Glob Heal. 2020;452–3.

22. Lau JT, Yang X, Leung P-C, Chan L, Wong E, Fong C, et al. SARS in Three Categories of Hospital Workers, Hong Kong. Emerg Infect Dis. 2004;10(8):1399–404.

23. World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected [Internet]. World Health Organization. 2020 [cited 2020 May 5]. <https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125>

24. Bi Q, Wu Y, Mei S, Ye C, Zou X, Zhang Z, et al. Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: aretrospective cohort study. Lancet Infect Dis. 2020;3099(20):1–9.

25. Sun K VC. Impact of contact tracing on SARS-CoV-2 transmission. Lancet Infect Dis. 2020;2019(20):2019–20.

26. Steinbrook R. Contact Tracing, Testing, and Control of COVID-19—Learning from Taiwan. JAMA Internal Medicine. 2020.

27. Sharma A, Fölster‐Holst R, Kassir M, Szepietowski J, Jafferany M, Lotti T, et al. The effect of quarantine and isolation for COVID‐19 in general population and dermatologic treatments. Dermatol Ther. 2020.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Outbreak Investigation of Coronavirus Disease (COVID-19) among Islamic Missionaries in Southern Thailand, April 2020

Farooq Phiriyasart[1,2]*, Sawanya Chantutanon[2], Fitreeyah Salaeh[2], Aran Roka[3], Tidaporn Thepparat[2], Sunisa Kaesaman[2], Asip Useng[2], Idres Abu[3], Rusna Weruma[3], Suratan Arrong[4], Choopong Sangsawang[2]

1 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 Office of Disease Prevention and Control 12, Songkhla Province, Department of Disease Control, Ministry of Public Health, Thailand

3 Thung Yang Daeng Hospital, Pattani Province, Ministry of Public Health, Thailand

4 Provincial Health Office, Pattani Province, Ministry of Public Health, Thailand

*Corresponding author, email address: farooqmedicine@gmail.com

Abstract

From 30 Mar to 20 Apr 2020, an outbreak of coronavirus disease (COVID-19) occurred in Thung Yang Daeng District of Pattani Province in Southern Thailand. An outbreak investigation was conducted to identify the outbreak's magnitude, epidemiologic characteristics, and source of infection. A descriptive study was conducted in which we reviewed investigation reports of all Real Time - Polymerase Chain Reaction (RT-PCR) confirmed COVID-19 cases and identified active local transmission villages. A case was defined as a person living in one of the active local transmission villages with laboratory confirmation of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). A total of 27 laboratory-confirmed cases were identified from 471 individuals (overall attack rate 5.7%) who were deemed to be high-risk contacts. Among them, two cases were detected from the active case finding. The median age of the 27 cases was 46 years (Q1=28, Q3=58) and the male to female ratio was 1.07:1. The first imported case returned from religious gatherings at Markaz Yala, a place of worship in Yala Province. The analytic result showed that the group of religious contacts at Markaz Yala, local religious contacts, and household contacts of the confirmed cases, had a significantly higher risk of SARS-CoV-2 infection than other community members. Local quarantine for people returning from outbreak areas and religious gatherings, and for high-risk close contacts will be appropriate for the district context.

Keywords: Coronavirus Disease, COVID-19, Islamic missionaries, southern, Thailand

Introduction

An outbreak of a novel coronavirus disease (later termed COVID-19) spread throughout China starting on 30 Dec 2019 and several confirmed cases were subsequently reported across the globe prompting the World Health Organization (WHO) to declare the situation a global pandemic.[1] Rapidly growing numbers of confirmed cases and deaths ensued with a mortality rate of around 4.6%. Most of the severe cases have been older people and persons with underlying diseases such as cardiovascular disease and diabetes mellitus. Patients may have a fever with respiratory symptoms such as cough, rhinorrhea, sore throat, or difficulty breathing, with death possible if the symptoms are severe. The incubation period is, on average, 5-6 days; however, it can be up to 14 days.[2] The route of transmission is human to human through droplets from coughing and sneezing of an infected person and close contact with a case.[2] Although there are several methods to diagnose COVID-19, the current gold standard was recommended by the US Centers for Disease Control and Prevention (CDC) and WHO[3] with Thai guidelines still using Real Time - Polymerase Chain Reaction (RT-PCR) for the diagnosis of SARS-CoV-2.[4]

Among member states of the Association of Southeast Asian Nations (ASEAN), Singapore has the highest attack rate, followed by Brunei, Malaysia, Philippines, Thailand, and Indonesia with morbidity rates of 2,881, 322, 192, 81, 43, and 38 per million population, respectively.[5]

The Southern Border of Thailand experienced an outbreak of COVID-19 after missionaries and pilgrims returned from abroad to attend religious gatherings. Islamic missionaries are known as Dawah Tablighi and focus on advising other Muslims and encouraging them to continue practicing their religion.[6] A Tabligh event in Kuala Lumpur called "International Qudamak & Ulamak Malaysia 2020" was held from 28 Feb to 2 Mar 2020, and was attended by over 100 Thai citizens.[7] The attack rate among Thai Islamic missionaries participants was 29.3% (36/123).[8] Another Tabligh event in South Sulawesi, Indonesia, that was held from 19 to 22 Mar 2020 resulted in a 60% attack rate among Thai Islamic missionaries participants (92/148).[8]

In mid-April 2020, the surveillance system for COVID-19 in the southern border provinces of Thailand showed that 25 cases occurred in Thung Yang Daeng District, Pattani Province. The distribution of confirmed cases was mainly in Village 6, Phiten Sub-District and Village 5, Nam Dam Sub-District. A joint investigation was conducted in Thung Yang Daeng District between 15 to 18 Apr 2020 to identify the outbreak's magnitude, epidemiologic characteristics, and source of infection, and to recommend prevention and control measures.

Methods

Review of Contact Tracing Data and Identification of Active Local Transmission Villages

We reviewed investigation reports of all laboratory-confirmed COVID-19 cases. We interviewed a physician and local public health officers to describe the contact tracing process, updated situation, epidemiological distribution, and events of the index case during 15 to 16 Apr 2020. An active local transmission village was defined as a village in Thung Yang Dang District or any other location that had an epidemiologic linkage with this cluster. We also reviewed and observed district geography, populations, and social culture during the investigation period.

Active Case Finding

We conducted an active case finding in two active local transmission villages on 17 and 18 Apr 2020. A Corona-1 questionnaire was used to collect identification data, demographic characteristics, clinical information, and risk factors from all participants.[4] A suspected case was defined as a person living in Village 6 of Phiten Sub-District or Village 5 of Nam Dam Sub-District in Thung Yang Daeng District who satisfied at least one of the following two criteria: (i) high-risk close contact with a confirmed case who did not take laboratory testing and who was a participant of a religious gathering at Markaz Yala (a central place of worship in Yala Province) during 22 to 25 Mar 2020 or other places within 14 days, or their household contacts, (ii) patient with a history of having fever or documented temperature ≥37.5 °C or any of the following respiratory symptoms: cough, rhinorrhea, sore throat, tachypnea, or shortness of breath, or difficulty breathing during 10 to 18 Apr 2020.

According to Thai guidelines for surveillance and investigation of COVID-19, close contact was defined as a person who had at least one of these following criteria[4]: (i) a person who came into close (within 1 meter) contact with, or had a conversation with any patient for >5 minutes, or was coughed or sneezed on by any patient when he/she did not wear appropriate personal protective equipment (PPE), e.g. a face mask, (ii) a person who was in an enclosed space without proper ventilation, e.g. in the same air-conditioned bus/air-conditioned room as any patient , and was within one meter of any patient for >15 minutes without wearing appropriate PPE.

A high-risk close contact was defined as a close contact who was likely to contract the virus from any patient through exposure to respiratory secretions of any patient while not wearing PPE according to standard precautions. While a low-risk close contact was defined as a close contact who was less likely to contract the virus from any patient. This includes close contacts who have not met the definition for high-risk close contacts.

A person who satisfied any of the above criteria would have a respiratory specimen collected to detect SARS-CoV-2 by RT-PCR, and become a laboratory-confirmed COVID-19 case when the result is positive.

Laboratory Investigation

Both nasopharyngeal and throat specimens were collected in all suspected cases and high-risk contacts to detect SARS-CoV-2 by RT-PCR. If the test results from any high-risk contact came back negative, a repeated specimen was taken 5 days later. Specimens were packaged at 2-8 °C and transported to the

regional medical sciences center, region 12, Songkhla Province for SARS-CoV-2 RT-PCR within 24 hours.

Table 1. Specific attack rate of confirmed COVID-19 cases in Thung Yang Daeng District, Pattani Province, April 2020[a]

Characteristic		Number of persons examined	Positive by RT-PCR	Attack rate (%)
Sex	Male	244	14	5.73
	Female	227	13	5.72
Age	≤5 years old	34	1	2.94
	6-14 years old	46	2	4.35
	15-24 years old	257	16	6.23
	25-59 years old	82	6	7.32
	≥60 years old	52	2	3.85
Case source	Contact tracing process	387	25	6.46
	Active case finding	84	2[b]	2.38
Type of contacts (contact tracing)	Religious contacts at Markaz Yala	56	5	8.93
	Household contacts	106	12	11.32
	Locally religious contacts	36	6	16.67
	Community contacts	189	2	1.06

Note: [a]including index case [b]both of them were communities contact of a prior confirmed case

Analytic study

A cross-sectional study was conducted among 471 participants from contact tracing and active case finding. All had respiratory specimens collected for detection of SARS-CoV-2 during 1 to 20 Apr 2020. A case was defined as having a positive result of RT-PCR for SARS-CoV-2, and a non-case was identified as a person with negative result of RT-PCR for SARS-CoV-2. Data were analyzed using Stata version 11. Univariable and multivariable analyses were conducted using logistic regression and presented as prevalence ratios (PR) and adjusted odds ratio (OR) with 95% confidence intervals (CI).

Results

Descriptive results

Thung Yang Daeng District is located in the south of Pattani Province. About 20,000 people live in four Sub-Districts. Around 98% of the residents are Muslim. A total of 27 laboratory-confirmed cases were identified from both contact tracing and active case finding (overall attack rate 5.7%; 27/471). Of the 27 cases, 25 were identified from index case detection with contact tracing and two cases were identified from active case finding among active local transmission villages (Table 1). By source of infection, five imported cases had returned from a religious gathering at Markaz Yala in Yala Province (four females and one male) and the remaining 22 cases were locally transmitted. The specific attack rates among religious contacts at Markaz Yala, household contacts, local religious contacts, and community contacts were 8.9%, 11.3%, 16.7%, and 1.1%, respectively. All of them were hospitalized for at least 14 days and received supportive treatment at the cohort ward, an isolation ward under infectious control specifically reserved for COVID-19 patients. One case had pneumonia. No case required a mechanical ventilator and there was no death. There were six symptomatic cases presenting with myalgia (five cases), fever (four cases), cough (four cases), rhinorrhea (two cases), and sore throat (two cases).

The median age was 46 years (Q1=28, Q3=58), and the male to female ratio was 1.07:1.

Confirmed cases were distributed in three villages. The highest attack rate occurred in Village 6 of Phiten Sub-District, followed by Village 4 of Paku Sub-District and Village 5 of Namdam Sub-District with attack rates of 148, 50, and 16 per 1 million people, respectively. The onset of symptoms for the first case (index case) was on 30 Mar 2020. As shown in Figure 1, the highest number of cases occurred during 9 to 13 Apr 2020 and onset of symptoms for the latest reported cases was on 18 Apr 2020.

Tracing of Index Case and Source of Infection Hypothesis

The first case was a 68-year-old male Muslim religious leader. He was an Islamic missionary (Dawah Tabligh) who returned from the Markaz Yala religious gathering in Yala Province, during 22 to 25 Mar 2020. At this central place of worship, daily religious activities are conducted. Some of Islamic missionaries returning from religious events in Malaysia and Indonesia had also attended that particular event at Markaz Yala. It is possible that the index case had spread the infection after returning from that event. His onset of symptoms began on 30 Mar 2020 and was diagnosed with SARS-CoV-2 on 5 Apr 2020 after being admitted to hospital with pneumonia. Between 25 Mar and 5 Apr 2020, he joined some local religious activities such as praying at the mosque near his home with many other people, a funeral ceremony, and two wedding ceremonies. His wife's onset of symptoms started on 4 Apr 2020 and she was later confirmed to have SARS-CoV-2. She attended the Markaz Yala religious gathering at the same time with her husband. She was a spiritual teacher in their community and hosted a religious gathering at her home (Taalem) among many women and on many occasions (Figure 2). The other three imported cases were women who attended the same religious gathering.

Laboratory Results

Of the 471 respiratory specimens tested, 27 were found positive for SARS-CoV-2 (5.7%). Of 387 collected specimens from the index case detection and contact tracing, 25 were positive (6.46%). The other 84 specimens were collected from the active case finding process of which two were positive (2.38%).

Analytical Study Results

After controlling for covariates in the multivariable analysis, the group of religious contacts at Markaz Yala (adjusted OR 5.85, 95% CI 1.52-22.49), locally religious contacts (adjusted OR 7.22, 95% CI 1.93-27.06), and household contacts of the confirmed case (adjusted OR 9.36, 95% CI 3.06-28.62) were a significantly risk of SARS-CoV-2 infection than community contacts (Table 2).

Preventive and Control Measures

We adjusted the proper case definition for early detection and immediately implemented control measures and set it as a surveillance definition in communities and hospitals. We joined the meeting with the local authorities including a district chief and village head to give specific recommendations on this outbreak.

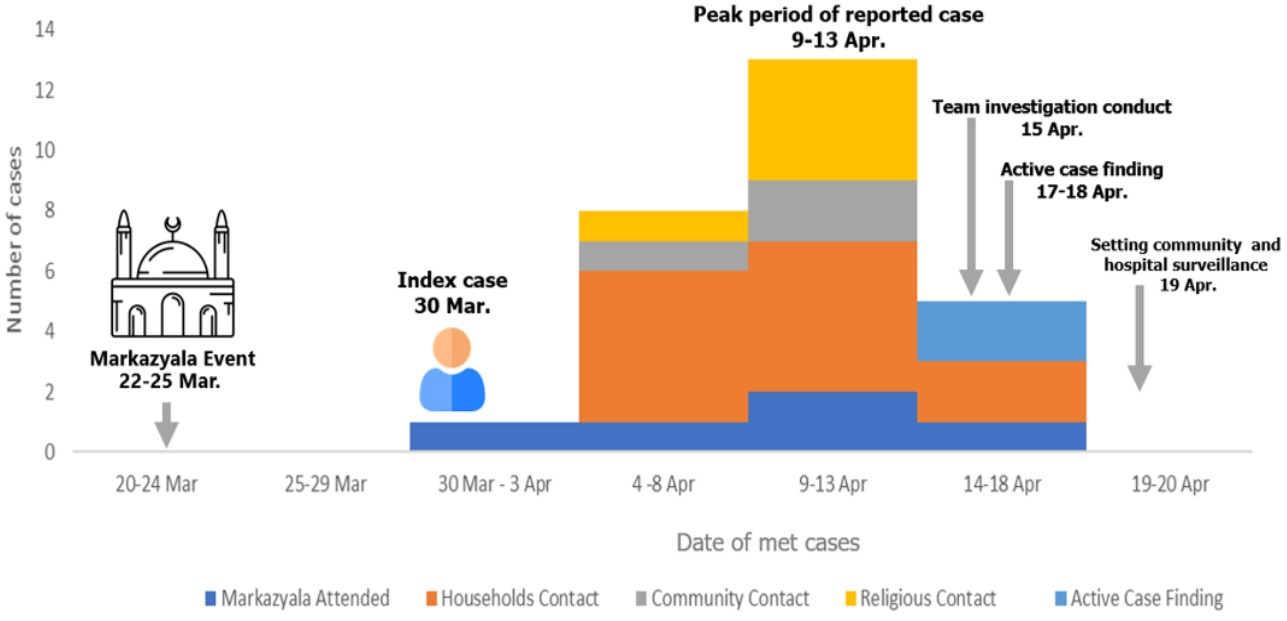

Figure 1. Number of COVID-19 cases in Thung Yang District, Pattani Province, Thailand between March and April 2020 (n=27)

Discussion

An outbreak of COVID-19 occurred in Thung Yang Daeng District due to imported cases of Islamic missionaries (Dawah Tabligh) who had returned from religious gatherings at Markaz Yala. Religious gatherings of Islamic missionaries had recently identified a high proportion of COVID-19 cases among Thai Islamic missionaries returning from Malaysia and Indonesia to the Southern Border Provinces of Thailand during the same time period.[7,8] Mass gatherings such as sporting, religious, music, and other events, can contribute to the spread of COVID-19, and have been the source of infectious diseases that have spread globally.[9]

The mass attendance of locals at religious gatherings in the area was an important factor that contributed to the spread of COVID-19 in this study supported by higher than expected specific attack rates and our analytical study. The index case and his wife were both religious leaders. They were often invited as guests of honor to take part in various ceremonies in the community, particularly religious gatherings.

Table 2. Factors associated with COVID-19 in Thung Yang Daeng district, Pattani Province, Thailand

Factor		Univariable analysis		Multivariable analysis	
		PR	95% CI	Adjusted OR	95% CI
Sex	Male	Ref	Ref	Ref	Ref
	Female	1.35	0.64-2.85	1.56	0.63-3.84
Age	<15 years old	Ref	Ref	Ref	Ref
	15-59 years old	1.70	0.51-5.64	3.06	0.82-11.43
	≥60 years old	2.09	0.54-8.11	4.33	0.86-21.74
Type of contact	Community contacts*	Ref	Ref	Ref	Ref
	Religious contacts at Markaz Yala	3.41	1.02-11.36	5.85	1.52-22.49
	Local religious contacts	5.30	1.62-17.39	7.22	1.93-27.06
	Household contacts	4.32	1.56-11.94	9.36	3.06-28.62

*Note: *Both close and non-close contacts*

In theory, a super-spreader is generally taken to refer to a person who infects significantly more people with a disease than usual; however, the WHO has not clearly defined this term. Many epidemiologists have suggested using the term "super-spreading event" because they were worried about “social stigma”. Many factors can contribute to a super-spreading event, including immune suppression, disease severity, viral load, large numbers of asymptomatic cases, and extensive social interactions.[10] The index case of this particular outbreak was likely to be the cause of a super-spreading event, although information about the disease severity is unknown. However, the prolonged duration of exposure and profusion of social interactions may have played key roles in this outbreak. The national Islamic authority of Thailand declared and set guidelines on how to behave in religious ceremonies for Muslims during the COVID-19 pandemic.[11] For example, instead of coming to the mosque for praying, people should pray at home. This is just one of the important ways in which the outbreak can be mitigated.

Household contacts had the highest odds of SARS-CoV-2 infection in this study (attack rate 11.32%; 12/106), which suggests a low quality of home quarantine among high-risk contacts of a confirmed case. According to the characteristics of Muslim families in the study area, most of the members interact together in a shared room which increases

the risk of disease transmission. Also, the rural lifestyle engenders close relationships with neighbors.

The percentage of asymptomatic cases in this cluster was 77.8%. It is claimed that most people infected with SARS-CoV-2 are asymptomatic but are still able to infect between 50% and 75% of others.[12] Therefore it is a challenge for healthcare workers to establish a new definition to cover those who have participated in community gatherings without showing any symptoms and set it up as a hospital and community surveillance system for early detection.

Aging is associated with certain changes in pulmonary physiology, pathology, and function, during the period of lung infection and can lead to worse clinical outcomes in elderly patients (those aged ≥60 years) compared with younger people.[13] The main behavioral risk factor in this study was a religious gathering of which many elderly people attended, and although none of the infected cases were severe, further policies should encourage them to avoid mingling in crowded areas.

Completion of contact tracing and implement immediate control measures were important to contain this outbreak. We used active case finding to assess the extent of the outbreak in villages where new cases were continuing to be reported and found two new cases having a history of contact with confirmed cases in the community. Active case finding can determine the effectiveness of contact tracing. Our study showed that SARS-CoV-2 transmission occurred mostly in high-risk contacts of the confirmed case according to classification by WHO, which is not common in general community members.[14]

Dawah Tabligh is an Islamic missionary with a way of doing unique religious activities. Members often travel to other countries such as India, Pakistan, Bangladesh, and ASEAN countries, usually once per month, and can takes about one week to four months, and sometimes there are more than 10,000 people per gatherings. They are one of the high-risk groups when there are emerging or re-emerging infectious disease outbreaks. Delayed detection often causes community transmission. Disease surveillance, and outbreak response, according to WHO guidelines for a mass gathering, should be considered, especially pre and post pilgrimage.[14]

Limitations

A limitation of this study is that the religious places in question were closed due to local control measures being enforced. Therefore, we could not explore in detail the characteristics of local religious gatherings that may have helped identify more specific interventions for further recommendations.

Recommendations

High-risk close contacts should be quarantined in designated disease control areas provided by the local authorities. The quantity and quality of these local quarantine places must be assessed by all stakeholders in the area for proper planning. The social distancing policy should be strengthened in public areas by the local authorities to prohibit gatherings, religious or otherwise, in the community according to the declaration of the national Islamic authority of Thailand. The Provincial Health Office should adapt the travel medicine to deal with the prevention and management of health problems of Thai Islamic missionaries (Dawah Tabligh) when attending further religious activities abroad, including health checkups, pre-travel vaccinations, and advice on how to take care of themselves while attending mass gathering events.

Conclusion

The majority of Islamic missionaries (Dawah Tabligh) in Thailand are from the Southern Border Provinces of Pattani, Narathiwat, and Yala Provinces. They attended religious activities abroad such as the last event held in Malaysia and Indonesia during the pandemic of COVID-19.[14] Some of them that were returning from both events also attended the Markaz Yala event that was held between 22 to 25 Mar 2020 then became a source of local transmission. For this particular COVID-19 cluster in Thung Yang Daeng District of Pattani Province, a religious leader was identified as the source of the outbreak. He had attended many joint activities in the community and thus deemed to be a super-spreader. A total of 27 cases were identified with an overall attack rate of 5.7% among suspected and high-risk contacts within this cluster. Local religious contacts and household contacts had a significantly high-risk of SARS-CoV-2 infection compared to community contacts. The cluster was localized to only three villages and transmitted only among the close contacts of the cases. According to the classification by WHO, there were no community transmissions.

Acknowledgement

This investigation was successful due to the cooperation of the following organizations: Thung Yang Daeng District Health Office, Pattani Provincial Health Office, and especially the Thung Yang Daeng disease investigation team, which supported us and

provided very useful advice for disease investigation and control.

Suggested Citation

Phiriyasart F, Chantutanon S, Salaeh F, Roka A, Thepparat T, Kaesaman S, et al. Outbreak investigation of Coronavirus Disease (COVID-19) among Islamic missionaries in Southern Thailand, April 2020. OSIR. 2020 Jun; 13(2):48-54.

References

1. Department of Disease Control. The COVID-19 situation and measures in Thailand [Internet]. Thailand: Department of Disease Control; 2020 [cited 2020 May 5]. <https://ddc.moph.go.th/viralpneumonia/eng/ind_situation.php>
2. World Health Organization. Coronavirus disease 2019 situation report-73 [Internet]. Geneva: World Health Organization; 2020 [cited 2020 May 5]. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_4>
3. Tang YW, Schmitz JE, Persing DH, Stratton CW. Laboratory diagnosis of COVID-19: Current issues and challenges. J Clin Microbiol. 2020 May 26;58(6). doi:10.1128/JCM.00512-20.
4. Department of Disease Control. Thai guidelines for surveillance and investigation of Coronavirus Disease 2019 (COVID-19) [Internet]. Thailand: Department of Disease Control; 2020 [cited 2020 May 5]. <https://ddc.moph.go.th/viralpneumonia/eng/file/guidelines/g_surveillance_150520.pdf>
5. Center for Strategic and International Studies. Southeast Asia COVID-19 tracker [Internet]. Washington, DC: Center for Strategic and International Studies; 2020 [cited 2020 June 6]. <https://www.csis.org/programs/southeast-asia-program/southeast-asia-covid-19>
6. Taylor J. What is the tablighi jamaat?. The Guardian [Internet]. 2009 [cited 2020 May 5]. <https://www.theguardian.com/commentisfree/belief/2009/sep/08/religion-islam-tablighi-jamaat >
7. Che Mat NF, Edinur HA, Abdul Razab MKA, Safuan S. A single mass gathering resulted in massive transmission of COVID-19 infections in Malaysia with further international spread. J Travel Med. 2020 May 18;27(3):taaa059. doi: 10.1093/jtm/taaa059.
8. Prevention and Control Region 12 Songkhla Province (ODPC12). Data of confirmed COVID-19 cases from Emergency Operation Center (EOC) [Data file as of 12 May 2020].
9. Memish ZA, Steffen R, White P, Dar O, Azhar E, Sharma A, et al. Mass gatherings medicine: public health issues arising from mass gathering religious and sporting events. Lancet. 2019;393(10185):2073-2084. doi:10.1016/S0140-6736(19)30501-X.
10. Al-Tawfiq JA, Rodriguez-Morales AJ. Super-spreading events and contribution to transmission of MERS, SARS, and SARS-CoV-2 (COVID-19). J Hosp Infect 2020;105(2):111-112. doi:10.1016/j.jhin.2020.04.002.
11. The Announcement by Sheikhul Islam of Thailand on Measures to prevent the spread of the coronavirus infection 2019 (COVID-19). 2020 March [cited 2020 April 2]. <https://skthai.org/th/news/category/3581-ประกาศจุฬาราชมนตรี>
12. Day M. COVID-19: identifying and isolating asymptomatic people helped eliminate virus in Italian village. BMJ. 2020 Mar 23;368:m1165. doi:10.1136/bmj.m1165.
13. Liu Y, Mao B, Liang S, et al. Association between age and clinical characteristics and outcomes of COVID-19. Eur Respir J. 2020 May 27;55(5):2001112. doi: 10.1183/13993003.01112-2020.
14. World Health Organization. Critical preparedness, readiness, and response actions for COVID-19: interim guidance [Internet]. Geneva: World Health Organization; 2020 [cited 2020 April 25]. <https://www.who.int/publications-detail/critical-preparedness-readiness-and-response-actions-for-covid-19>

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

An Investigation of Coronavirus Disease (COVID-19) in a Chinese Tourist, January-February 2020: Surgical Mask Wearing in Pre-Physical Distancing Strategy

Ratchadaporn Papwijitsil[1]*, Paphanij Suangtho[1], Rungrot Jaiyong[1], Sirima Thananun[2], Kalita Wareewanit[3], Tipamas Angthong[4], Pawinee Doung-ngern[1]

1 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 Institute for Urban Disease Control and Prevention, Department of Disease Control, Ministry of Public Health, Thailand

3 Office of Disease Prevention and Control 11, Nakhon Si Thammarat Province, Department of Disease Control, Ministry of Public Health, Thailand

4 Office of Disease Prevention and Control 1, Chiang Mai Province, Department of Disease Control, Ministry of Public Health, Thailand

*Corresponding author, email address: kaenoipap@gmail.com

Abstract

On 29 Jan 2020, the Operation team was notified by the Emergency Operation Center that there was a Chinese man infected with SARS-CoV-2 admitted in a private hospital in Bangkok. Division of Epidemiology, Office of Disease Prevention and Control 1, 11, and Institute for Urban Disease Control and Prevention jointly deployed to conduct an investigation. Descriptive study was conducted by interviewing the index case about his symptoms, travel history, and reviewing medical records. Contact tracing was done. Close contacts of the index case were classified to high-risk and low-risk contacts. Laboratory testing for SARS-CoV-2 was done among high-risk contacts and symptomatic low-risk contacts. The index case was a 30-year-old Chinese. He had worked in Guangxi province, China. He spent 2 days in Wuhan city and 2 days in Guangzhou city before traveling to Thailand. He developed fever, cough, and sore throat after being in Thailand for 3 days. According to the median incubation period of COVID-19, he could be infected from China. Since he started traveling from China, he wore a surgical mask all the time. From contact tracing, the high-risk contacts that could be followed, none of them had laboratory test positive. Therefore, this strategy of wearing a face mask should be encouraged nationwide especially in case that physical distancing could not be done.

Keywords: Coronavirus Disease, COVID-19, imported case, case investigation, surgical mask, Thailand

Introduction

On 31 Dec 2019, a cluster of pneumonia of unknown etiology was reported in Wuhan City, Hubei Province of China. Chinese authorities reported in the media that the cause of this viral pneumonia was initially identified as a new type of coronavirus, which is different from any other human coronaviruses discovered so far.[1] On 7 Jan 2020, the World Health Organization (WHO) named it as the 2019 novel coronavirus (2019-nCoV). On 11 Feb 2020, WHO named the illness associated with 2019-nCoV as the 2019 Coronavirus Disease (COVID-19) and International Committee on Taxonomy of Viruses (ICTV) announced "Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)" as the name of the new virus.[2-5]

On 10 Jan 2020, the first death and 41 clinically confirmed infections caused by the coronavirus were reported in China.[6] By 22 Jan 2020, COVID-19 had spread to major cities and provinces in China, with 571 confirmed cases and 17 deaths reported. Confirmed cases were also reported in other regions and countries, including Hong Kong, Macau, Taiwan, Thailand, Japan, South Korea, and the United

Table 1. Case definition of COVID-19 (version 28 January 2020)

Type	Definition
Patients under investigation (PUI)	Anyone who had body temperature ≥ 37.5 °C or had history of fever with one of these following signs & symptoms: cough, runny nose, sore throat, dyspnea or difficult breathing With one of these following situations: • Traveled from or lived in China (Exclude Hongkong, Macau, and Taiwan) within 14 days before onset of symptoms • Close contacted with confirmed case
Probable case	PUI with detected SARS-CoV-2 by rRT-PCR from 1 designated laboratory
Confirmed case	PUI with detected SARS-CoV-2 by rRT-PCR from 2 designated laboratories

States.[7] On 23 Jan 2020, the central government of China imposed a lockdown in Wuhan and other cities in Hubei to quarantine the center of an outbreak of COVID-19; this action is commonly referred to as the "Wuhan lockdown" as a last resort to contain the epidemic.[6,8] To contain the spread in Wuhan, authorities imposed unprecedented restrictions on travel and ordered the closure of most businesses in the bustling metropolis, which is home to 11 million people. Chinese authorities have credited these measures with a downturn in infection rates, and the vast majority of cases are now being reported outside of China.[9]

On 29 Jan 2020, the Operation team was notified by Situation Awareness Team (SAT) of Emergency Operation Center (EOC) that there was a Chinese man infected with SARS-CoV-2 admitted in a private hospital in Bangkok, Thailand, since 27 Jan 2020. Division of Epidemiology, Office of Disease Prevention and Control 1, 11, and Institute for Urban Disease Control and Prevention from the Department of Disease Control (DDC) jointly deployed to conduct an investigation.

Methods

Descriptive Study

A descriptive study was conducted. We followed the guidelines of the DDC, Ministry of Public Health (MOPH), for case definition of COVID-19 (version 28 Jan 2020) as show in Table 1.

We performed data collection by interviewing the index case about his symptoms, travel history, and reviewing medical records. We did an active case finding of those who had come in close contact with the index case from 30 Jan – 10 Feb 2020 by watching closed-circuit television (CCTV) in the private hospital, coordinating with Health Control at the airport, airlines, hotels, taxi cooperatives, and bus company for a list of close contacts.

Close contacts were people who contacted with the index case since he developed signs or symptoms. We classified close contacts into high-risk and low-risk contacts according to the guideline by DDC, as show in Table 2.

Information of close contacts who were foreigners was sent to the Thai International Health Regulations (IHR) focal point to alert its IHR network of their country of origin. Therefore contact tracing can be done to prevent spreading of the disease. For close contacts who were Thai, we coordinated with relevant organizations to follow up their symptoms for 14 days after the last exposure with the index case.

Laboratory Investigation

According to the DDC guideline, throat swab (TS) for SARS-CoV-2 by real time reverse transcription polymerase chain reaction (rRT-PCR) was done in all asymptomatic high-risk contacts. For symptomatic cases, both low-risk and high-risk contacts that met Patient Under Investigation (PUI) criteria as in Table 1, nasopharyngeal swab (NPS) and TS was done. Samples were sent to two designated laboratories including the National Institute of Health (NIH), Department of Medical Sciences, MOPH, and the Thai Red Cross Emerging Infectious Diseases (TRC-EID) Health Science Centre, Chulalongkorn University (Table 3). Samples with detected SARS-CoV-2 by rRT-PCR from these 2 designated laboratories were classified as confirmed (Table 1).

Table 2. Contacts classification (version 30 Jan 2020)

Type	High-risk contacts	Low-risk contacts
Household contacts	- People who took care of the index case - People who lived in the same house with the index case	
Hospital contacts	- Healthcare workers or visitors who contacted with the index case in hospital without standard PPE - Other patients or visitors who lived in the same ward with the index case - Laboratory staff who dealed with the index case's specimens without standard PPE	Healthcare workers or laboratory staff or visitors who contacted with the index case in hospital with standard PPE
Vehicles	Airplane: - Passengers who had seat in the same row, 2 front rows and 2 back rows of the index case - Crews who responsible in zone of the index case seated Bus: - Passengers who had seat in the same row, 2 front rows and 2 back rows of the index case - Staff who contacted to the index case's belongings Taxi: - Taxi driver who took index case to any places	All passengers and crews in the same vehicle with the index case who did not meet high-risk contact criteria
Hotels	- The hotel staff who took risk of contact with the index case's secretion such as receptionist, maids who made the index case's room, hotel drivers who took the index case to any places	

Results

Index Case

Travel history

The index case was a Chinese man, aged 30 years old. He had no past medical illness, no history of smoking, or regular drinking. His hometown was in Wuhan city, Hubei province, China. He worked as an environmental engineer in Guangxi province which located in South China. He mostly lived in Guangxi for working and going back to his hometown occasionally. On 17 Jan 2020, he traveled from Guangxi to Wuhan by high-speed train, arrived Wuhan on 18 January. On 18 to 20 January, he worked in the Wuhan branch company and had a party with his friends every evening. No one wore any protective equipment.

On 20 January, he traveled from Wuhan to Guangzhou city, Guangdong province by high-speed train and stayed in Guangzhou until 22 Jan. When he was in Wuhan and Guangzhou, no one around him had any abnormal symptoms. On 22 Jan, he traveled from Guangzhou to Don Mueang International Airport, Bangkok, Thailand and arrived at 7.30 a.m. The flight time was approximately 3 hours. At Don Mueang International Airport, there was no screening for people traveling from cities other than Wuhan. All passengers from Wuhan were screened by using thermoscan. People with the temperature of 38.0 °C or more were separated for further investigation by airport officials to prove whether they had met the PUI criteria or not. Passengers who met PUI definition were transferred for laboratory testing and quarantined at the hospital. Screening for flights from Guangzhou began on the 25 Jan 2020.

Therefore, on 22 January, he did not receive any screening.

On 22 January, he stopped shortly at Hotel A where was located near the airport and met his girlfriend. On the same day, he and his girlfriend traveled to Chiang Mai Province by plane and arrived at 10.00 p.m., then stayed in Hotel B for one night. On 23 January in the morning, they went to a temple in Chiang Mai Province. Then in the afternoon, they went to Pai District, Mae Hong Son Province by a bus and stayed in Hotel C during 23 to 25 January.

Table 3. Laboratory test (version 30 Jan 2020)

	Site of specimen collection	Designated Laboratory	Laboratory testing
PUI	Both of - Nasopharyngeal swab - Throat swab in 1 UTM*	Both of - NIH - TRC-EID	rRT-PCR for SARS-CoV-2
High-risk contacts	Throat swab in 1 VTM**	Both of - NIH - TRC-EID	rRT-PCR for SARS-CoV-2

*Universal transport media, ** Viral transport media

They traveled around Pai District by riding a rental motorcycle. In the morning of 25 Jan, the index case started having a sore throat, cough, and low-grade fever. He did self-checked body temperature was 37.2 °C. He did not take any medicine. He and his girlfriend went back to Chiang Mai Province in the afternoon of 25 January by the bus. After that, they took a 2-hour-direct-flight from Chiang Mai Province to Phuket Province, and arrived there at midnight. They took a van of Hotel D to the hotel and stayed in Hotel D, Mueang District, Phuket Province, on 25 to 27 January. During their stay in Phuket Province, they spent their time relaxing on the beach, in front of the hotel and walking around the nearby shops. On 27 January, he still had a fever, his body temperature was 38.0 °C by self-checking and had muscle pain. In the evening, they took a van of the hotel to Phuket Airport. Then they took a 1.5-hour-flight from Phuket Province to Suvarnabhumi International Airport, Bangkok. There was no temperature screening of the domestic flight at that time. As his symptoms got worse, they decided to take a taxi from the airport to a private hospital. Timeline of the index case shows in Figure 1.

Figure 1. Timeline of the index case during 1 to 28 Jan 2020

Clinical history

At the private hospital, he was diagnosed as PUI for COVID-19 with the following criteria: temperature more than 37.5 °C, cough, and sore throat with history of living in China. Then, he was placed in a negative pressure room. The physical examination showed body temperature 38.0 °C, slightly tachycardia, no dyspnea, no tachypnea and normal oxygen saturation. Laboratory investigation showed SARS-CoV-2 detection from both designated laboratories. Chest radiography revealed minimal peri-bronchial interstitial infiltration at both lungs, suggested of bilateral bronchitis. He was treated by symptomatic and supportive treatment. Neither antiviral nor antibiotic was given. On 31 January, the fever disappeared but cough and sore throat

remained. On 3 February, his clinical symptoms were improved, but because of economic problem, he was transferred to a government hospital. The followed-up chest radiography was normal, and he was fully recovery by 10 February. However, NPS and TS samples were positive for SARS-CoV-2 until 19 February. At that time, criteria for discharging COVID-19 patients from the hospital was undetected of SARS-CoV-2 by rRT-PCR for two consecutive times from two designated laboratories. He was discharged on 27 Feb 2020. The final diagnosis of this case was COVID-19 bronchitis. For this case, it took 16 days from the onset to fully recovery and took 32 days from the onset to two negative rRT-PCR result. Timeline after the onset of symptoms of the index case shows in Figure 2.

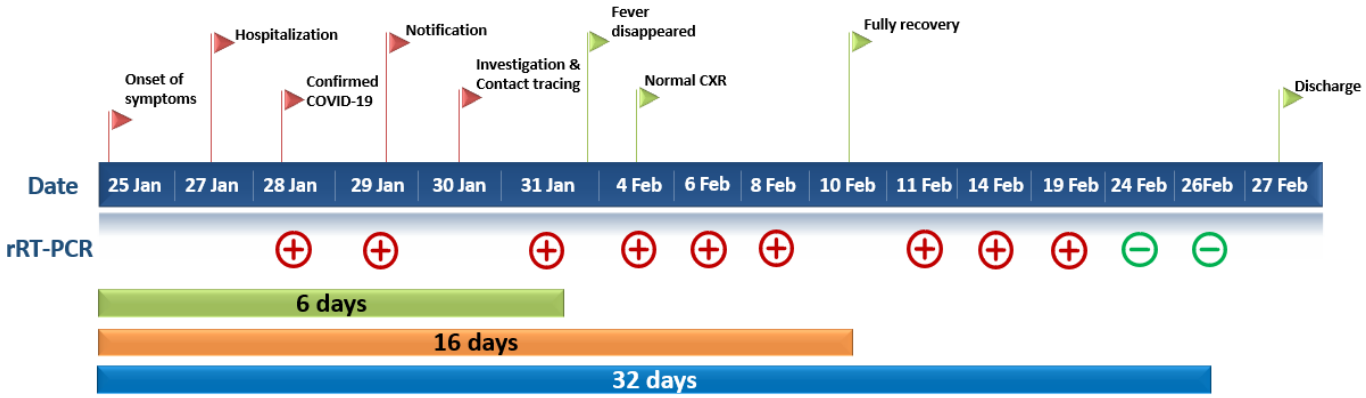

Figure 2. Timeline of the index case, from onset of symptoms to date of discharge from the hospital

Health behavior, hygiene, and risk factors

When he was in China, he had never gone to fresh market or exposed to poultry. He sometimes wore a mask while being on a bus or train. But while he was with his friends or colleagues, he did not wear a mask at all.

During traveling in Thailand, the news of outbreak of COVID-19 had been increasing in China. He was quite concerned about it, therefore after leaving the room or traveling in public, he and his girlfriend wore surgical masks and kept hand hygiene by using alcohol gel all the time. His mask-wearing information was obtained from the interview with him, his flight attendants, the hotel staff, and CCTV, which had the same information. After he got sick, he and his girlfriend wore surgical masks and kept distancing even in their personal time.

Contact Tracing

Contact tracing was done in collaboration with relevant partners including Office of Disease Prevention and Control 1 (for Chiang Mai Province), 11 (for Phuket Province), and Institute for Urban Disease Control and Prevention (for Bangkok). There were totally 591 close contacts in which 114 were classified as high-risk contacts and 405 were classified as low-risk contacts. Among 114 high-risk contacts, there were one household contact (girlfriend), 13 healthcare workers, 80 passengers and crews on the airplanes, one taxi driver, six passengers on the bus, and 13 people at the hotels.

His girlfriend got tested on 30 Jan 2020 and the result was not detected. However, on 2 February she developed fever and cough. Therefore, she was hospitalized and was tested again on 3, 6, and 8 February (number of laboratory testing depended on the clinician). The laboratory results were not detected for SARS-CoV-2 by rRT-PCR from two designated laboratories and her chest radiography was within normal limit. She was diagnosed with acute bronchitis from other causes and was discharged on 9 Feb 2020.

Thirteen healthcare workers were classified as high-risk contacts, including two registration officers, six nurses, one laboratory personnel, three security guards, and one maid. All of them did not wear appropriate masks and contacted with the index case's belongings without appropriate hand hygiene. One nurse met PUI criteria. However, all of them were tested for SARS-CoV-2 and the results were not detected.

For airplane setting, the onset of the index case was on 25 Jan 2020, therefore, two domestic airlines were involved (Table 4). There were 63 passengers classified as high-risk contacts. Fifty of 63 were foreigners (79.4%), and 13 (20.6%) were Thai. Among 50 foreign passengers, 42 (84%) had contact information available. Thus, information of those 42 people was sent to IHR focal point to coordinate with IHR of their homeland countries. For 13 Thai passengers, only two people had contact information available and could be reach. The rest of them had wrong telephone number and contact information. We monitored symptoms of two contacts by phone everyday as they were not comfortable to go to the hospital for specimen collection. None of them had

any abnormal symptoms 14 days after being exposure. Seventeen aircrews were classified as high-risk contacts. They wore surgical masks and gloves all the time while working on the airplanes to follow the flight rules during the COVID-19 outbreak. All of them were tested and the results were not detected. The taxi driver who took the index case to the private hospital was also classified as a high-risk contact. He met the PUI criteria and the test for SAR-CoV-2 was not detected. The six bus passengers on the Pai-Chiang Mai route were the high-risk contacts. Two people were tested for SARS-CoV-2 and the results were not detected but another four people had no contact information.

In the hotel setting, from the onset of the index case, only two hotels were involved (Table 4). There were 13 hotel staff classified as the high-risk contacts: receptionists, drivers, and maids. All of them were not detected for SARS-CoV-2.

Among 405 low-risk contacts, we were able to follow up 25 people (6.2%) who were healthcare workers. The team monitored their symptoms by phone. No one had any abnormal symptoms 14 days after exposure. The rest of the low-risk contacts were passengers on the planes (91.3%) who had left Thailand at the time of the investigation and the passengers on the bus (2.5%) whose contact information was not available. More details of close contacts show in Table 4.

Discussion

The index case was a Chinese man, traveling to Thailand before Wuhan lockdown. He was among the early imported COVID-19 cases in Thailand (No. 18 of Thailand). At the time of his travels, as of 21 Jan 2020, WHO reported 270 cases in Wuhan city and 17 cases in Guangdong Province, the two most reported cities in China but no COVID-19 case was reported in Guangxi at that time.[11]

Table 4. Number of close contacts and laboratory testing classified by risk group

Type	High-risk contacts			Low-risk contacts		
	Total	rRT-PCR	Result	Total	rRT-PCR	Result
Household contact	1	1	Not detected (PUI)	-	-	-
Hospital contact						
- The private hospital	13	13	Not detected: 13 (PUI:1)	15	-	-
- The government hospital	0	0	-	10	-	-
Vehicles						
# Airplane						
- Passengers (N=63)						
- Flight $^{\beta}$CNX-$^{\gamma}$HKT	21	0	IHR: 12	149	-	-
- Flight HKT-$^{\delta}$BKK	42	0	IHR: 30 Monitored by phone: 2 (Thai)	221	-	-
- Crews (N=17)						
- Flight CNX-HKT	4	4	Not detected: 4	-	-	-
- Flight HKT-BKK	13	13	Not detected: 13 (PUI:1)	-	-	-
# Taxi	1	1	Not detected (PUI)	-	-	-
# Bus	6	2	Not detected: 2	10	-	-
Hotels						
- Hotel C	6	6	Not detected: 6	-	-	-
- Hotel D	7	7	Not detected: 7	-	-	-
Total	114	47	Not detected: 47	405	-	-

Note: $^{\beta}$CNX; Chiang Mai Province, $^{\gamma}$HKT; Phuket Province, $^{\delta}$BKK; Bangkok

According to the report from WHO, the median incubation period of SARS-CoV-2 was 5.1 days (range 2.1-11.1 days), he could be infected from either Wuhan city in Hubei or Guangzhou city in Guangdong than anywhere else.[12,13] Since two cities were the most epidemic at that time and he had activities outside without protective equipment. It was less likely to be infected in Thailand because during 22 to 24 Jan 2020, before the onset, there were only five COVID-19 cases in Thailand, and all of them were imported from Wuhan.[14] Moreover, while he was traveling in Thailand, he wore surgical mask all the time.

At point of entry, only flight from Wuhan would be screening at the airport since 3 Jan 2020. The screening for flight from Guangzhou began on 25 Jan 2020. The airport screening strategy would miss people who were from Wuhan but traveled to other cities for boarding to Thailand. From this investigation, we could see the gap in the detection PUI case at the airport. There were the checkpoints on only the international flights but not on the domestic flights. He might be detected in Chiang Mai, Phuket, or Suvarnabhumi International Airport if there were the thermoscan screenings for domestic flights. If he had been detected as PUI since those airports, he would be confined earlier. We would be able to reduce the number of people who were at risk of infection on the airplanes and the taxi. In early period of COVID-19 outbreak, the airport screening was the responsibility of Health Control, DDC, in which the personnel were not sufficient for the number of flights that need to be screened day by day. Therefore, there was a collaboration with the Ministry of Transport to screen travelers in both domestic and international flights extending to the whole country by the end of March.[15,16]

The index case was aware of the droplet precaution and hygiene as he and his girlfriend wore surgical mask all the time in public, even in the personal time with his girlfriend after he knew that he might be infected. Although, we were unable to follow all close contacts, but none of the close contact that were tested had positive result, even in the really close contact like his girlfriend. According to current evidence, respiratory droplet is one of transmission mode of SARS-CoV-2. Droplet transmission occurs when a person is in close contact (within 1 meter) with someone who has respiratory symptoms.[17] Therefore, wearing surgical mask is useful in reducing the spread of infection. In this case, especially during that time, there had been no physical distancing strategy. This investigation result corresponded with a study demonstrating the efficacy of surgical masks to reduce coronavirus detection and viral copies in large respiratory droplets and aerosols.[18] In accordance with another study, using surgical masks at the infection source could reduce environmental contamination. Surgical mask could capture particles both tidal volume breathing and cough.[19] This is important implications for control of COVID-19, suggesting that surgical masks can be used by ill people to reduce onward transmission especially in case where physical distancing was difficult or cannot be done.

Limitations

There were many obstacles in this invesigation, especially for the contact tracing. Hence, we were not able to follow all contacts. At that time, WHO had not yet announced COVID-19 as Public Health Emergency of International Concern (announced on 30 January 2020) and Thailand had not yet announced COVID-19 as Dangerous Communicable Disease under the Communicable Disease Act 2015 (announced on 29 Feb 2020).[20,21] As the result, some organizations did not cooperate, especially in matters related to personal information since there was no law to be enforced under the Act. Nevertheless, in this event, the secondary attack rate among close contacts was zero, even his girlfriend who traveled along with him all the time was negative. So, it was likely that those missing contacts had low probability of infection as well.

Information on travel from the index case might be incomplete due to retrospective memory. Moreover, the national guideline on investigation of COVID-19 in Thailand, including definitions of PUI and close contacts, has been frequently updated following the revolving situation. As a result, operation definitions and criteria in our study were revised accordingly as well.

Recommendations

Wearing surgical mask by an infected person is likely to reduce the COVID-19 transmission. Thus, this strategy should be encouraged nationwide, especially when physical distancing is not feasible. Close contacts should maintain good personal hygiene and observe clinical symptoms for 14 days after exposure. The innovative technology for contact tracing would be helpful in obtaining complete information for epidemiological investigations.

Acknowledgement

The authors were grateful for the patient and contacts for providing information. In addition, we would like to express our deepest appreciation to the Health Control, airlines, hotels, taxi cooperatives, bus company, the private hospital, and the government hospital for all supports and good cooperation.

Suggested Citation

Papwijitsil R, Suangtho P, Jaiyong R, Thananun S, Wareewanit K, Angthong T, Doung-ngern P. An investigation of Coronavirus Disease (COVID-19) in a Chinese tourist, January-February 2020: surgical

mask wearing in pre-physical distancing strategy. OSIR. 2020 Jun; 13(2):55-63.

References

1 World Health Organization. WHO advice for international travel and trade in relation to the outbreak of pneumonia caused by a new coronavirus in China [Internet]. World Health Organization. 2020 [update 2020 Jan 24; cited 2020 April 2]. <https://www.who.int/news-room/articles-detail/who-advice-for-international-travel-and-trade-in-relation-to-the-outbreak-of-pneumonia-caused-by-a-new-coronavirus-in-china/>

2 Tan WJ, Zhao X, Ma XJ, et al. A novel coronavirus genome identified in a cluster of pneumonia cases — Wuhan, China 2019–2020. China CDC Weekly 2020; 2:61-2.

3 Lu R, Zhao X, Li J, et al. Genomic characterization and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet. 2020; 395 (10224):565-574. doi: 10.1016/S0140-6736(20)30251-8.

4 Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020; 382(8): 727-733. doi:10.1056/NEJMoa2001017.

5 World Health Organization. Naming the coronavirus disease (COVID-19) and the virus that causes it [Internet]. World Health Organization. 2020 [update 2020 Feb 11; cited 2020 April 2]. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it>

6 Qin, Amy; Hernández, Javier C. China reports first death from new virus. The New York Times. ISSN 0362-4331. Archived from the original on 11 January 2020. Retrieved 23 January 2020.

7 Wikipedia. Wuhan lockdown [Internet]. 2020 [cited 2020 April 2]. Available from: <https://en.wikipedia.org/wiki/2020_Hubei_lockdowns>

8 Yahoo.Build-up to coronavirus lockdown: inside China's decision to close Wuhan. Yahoo News. 2 April 2020. Retrieved 5 April 2020.

9 British Broadcasting Corporation [Internet]. Coronavirus: People of Wuhan allowed to leave after lockdown. 2020 [cited 2020 April 2]. <https://www.bbc.com/news/world-asia-china-52207776>

10 Lau H, Khosrawipour V, Kocbach P, Mikolajczyk A, Schubert J, Bania J, et al. The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. J Travel Med. 2020;001(714).

11 World Health Organization. Novel Coronavirus (2019-nCoV) 22 January 2020. WHO Bull [Internet]. World Health Organization. 2020;(JANUARY):1–7. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200122-sitrep-2-2019-ncov.pdf>

12 Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application. Ann Intern Med. 2020;2019.

13 Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019- nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Eurosurveillance. 2020;25(5):1–6.

14 Open Government Data of Thailand [Internet]. COVID-19 Daily report. [cited 2020 June 22]. <https://data.go.th/dataset/covid-19-daily>

15 The Thaiger [Internet]. AOT sets up checkpoints to check passengers from Wuhan, China for virus. [cited 2020 April 22]. <https://thethaiger.com/hot-news/tourism/aot-sets-up-checkpoints-to-check-passengers-from-wuhan-china-for-virus>

16 Komchadluek [Internet]. Intensive control measures of COVID-19 in regional airports. [cited 2020 April 22]. <https://www.komchadluek.net/news/regional/423706>

17 World Health Organization. Modes of transmission of virus causing COVID-19. Sci Br. 2020;(March):19–21.

18 Leung NHL, Chu DKW, Shiu EYC, Chan K-H, McDevitt JJ, Hau BJP, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. Nat Med [Internet]. 2020.

19 Patel RB, Skaria SD, Mansour MM, Smaldone GC. Respiratory source control using a surgical mask: An in vitro study. J Occup Environ Hyg. 2016;13(7):569–76.

20 World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV) [Internet]. 2020 [cited 2020 April 23]. <https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)>

21 Department of Disease Control. COVID-19 is a Dangerous Communicable Disease under the Communicable Disease Act 2015 (B.E. 2558) [Internet]. Department of Disease Control. 2020 [cited 2020 April 23]. <https://ddc.moph.go.th/viralpneumonia/eng/index.php>

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

A Cluster of Coronavirus Disease (COVID-19) Cases Linked to a Restaurant during Early Local SARS-CoV-2 Transmission in Thailand

Natthaprang Nittayasoot[1]*, Ratchayapat Samphao[1], Kanidta Poobua[1], Rapeepong Suphanchaimat[1,2]

1 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 International Health Policy Programme, Ministry of Public Health, Thailand

*Corresponding author, email address: n.natthaprang@gmail.com

Abstract

Coronavirus disease (COVID-19) has become a global pandemic. After notification of a new COVID-19 case working in a restaurant on 10 Mar 2020, the Department of Disease Control, Ministry of Public Health of Thailand initiated an investigation of the index case and all contacts. The aim was to identify COVID-19 cases associated with the index case, identify potential sources of disease, describe the epidemiological characteristics, and control the outbreak. We conducted a cross-sectional descriptive study of the identified cases from active case finding. A total of three laboratory-confirmed COVID-19 cases were identified, two of which were asymptomatic. The cases included the owner of the restaurant A (index), and two employees in the restaurant. In-dept interviews with the cases found that restaurant staffs and customers did not comply with important preventive methods such as social distancing and use of personal protective equipment. However, all cases were diligent about self-isolation when they were identified as having the infection by laboratory tests or when they developed symptoms. Following the investigation, the Thai government strengthened messaging about COVID-19 risks and prevention practices directed to restaurants.

Keywords: Coronavirus Disease, COVID-19, restaurant, Thailand

Introduction

Coronavirus disease (COVID-19) is a new emerging disease caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The common clinical symptoms of the disease are fever, cough and shortness of breath.[1] The exact mode of transmission is unknown; however, it is believed that the disease can spread through respiratory droplets.[2] The mortality rate varies depending on age, gender and co-morbidities, and is estimated to be approximately 0.001 to 0.068 deaths per 10 person-days.[3] The incubation period has been reported to be 4 to 6 days on average, and the reproductive number is 2.2.[4-6]

The World Health Organization (WHO) declared COVID-19 a global pandemic. As of 11 Mar 2020, there were over 100,000 confirmed COVID-19 cases and 7,000 deaths, reported from a large number of countries, including Thailand.[7,8] In Thailand, during this period, more than 200 confirmed COVID-19 cases and one death were identified.[9] To prevent and control the disease with a timely and coordinated response, the Ministry of Public Health (MOPH) activated the Emergency Operation Center (EOC) which included a Situation Awareness Team (SAT) and an Operation Team. The Operation Team was responsible for field investigation of all cases when the Thai MOPH was notified from local public health staffs.

On 10 Mar 2020, the Operation Team received notification from the SAT that there was a probable COVID-19 case visiting Bamrasnaradura Infectious Diseases Institute (BIDI). The Operation Team conducted a joint investigation with BIDI with the following objectives: (i) to identify COVID-19 cases associated with the index case, (ii) to identify the potential source of disease, (iii) to describe epidemiological characteristics, and (iv) to provide recommendations to control the outbreak.

Methods

The index case was interviewed regarding symptoms, travel history, behavioral characteristics and all high-

Table 1. Definitions of COVID-19 cases and contacts

Type	Definition
COVID-19 cases	
Patient under investigation (PUI)	A person who developed fever (or body temperature ≥37.5°C) and at least one of the following respiratory symptoms, cough, rhinorrhea, sore throat, dyspnea, shortness of breath.
Probable case	A PUI who had SARS-CoV-2 detected by a single reference laboratory*.
Confirmed case	A PUI who had SARS-CoV-2 detected by at least two reference laboratories*.
Asymptomatic infection	A person who had no abnormal signs and symptoms but a positive test for SARS-CoV-2 from at least two reference laboratories.
Contacts	A person who shared activities with case
High-risk contact	A person who lived with, or had a history of close contact with, a confirmed COVID-19 case by either one of the following means: (i) talking with a case for more than 5 minutes without wearing proper personal protective equipment, (ii) being exposed to the body secretions from a case without wearing proper personal protective equipment, and (iii) staying together with a case within 1 meter-distance in a closed space, e.g. same vehicle or same air-conditioned room, for more than 15 minutes without wearing proper personal protective equipment.
Low-risk contact	A contact who did not meet the criteria for a high-risk contact.

*Note: *Reference laboratory means a laboratory that was approved for Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) test by the Department of Medical Sciences.*

risk and low-risk contacts focusing on 14 days before the onset of symptoms of the index case to the isolated period. Medical records were reviewed to record the medical history and prescribed medications of the index case. To identify the cases and risk assessment of contacts, the investigator teams used the established case definitions from the standard national guideline for COVID-19 investigation in Thailand as outlined by the Thai Department of Disease Control as of 3 Mar 2020.[10] The definitions for COVID-19 cases and contacts are shown in Table 1.

An in-depth interview was conducted with all high-risk and low-risk contacts of the COVID-19 cases to obtain information on symptoms, travel history, mechanism of contacts, and their preventive measures.

Laboratory testing of the index case was performed using a nasopharyngeal and throat swab tested for SARS-CoV-2 by real time reverse transcription polymerase chain reaction (RT-PCR) at BIDI. Symptomatic contacts of the index case were tested immediately using the same methods. All specimens obtained from the remaining high-risk contacts were tested on day 5 or later after contact with the index case. If the contacts with undetected SARS-CoV-2 laboratory result met the PUI criteria later, he/she will be tested for COVID-19 one more time.

Results

History of Index Case

The index case was a Singaporean male, aged 36 years old, and living in Bangkok, Thailand. He was the owner of a restaurant in Bangkok (Restaurant A). He developed chills, fatigue, and muscle aches on 8 Mar 2020; he visited Hospital A on the following day presenting with the above-mentioned symptoms plus fever and cough. At the hospital, physical examination revealed a body temperature of 38.6 degrees Celsius, a pulse rate of 99 beats per minute, and a respiratory rate of 20 breaths per minute. Further laboratory tests included complete blood count (hematocrit 47.8%, hemoglobin 16.1 g/dL, white blood cells 5,000 cell/ml [Neutrophil 75%, Lymphocyte 19%, Monocyte 6%] and platelet count 251,000 cell/ml); RT-PCR for SARS-CoV-2 was collected on 9 Mar 2020 and reported as detected on 10 Mar 2020 by two reference laboratories, Ramathibodi Hospital and the National Institute of Health, Department of Medical Sciences.

The index case had recently visited Singapore and returned to Thailand on 2 Feb 2020. He lived alone and had no household contacts. His routine schedule included working at his own restaurant, a football workout with his friends every Monday, teaching students every Wednesday and Saturday, and dinner with his girlfriend at least once per week. In addition

to this routine, he had a meeting with a Singaporean friend at a bar on Thonglor street, Bangkok, on 7 Mar 2020. Figure 1 shows a timeline of his movements during the 14-day period leading up to his hospital admission.

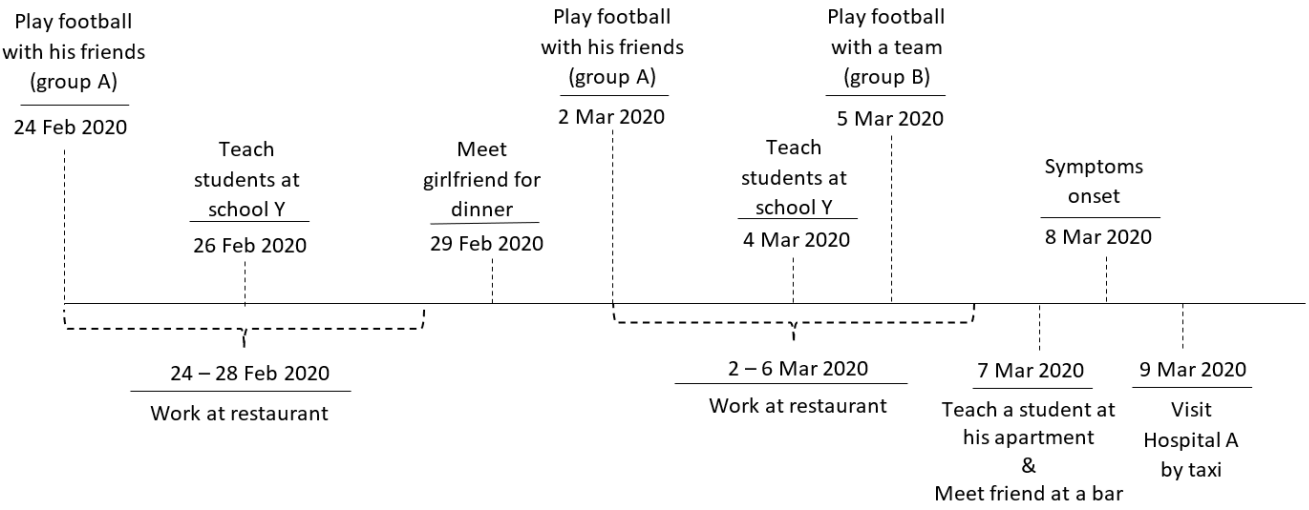

Figure 1. Detailed history of index case during the fourteen-day period before visiting a hospital

Contact Tracing

A total of 46 contacts were identified. His contacts could be categorized into five groups: (i) 13 school contacts, (ii) 15 hospital contacts, (iii) 10 football-playing friends (group A), (iv) five restaurant employees, including four full-time employees and one part-time employee, and (v) three others (his girlfriend, a Singaporean friend, and a taxi driver). Restaurant customers and other football players (group B) could not be traced due to a lack of information. Of the 46 contacts, 33 (71.7%) were classified as high-risk contacts. Among the high-risk contacts, four reported experienced abnormal clinical symptoms; two of whom met the definition of PUI. A summary of the contacts is shown in Table 2.

All thirty-three nasopharyngeal and throat swab specimens from the high-risk contacts were collected and tested for SARS-CoV-2. Of all collected specimens, two were positive for SARS-CoV-2. These two were employees (employee A and employee B) at the index case' restaurant despite exhibiting no symptoms. Table 3 presents the results of the laboratory testing among the 33 high-risk contacts.

History of Laboratory Confirmed Cases that were Contacts with the Index Case

Both employees, A (female, 33 years old) and B (female, 27 years old), who were asymptomatic SARS-CoV-2 infections, worked with the index case during weekdays. Fourteen days prior to the index case's symptoms onset, all full-time employees, including A and B, had a meeting with the index case with a gap of at least 1 meter between each person. Nobody wore a face mask or other personal protective equipment. After the meeting, the index case worked in his office at the restaurant or greeted the customers. The last contact that the two employees had with the index case was at the restaurant on 6 Mar 2020. During work, employee A and B did not talk to each other; however, they had lunch together with other colleagues without the use of serving spoons to serve the food from the shared dishes.

The restaurant employees' responsibilities included cooking, serving food, and cleaning. The employees had no fixed duty; their role varied depending on the restaurant's needs. They wore no face mask or gloves when they were working; but they did wear a mask when going outside the restaurant. Both had no respiratory symptoms and quarantined themselves on 10 Mar 2020 after being notified of the laboratory result by their employer.

Contacts of employee A included a boyfriend who was living in the same apartment, two sisters, a brother-in-law, who shared a meal together once a week, and the four other restaurant employees. All were considered high-risk contacts. Employee B had six contacts, namely, two household members and the four other restaurant employees. No low-risk contacts were identified. The total number of contacts of employees A and B comprised nine high-risk contacts. Their nasopharyngeal and throat swabs were collected and tested for SARS-CoV-2 and the results of all tests were not detected.

Preventive and Control Measures of COVID-19 at the Restaurant

The restaurant, located in a community building, was an air-conditioned restaurant with an on-site dining and indoor seating area. In terms of preventive and

Table 2. Description of contacts and clinical presentation (n=46)

Location of contacts	Total n (%)[b]	Clinical presentation[a]	
		Symptomatic n (%)	Asymptomatic n (%)
School (n=13)			
High-risk	11 (84.6)	2 (18.2)[c]	9 (81.8)
Low-risk	2 (15.38)	0	2 (100.0)
Hospital (n=15)			
High-risk	5 (33.3)	0	5 (100.0)
Low-risk	10 (66.7)	0	10 (100.0)
Football[d] (n=10)			
High-risk	10 (100.0)	1 (10.0)[c]	9 (90.0)
Low-risk	0	0	0
Restaurant[e] (n=5)			
High-risk	4 (80.0)	0	4 (100.0)
Low-risk	1 (20.0)	0	1 (100.0)
Others (n=3)			
High-risk	3 (100.0)	1 (33.3)	2 (66.7)
Low-risk	0	0	0
Total (n=46)			
High-risk	33 (71.7)	4 (12.1)	29 (87.9)
Low-risk	13 (28.3)	0	13 (100.0)

Note: [a] Row percentage, [b] Column percentage, [C] One met PUI definition, [d] Only football players group A, [e] Only restaurant employees

control measures of COVID-19 at the restaurant before detecting the index case, screening for respiratory symptoms including fever and social distancing was not being practiced and improper protective equipment were being used. Seating space was less than 1 meter with no barriers. Face masks and gloves were not used.

Preventive and Control Measures of COVID-19 Cases and their Contacts

After the outbreak was recognized, the owner of restaurant and all employees were aware of the risk of SARS-CoV-2 infection and transmission. The owner closed the restaurant for at least 14 days, cleaned and disinfected all areas. In addition, the owner also notified customers of the restaurant to be tested for SARS-CoV-2 via his social media. He also informed the school where he taught about this incident.

None of the identified contacts wore facial masks before the outbreak detection. However, after the outbreak was detected and notified, they all complied with preventive and control measures as instructed by the Department of Disease Control. They quarantined themselves and reported their symptoms each day for the next 14 days after their last contact with the index case.

Table 3. SARS-CoV-2 laboratory results of identified high-risk contacts of the index case classified by types and clinical presentations (n=33)

Type of Contact*	Specimen collected [a]			Positive for SARS-CoV-2	
	Total	Symptomatic	Asymptomatic	Symptomatic	Asymptomatic
School	11	2 (18.2%)[b]	9 (81.8%)	0	0
Hospital	5	0	5 (100.0%)	0	0
Football	10	1 (10.0%)[b]	9 (90.0%)	0	0
Restaurant	4	0	4 (100.0%)	0	2 (50.0%)
Others	3	1 (33.3%)	2 (66.7%)	0	0
Total	33	4 (12.1%)	29 (87.9%)	0	2 (6.9%)

*Note: [a] Row percentage, [b] One met PUI definition, * All identified high-risk contacts were tested for SARS-CoV-2.*

Discussion

This report describes a local outbreak of SARS-CoV-2 in Thailand with a confirmed COVID-19 index case and two asymptomatic SARS-CoV-2 infections. As the index case developed symptoms approximately 35 days after arrival in Thailand from Singapore, which was longer than the documented incubation time, it was unlikely that he acquired the infection abroad. In addition, the two asymptomatic SARS-CoV-2 infections had no history of traveling abroad. This information indicates a local SARS-CoV-2 transmission in Thailand. The potential sources of the SARS-CoV-2 infection in this outbreak cluster was someone from the unidentified contacts – a customer of the restaurant or a football player in group B – as all identified contacts of the index case tested negative for SARS-CoV-2.

Regarding the transmission path among the index case, employee A, and employee B, the most likely scenario is that the index case was infected by a customer (since part of his duty was to greet all customers entering his restaurant), while employees A and B may have also been infected by the same unknown customer, or one was infected by the unknown customer and then she infected the other employee. As the index case had only one meeting with his employees and kept a distance of more than 1 meter during the asymptomatic period, transmission between the index case and the two employees with positive SARS-CoV-2 was less likely. For employees A and B, transmission might be explained by two possible paths. First, sharing dishes during lunchtime without the use of a serving spoon, and second, direct contact with an infected customer as previously mentioned. Transmission of a virus through the consumption of shared food without the use of a serving spoon has also been documented in a cluster in Singapore.[11,12] It is possible that both employees became infected after direct contact with a source case who was a customer at the restaurant, or were exposed to some fomite such as a used napkin and cutlery because preventive measures such as face shields and protective masks were not worn by the employees.

In terms of prevention and control measures, personal protective equipment was not worn before the index case was detected as SARS-CoV-2 positive. However, after the index case became symptomatic, he isolated himself immediately. Additionally, all contacts quarantined themselves, thus complying with COVID-19 prevention and control protocols announced by the Ministry of Public Health.

Restaurants are known to be a source of several COVID-19 outbreaks.[13–16] This particular restaurant was considered to be the highest risk setting according to guiding principles devised by the US Centers for Disease Control and Prevention.[17] As the restaurant had air-conditioning, indoor-dining, and less than 6 feet between adjacent seats, the potential for SARS-CoV-2 transmission was relatively high.[15–17] In addition, as the employees did not wear protective face-shields or masks, the chances of contact with respiratory droplets from customers to employees and vice versa was increased.

This study emphasized the importance of prevention and control measures for restaurants and supports the national policy for COVID-19 prevention and control in a restaurant. As restaurants are a potential source of a large outbreak, the Thai Emergency Operations Center launched restaurant policies and regulations which is composed of five major requirements: (i) screening system using body temperature; (ii) track and trace systems using a technology-based application called “Thaichana”; (iii) social distancing (table space ≥2 meters or barrier ≥1.5 meters) and proper protective equipment; (iv) air ventilation (v) cleaning and disinfection procedures.

Actions Taken

In terms of preventive and control measures, all contacts were recommended to self-quarantine themselves, wash their hands frequently, and wear a face mask whenever they ventured outdoors or received visitors to their homes. Although some contacts tested negative for SARS-CoV-2, several studies have reported that the incubation period varies widely across individuals and asymptomatic infections can also transmit the virus.[4,5,14] In addition, all contacts reported their daily health status to the Department of Disease Control for the 14-day period after their last contact with a SARS-CoV-2 infected case.

Limitations

As some of the contacts (restaurant customers and members of the football team B) could not be followed, the definite source of infection is yet to be identified and the magnitude of SARS-CoV-2 infections from this cluster is indeterminate. This study only followed the contacts for 14 days, although the reported longest incubation period is 27 days.[15] Therefore, contacts who developed symptoms after the follow-up time ended were not detected. However, this error would be relatively small as one study reports that the 95th percentile for the incubation period is 12.5

days.[6] Moreover, information bias might occur as 14-day timing for contact tracing is not recent. Finally, this study was conducted using a routine outbreak investigation. Therefore, time was limited for conducting intensive interviews.

Public Health Recommendations

The Department of Disease Control should enhance the effectiveness of the track-and-trace system to indicate the telephone number and location of the investigated person within a specific time frame. This will help increase the timeliness and completeness of contact tracing. In addition, the Department of Disease Control should work in concert with the Department of Health to disseminate the guideline for prevention and control of COVID-19 at restaurants. After that, the guideline should be distributed to the wider public, especially restaurants and canteens, with regular assessment after its launch.

Conclusion

A confirmed SARS-CoV-2 cluster was detected with one confirmed COVID-19 case and two asymptomatic infections. The likely source of infection was a customer(s) of the restaurant or football players who the index case had played with 3 days prior to symptoms onset. The definite source of infection and magnitude of the outbreak are unknown due to a lack of information from all contacts of the index case. Therefore, a tool for tracing people attending community places should be strengthen and implemented effectively. In addition, a guideline for COVID-19 prevention in restaurants should be publicized and adapted. The index case and identified contacts complied with the Ministry of Public Health's COVID-19 prevention and control protocols after developing symptoms or being notified of the index case's status. These practices likely led to effective control and ultimately resulted in a small number of subsequent cases/contacts.

Acknowledgement

We thank the Urban Institute for Disease Prevention and Control and the Division of Communicable Disease Control, Bangkok Metropolitan Administration for their cooperation and support in the field work.

Suggested Citation

Nittayasoot N, Samphao R, Poobua K, Suphanchaimat R. A cluster of Coronavirus Disease (COVID-19) cases linked to a restaurant during early local SARS-CoV-2 transmission in Thailand. OSIR. 2020 Jun; 13(2):64-70.

References

1. World Health Organization. Coronavirus [Internet]. World Health Organization. 2020. [cited 2020 Mar 18]. <https://www.who.int/health-topics/coronavirus>
2. Centers for Disease Control and Prevention. Transmission of Coronavirus Disease 2019 (COVID-19) [Internet]. Centers for Disease Control and Prevention 2020. [cited 2020 Mar 18]. <https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html>
3. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020[J]. China CDC Weekly, 2020, 2(8): 113-122.
4. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The incubation period of Coronavirus Disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med. 2020 May 5;172(9):577-582. doi: 10.7326/M20-0504.
5. Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical characteristics of Coronavirus Disease 2019 in China. N Engl J Med 2020; 382:1708-1720doi:10.1056/nejmoa2002032
6. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. N Engl J Med 2020; 382:1199-1207. doi:10.1056/nejmoa2001316
7. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 Mar 2020 [Internet]. World Health Organization. 2020 [cited 2020 Mar 18]. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>

8. World Health Organization. Coronavirus disease 2019 (COVID-19): Situation Report –53 [Internet]. World Health Organization. Mar 2020. [cited 2020 Mar 18] <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200313-sitrep-53-covid-19.pdf?sfvrsn=adb3f72_2>

9. Department of Disease Control. Coronavirus Disease 2019 (COVID-19): Thailand Situation [Internet]. Department of Disease Control. 2020 [cited 2020 Mar 18]. <https://ddc.moph.go.th/viralpneumonia/index.php>

10. Department of Disease Control. Coronavirus Disease 2019 (COVID-19): Ministry of Public Health's COVID-19 prevention and control protocols [Internet]. Department of Disease Control. Mar 2020. [cited 2020 Mar 18]. <https://ddc.moph.go.th/viralpneumonia/g_srrt.php>

11. The Straits Times. Coronavirus: 5 good personal hygiene practices to keep the virus at bay, health news & top stories [Internet]. Apr 2020 [cited 2020 Mar 18]. <https://www.straitstimes.com/singapore/health/coronavirus-5-good-personal-hygiene-practices-to-keep-the-virus-at-bay>

12. Pung R, Chiew CJ, Young BE, Chin S, Chin S, Chen MI, et al. Investigation of three clusters of COVID-19 in Singapore: implications for surveillance and response measures. Lancet. 2020 Mar 28;395(10229):1039-1046. doi: 10.1016/S0140-6736(20)30528-6.

13. Coronavirus: 18 cases linked to outbreak at Harper's Restaurant. [cited 2020 Jun 24] <https://www.lansingstatejournal.com/story/news/2020/06/23/coronavirus-covid-19-cases-outbreak-harpers-restaurant-east-lansing/3242343001/>

14. Lu J, Gu J, Li K, Xu C, Su W, Lai Z, et al. COVID-19 outbreak associated with air conditioning in restaurant, Guangzhou, China, 2020. Emerg Infect Dis. 2020 Jul;26(7):1628-1631. doi: 10.3201/eid2607.200764.

15. Science Tech. An analysis of three Covid-19 outbreaks: how they happened and how they can be avoided [Internet]. 2020 [cited 2020 Jun 24] <https://english.elpais.com/spanish_news/2020-06-17/an-analysis-of-three-covid-19-outbreaks-how-they-happened-and-how-they-can-be-avoided.html?ssm=FB_CC>

16. World Health Organization. Coronavirus disease 2019 (COVID-19): Coronavirus Disease 2019 (COVID-19) WHO Thailand Situation Report [Internet]. World Health Organization. 29 Mar 2020. [cited 2020 Jun24] <www.who.int/Thailand>

17. Centers for Disease Control and Prevention. Considerations for restaurants and bars | COVID-19 [Internet]. Centers for Disease Control and Prevention. 2020 [cited 2020 Jun24] <https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/business-employers/bars-restaurants.html>

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Designing a Competent Chatbot to Counter the COVID-19 Pandemic and Empower Risk Communication in an Emergency Response System

Chonnatee Rodsawang[1]*, Pongsutee Thongkliang[2], Theeraporn Intawong[1], Apisit Sonong[1], Yosita Thitiwatthana[1], Suthat Chottanapund[3]

1 Division of Innovation and Research, Department of Disease Control, Ministry of Public Health

2 Public Sector Development Group, Department of Disease Control, Ministry of Public Health

3 Bureau of Risk Communication and Health Behavior Development, Department of Disease Control, Ministry of Public Health

*Corresponding author, email address: chonnatee.r@ddc.mail.go.th

Abstract

Risk communication is incorporated into an emergency response system. In Thailand, the Department of Disease Control (DDC) manages emergencies through the Emergency Operation Center (EOC). As a part of the EOC, the risk communication unit provides a hotline service that delivers information to and receives complaints and concerns from the general public. During the Coronavirus Disease 2019 (COVID-19) pandemic, a chatbot, which is a type of artificial intelligence (AI) was used to support the hotline service. This paper focuses on how to design an informative chatbot for the COVID-19 pandemic period that disseminates information to the general public. The chatbot, named "COVID-19 Preventable", was created based on the Design Science Research Methodology (DSRM) under two cycles of design and development. At the early stage of development, information from reliable sources was transformed into a question and answer system and imported to natural language processing in the Dialogflow on Google Cloud. The chatbot was the first official chatbot to communicate on COVID-19 on behalf of public health authorities. It consists of seven prompt features, namely, a situation report, how to protect yourself from COVID-19, fake news, self-screening for COVID-19, a list of nearest hospitals, the hotline number to call, and report notification. The uniquely informative and dynamic chatbot is likely to be an alternative channel for disseminating timely information on COVID-19.

Keywords: COVID-19, chatbot development, risk communication, Thailand

Chatbot and COVID-19

Thailand has been confronted with the spread of the Coronavirus Disease 2019 (COVID-19) since January 2020 and was the first country outside of China to report a confirmed case of COVID-19.[1] Staff in charge of the 1422 hotline under the Emergency Operation Center (EOC), Department of Disease Control (DDC), a strategic unit responsible for emergency management has been severely overwhelmed by calls, reflecting the high concern by the general public toward COVID-19.

Nowadays, artificial intelligence (AI) technologies, such as formal document completion, requisition response, automatic translations, and document outline, have been applied in various aspects of service in the government sector.[2] A chatbot is a particular AI technology that mimics human-like conversation through speech or text chats on a messaging platform. Its capabilities have been extensively used in both government and business sectors.[3-5]

The focus of this paper is to describe the development process and to present characteristics of a competent chatbot with an emphasis on COVID-19.

Development Process

To achieve the objective, the development process was designed based on the Design Science Research Methodology (DSRM), and consists of six steps: identify problem and motivation, define the objective of a solution, design and development, demonstration,

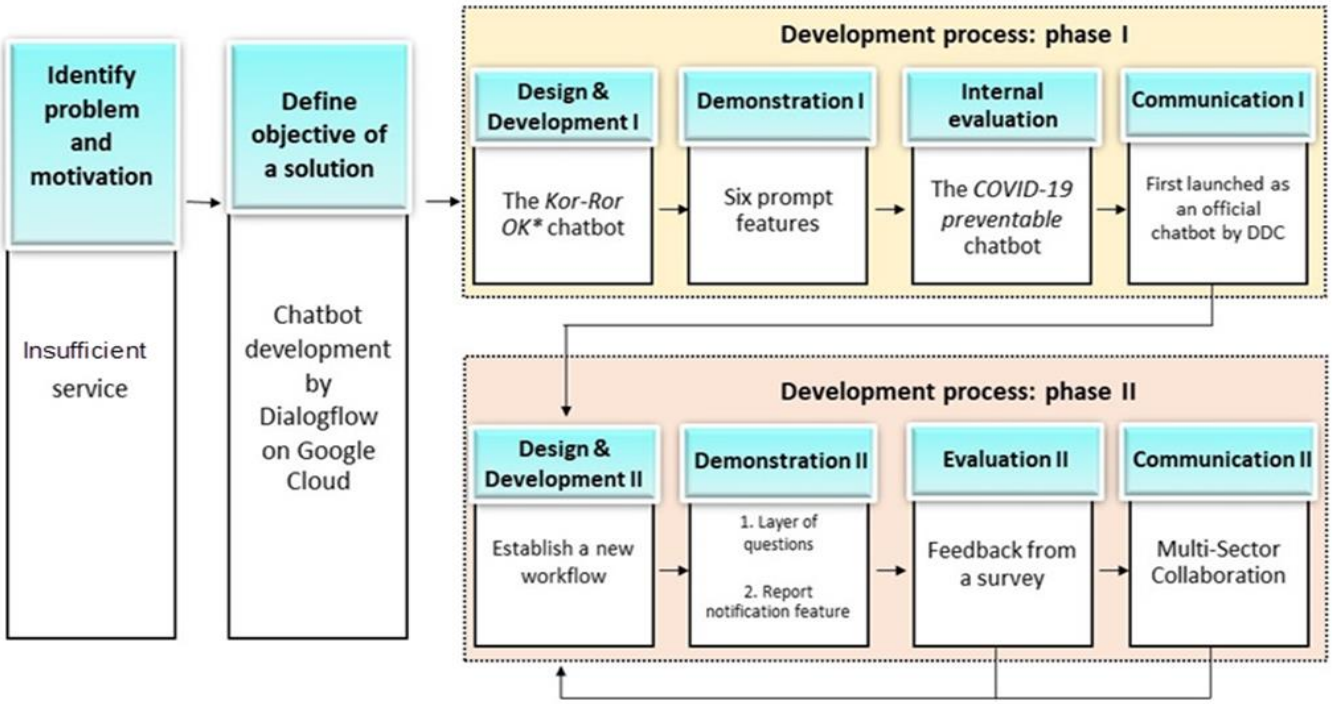

Figure 1. Process of the chatbot development based on the DSRM. The Chatbot in phase I was named "Kor-Ror OK", which is the abbreviation (in Thai) for the Department of Disease Control

evaluation, and communication.[6] This study divided the last four steps into a two-phase development cycle (Figure 1).

Identify Problem and Motivation

Under the uncertain COVID-19 situation, the number of phone calls to the 1422 hotline service increased noticeably. It is commonly assumed that the public expects truthful information on COVID-19 from public health authorities, including the DDC. However, most of the staff who answers the calls had limited access to information, and therefore could not satisfy the concerns of the caller. A certain level of broad knowledge and information needs to be prepared and organized in a limited time, otherwise it results in inefficient service. An AI tool can access information frequently and quickly and therefore provide answers to a wide range of inquiries that may be beyond a human's ability to remember. Conventional customer service provided via phone calls may be insufficient for people who have high concerns about COVID-19. A new approach is therefore needed to provide a more informative and responsive service.

Define the Objective of a Solution

To solve these limitations, AI technology, particularly a chatbot, was considered because of its ability to provide practically instant and up-to-date answers to almost every question a person could ask. We believe chatbot was a solution that could handle a larger number of calls. It is able to handle simple questions and frequently asked questions (FAQs), relieving the burden of the call center. It is also able to monitor calls 24/7 and reduces the time spent communicating with users. Moreover, a chatbot provides 2-way communication that can cater to a massive number of users in a very short time. This project aims to develop a chatbot as a novel approach to provide information on COVID-19.

Phase I: Design and Development, Demonstration, Evaluation, and Communication

According to the Thailand internet user behavior survey in 2019 conducted by the Electronic Transactions Development Agency (ETDA), the LINE messaging platform was reported as the most widely used online communication application, followed by Facebook Messenger, FaceTime and WhatsApp.[7] Thus, LINE chatbot was justified as an alternative risk communication channel by the DDC.

To deliver in Thailand, LINE chatbot was deployed using Dialogflow on Google Cloud. Dialogflow is a natural language processing (NLP) platform for creating human-like conversational interfaces over 20 languages on websites, mobile applications, and messaging platforms.[8] Initially, the LINE chatbot was named *Kor-Ror OK (*pronunciation of the abbreviation for the DDC in Thai). *Kor-Ror OK* was designed to support staff by searching for information while staff

received calls from people asking questions about COVID-19.

During the early phase of the pandemic, FAQs were responsively added to the Dialogflow. It is important to bear in mind that informative and up-to-date content is likely to be a key factor in convincing and engaging customers to use the chatbot. Information was gathered from public health authorities such as the DDC and the World Health Organization (WHO), other official government websites, and the Thai Public Broadcasting Service (ThaiPBS). According to the Dialogflow's mechanism, the extracted information is uploaded as *intents* that map the user's response.[8] Then, possible statements and their synonyms are created to trigger related intent. This is one reason why a chatbot can mimic a human-like conversation.

Kor-Ror OK provided an interactive response with six prompt features that derived from FAQs via the DDC hotline, namely, situation report, how to prevent yourself from COVID-19, fake news, self-screening for COVID-19, a list of nearest hospitals, and the 1422 hotline number to call (Figure 2). Then, *Kor-Ror OK* demonstrated its ability as a responsive system for providing instantaneous content related to COVID-19 in both Thai and English. This step highlighted the advantages and practicability of *Kor-Ror OK* to the hotline staff and internal stakeholders. As simulated chatbot users, they evaluated and gave useful and productive comments. For example, the user interface should focus on ease of access and represent public health authorities, not only the DDC.

After the first round of internal evaluations, Kor-Ror OK was promoted as an officially dedicated chatbot not only for staff but also for the public on 27 Feb 2020. Later, policymakers renamed the chatbot to COVID-19 Preventable (COVID-19 ป้องกันได้) to communicate to the public that COVID-19 is preventable.

Phase II: Design and Development, Demonstration, Evaluation, and Communication

After the number of users reached over 100,000, the menu usage rose remarkably. The number of complex questions that were needed accumulated gradually. These challenging problems, which arose in Phase I, were categorized and considered carefully. Consequently, two solutions were proposed to solve these problems. Complex questions were analyzed and classified into two main types of questions, namely unmatched questions and unanswered questions. Two academic teams were assigned responsibility for information management.

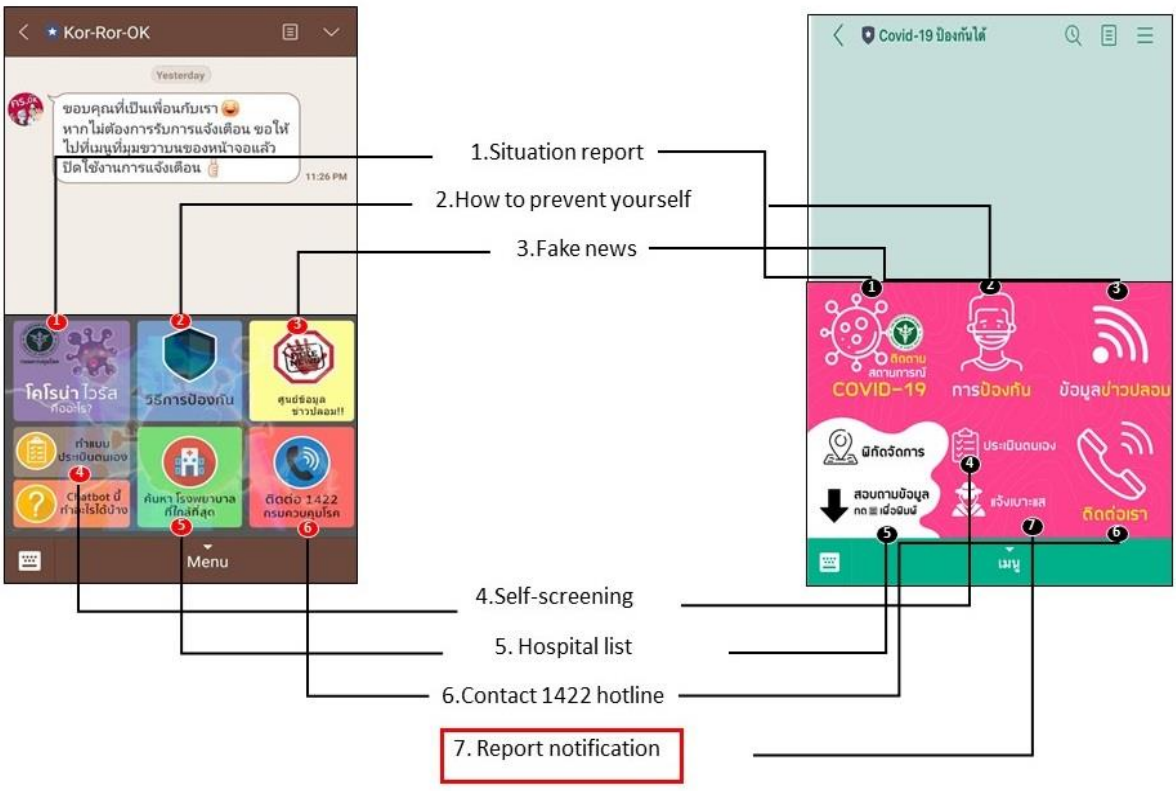

Figure 2. Six menu icons of the initial "Kor-Ror OK" chatbot (left) and seven menu icons of the latest version: the "COVID-19 Preventable" chatbot (right)

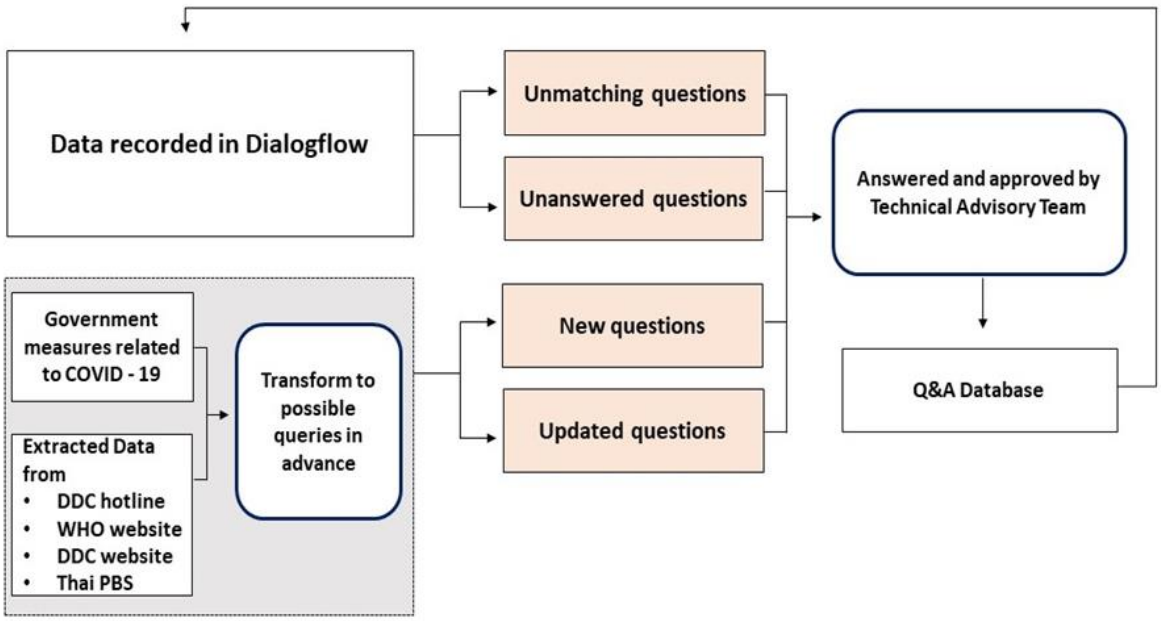

Figure 3. The workflow for organizing information to the Dialogflow

The first team was assigned to respond to the Dialogflow configuration of unmatched questions and answers. Meanwhile, the second team was assigned to deliberate on answering a backlog of questions that relied on academic principles (Figure 3).

The teams conducted brainstorming sessions to design new features to provide a more effective answer by obtaining the four most frequent user groups of choice.

Moreover, it was decided that the information in the chatbot should be updated daily following announcements from the Thai government via the Centre for Covid-19 Situation Administration (CCSA). It was deemed necessary to establish a workflow to extract core contents of announcements or measures from the CCSA daily including relevant information from reliable sources and then transform them into pairs of questions and answers (Figure 3).

Approximately, three hundred imported questions could be classified into four sections: section 1) general knowledge, section 2) ways to control COVID-19 and prevent oneself from being infected, section 3) travel advisories, section 4) the Communicable Disease Act 2015. Users could find more specific answers by choosing each layer of questions (Figure 4). This new feature seemed to help users easily find answers to expected questions.

As a consequence of the government announcement about the Communicable Disease Act 2015 (B.E. 2558) and the Emergency Decree, many notifications of violations were reported via the LINE chatbot. For example, potentially infected people who were observed and needed to be quarantined according to the DDC guideline. As a result, a new feature menu "report notification" was designed and integrated into the chatbot to support reporting from people concerning the spread of COVID-19 immediately and then forwarded to designated sections for immediate action. Initially, the report notification menu used Google Forms to facilitate data collection and inform users to the designated sections, such as the EOC. The report notifications may lead to prompt investigation of COVID-19. Currently, the report notification is being developed under ArcGIS Online, a Cloud-Based GIS Mapping Software which reports violations by location.

After two months, two new features, which were question categories and report notification, were demonstrated to the hotline staff and stakeholders. To evaluate these features, an online survey was sent to a random sample of chatbot users. Their feedback was analyzed and used to make improvements. The latest version of the chatbot was proposed at the DDC executive meeting, which was attended by designated government sectors following the Emergency Decree to take actions in their roles.

Results

The "COVID-19 Preventable" chatbot is one of the official interactive channels used by the DDC to deliver risk communication on COVID-19 and contains 262 pre-programmed questions in Thai (43 in English). Currently, there are over 500,000 users with the number of requests per day peaking at 10,000. The

"COVID-19 Preventable" chatbot was the first available chatbot on behalf of public health authorities developed during the COVID-19 crisis based on user needs and the development process remains dynamic. It is important to note that the pattern of chatbot usage and characteristic of queried statements may guide the direction for improving the capabilities of the chatbot.[9]

The feedback from the survey was positive and reflects the trust in the application by users who tended to use the chatbot every day. Sixty four percent of respondents thought that the chatbot answered their questions appropriately. Most (98%) of the respondents stated that they were likely to continue using the chatbot and 96% said that they would recommend chatbot to others. Some respondents suggested that mental health advice be included with, for certain cases, an option to provide a direct connection to the DDC hotline staff. Concerning the evaluation standard, classified chatbot evaluation into three categories: content evaluation, user satisfaction, and evaluation of other aspects.[10] We, therefore, recommend that the first two categories be the focus of future development for the chatbot.

With its current features, the chatbot has exceeded expectations in terms of disseminating information on COVID-19 as a new alternative. It can also be used as a novel channel for reporting violations of the Communicable Disease Act 2015 (B.E. 2558) and the Emergency Decree. The reported data will provide effective support to government officers in their disease investigations according to epidemiological guidelines for controlling the spread of COVID-19.

Benefits

Since the first reported case of COVID-19, many chatbots have been created covering different aspects of the pandemic; however, some chatbots are now virtually inactive because of their lack of interest by the community. To address this challenge, we established a dynamic response system to maintain the processes causing the chatbot to be more informative, up-to-date, and well-organized. The chatbot information sources were approved by experts; therefore, its reliability should be high.

Regarding privacy and security, the chatbot does not ask for a user's personal information. The chatbot was built using Dialogflow on Google Cloud, which has a strong privacy protection and security policy.[8] Therefore, users of the chatbot have the same level of security risk as users of LINE and Google.

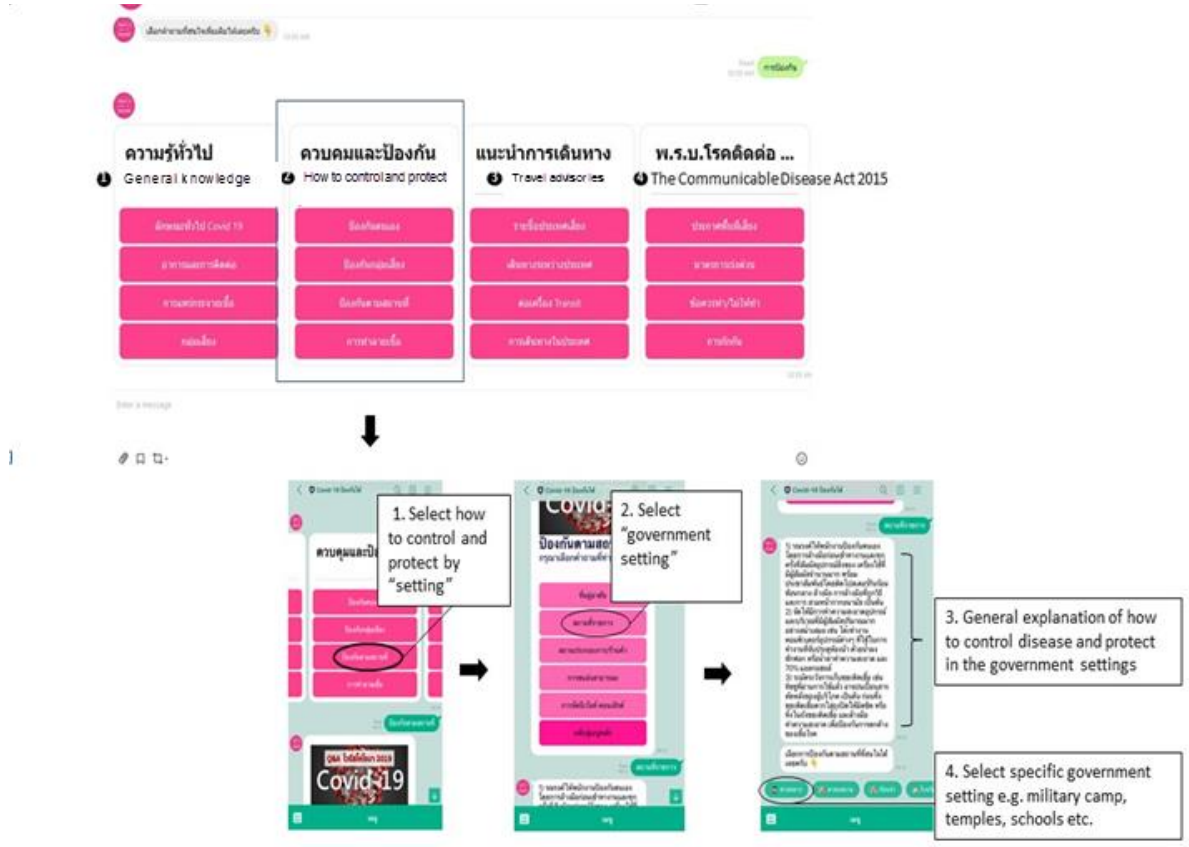

Figure 4. Illustration of four question categories and how users can easily find more specific questions

Limitations

All members of the chatbot development team were government officers employed at the DDC as doctors or public health officers, thus, their expertise was generally related to public health knowledge in terms of epidemiology and disease control principles. However, they had no expertise in AI or chatbot development.

As a result, a lack of technical skills to create a high-potential chatbot providing complete user satisfaction may be one of the limitations of this project. For example, feature menus are not desktop-friendly, and speech recognition is not fully functional. To solve these problems, a technical collaboration between AI specialists and the DDC team is encouraged.

Future Recommendations

We aim to improve the chatbot's accessibility by establishing access on Facebook Messenger and WhatsApp. Another possible area of future development would be to translate the contents to other languages and add more information for the resilience stage of spread and vaccination. According to the survey results, the DDC website was the most popular among other channels of the DDC. Therefore, embedding the chatbot in the DDC website should be considered by policymakers. Similar chatbots could also be applied for the dissemination of general knowledge to control other diseases.

Implications

Amid the emergency circumstances of the COVID-19 crisis, the development of an innovative chatbot that can provide risk communication to the public is timely. A focus on developing the chatbot to be more informative and dynamic may improve user satisfaction. Moreover, to engage more users to the chatbot, the developers should establish an appropriate workflow, containing organized and accurate information to ensure that risk communication under crisis is delivered to make user's satisfaction. The usefulness of this chatbot may be to apply to mitigate and relieve the burden of concerns affecting public health staff during a crisis.

Acknowledgements

The authors would like to express their sincere gratitude to the Division of Innovation and Research, Public Sector Development Group and Bureau of Risk Communication and Health Behavior Development for their valuable support.

Suggested Citation

Rodsawang C, Thongkliang P, Intawong T, Sonong A, Thitiwatthana Y, Chottanapund S. Designing a competent chatbot to counter the COVID-19 pandemic and empower risk communication in an emergency response system. OSIR. 2020 Jun; 13(2):71-77.

References

1. Namwat C, Suphanchaimat R, Nittayasoot N, Iamsirithaworn S. Thailand's response against Coronavirus Disease 2019: challenges and lessons learned. OSIR. 2020 Mar;13(1):33-37.
2. Mehr, Hila. 2017. "Artificial Intelligence for Citizen Services and Government". <https://ash.harvard.edu/publications/artificial-intelligence-citizen-services-and-government>
3. Chatbot Definition [Internet]. [cited 2020 May 15]. <https://www.investopedia.com/terms/c/chatbot.asp>
4. Androutsopoulou A, Karacapilidis N, Loukis E, Charalabidis Y. Transforming the communication between citizens and government through AI-guided chatbots. Gov Inf Q. 2019 Apr 1;36(2):358–67.
5. Zumstein D, Hundertmark S. Chatbots: an interactive technology for personalized communication and transaction. Int J WWW/Internet. 2018;15(1):96–109.
6. Peffers K, Tuunanen T, Rothenberger M. A, Chatterjee S. A design science research methodology for information systems research. Journal of management information systems. 2007; 24(3): 45-77.
7. Hughes R. Thailand internet user behavior 2019. Vol. 53, Journal of Chemical Information and Modeling. 2008. 287 p. (in Thai).
8. Building and deploying a chatbot by using Dialogflow (overview) [Internet]. [cited 2020 May 15]. Available from: <https://cloud.google.com/solutions/building-and-deploying-chatbot-dialogflow>
9. Chaturvedi A, Srivastava S, Rai A, Cheema AS. A Hybrid Approach to Develop and Integrate Chatbot in Health Informatics Systems. 13th International Conference on Health Informatics; 2020 Jan 8.

10. Maroengsit W, Piyakulpinyo T, Phonyiam K, Pongnumkul S, Chaovalit P, Theeramunkong T. A survey on evaluation methods for chatbots. ACM Int Conf Proceeding Ser. 2019;Part F1483 (March):111–9.