

How is Case Investigation Performed in Light of Coronavirus Disease 2019 (COVID-19) Pandemic—A Case Study of the First Imported COVID-19 Case from Europe in Thailand

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Abstract

This study aimed at describing an investigation of a confirmed coronavirus disease 2019 (COVID-19) case in Chonburi, Thailand. He was the first imported case of COVID-19 from Europe to Thailand. The case was an Italian expatriate working in Chonburi. He left for Italy on 14 February 2020 and returned to Thailand on 1 March 2020. At the port of entry, he passed the temperature scan. The following day, he developed upper respiratory symptoms. The providers at a private hospital performed nasopharyngeal swab (NPS) and throat swab (TS). On 3 March 2020, positive results for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection were reported. Subsequently, he was referred to Chonburi Regional Hospital. The investigation team of the Department of Disease Control (DDC), Ministry of Public Health (MoPH), could identify 75 contact persons. Of these 75, 56 were classified as high-risk. Of these 56, 40 were tested for NPS and TS and all were found negative for SARS-CoV-2 infection. The rest 16 contacts could not be reached at the time of investigation but their name list was submitted to the incident commander (IC) and the Immigration Bureau for further tracing. Later, the investigation team found that none of these 16 contacts became positive. Another important discovery from this investigation was that a number of healthcare workers were counted as high-risk contacts due to improper use of personal protective equipment (PPE). The report of this investigation raised the concern for proper PPE application

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amongst healthcare workers to the Emergency Operating Center (EOC) of the MoPH. Outcomes from this event in combination with other events alike were fed into policy decision making process of the MoPH. The MoPH later launched a message to emphasize the importance of proper PPE application amongst healthcare providers to minimize the number of high-risk healthcare-worker contacts who would be subject to a 14-day quarantine. In addition, the MoPH also underpinned that the self-quarantine measure must be strictly enforced to mitigate the risk of wider disease spreading.

Keywords: COVID-19, SARS-CoV-2, case investigation, contact tracing, Thailand

การสอบสวนโรคในภาวะการระบาดของ Coronavirus Disease 2019 (COVID-19) ดำเนินการอย่างไร-กรณีศึกษาจากผู้ป่วย COVID-19 รายแรกจากยุโรปในประเทศไทย

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่ออธิบายกระบวนการสอบสวนโรค coronavirus disease 2019 (COVID-19) ผ่านกรณีศึกษาของผู้ป่วย COVID-19 ที่จังหวัดชลบุรี ซึ่งเป็นผู้ป่วยยืนยัน COVID-19 จากทวีปยุโรปรายแรกในประเทศไทย ผู้ป่วยเป็นชาวอิตาลีที่ทำงานในจังหวัดชลบุรี เดินทางไปอิตาลีเมื่อวันที่ 14 กุมภาพันธ์ 2563 จากนั้นเดินทางกลับถึงประเทศไทยเมื่อวันที่ 1 มีนาคม 2563 ผ่านการตรวจวัดอุณหภูมิที่ด่านตรวจที่สนามบิน ในวันต่อมาผู้ป่วยเริ่มมีอาการในระบบทางหายใจส่วนต้น จึงไปตรวจที่โรงพยาบาลเอกชนแห่งหนึ่ง และได้รับการตรวจ nasopharyngeal swab (NPS) และ throat swab (TS) ผลการตรวจ NPS และ TS รายงานผลพบเชื้อ severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) เมื่อวันที่ 3 มีนาคม 2563 จากนั้นถูกส่งตัวไปโรงพยาบาลศูนย์ชลบุรี ทีมสอบสวนของกรมควบคุมโรค กระทรวงสาธารณสุขสามารถระบุผู้สัมผัสได้ 75 ราย ในจำนวนนี้ 56 ราย นับเป็นผู้สัมผัสที่มีความเสี่ยงสูง ในจำนวน 56 ราย 40 รายได้รับการตรวจ NPS และ TS ผลไม่พบเชื้อ SARS-CoV-2 ส่วนผู้สัมผัส 16 รายที่เหลือที่ไม่สามารถติดตามได้ในขณะนั้น จึงได้ส่งรายชื่อไปให้ผู้บัญชาการเหตุการณ์และสำนักงานตรวจคนเข้าเมืองเพื่อติดตามต่อไป ซึ่งต่อมาทีมสอบสวนโรคพบว่าไม่มีใครใน 16 รายที่ยืนยันว่ากลายเป็นผู้ป่วย COVID-19 ทั้งนี้ ข้อค้นพบที่สำคัญอีกประการก็คือ การที่บุคลากรทางการแพทย์สวมอุปกรณ์ป้องกันที่ไม่เหมาะสม ทำให้ถูกนับรวมอยู่ในกลุ่มผู้สัมผัสที่มีความเสี่ยงสูงด้วย ทีมสอบสวนโรคได้ส่งรายงานการสอบสวนและยกประเด็นเรื่องการสวมใส่อุปกรณ์ป้องกันที่เหมาะสมในบุคลากรทางการแพทย์ต่อศูนย์ปฏิบัติการภาวะฉุกเฉินของกระทรวงสาธารณสุข ผลลัพธ์จากการสอบสวนโรคในเหตุการณ์นี้ร่วมกับเหตุการณ์อื่นๆ ที่คล้ายกันได้ถูกป้อนเข้าสู่กระบวนการตัดสินใจเชิงนโยบายของกระทรวงสาธารณสุข ต่อมากระทรวงสาธารณสุขได้ออกประกาศเน้นย้ำถึงความสำคัญของการสวมใส่อุปกรณ์ป้องกันที่เหมาะสมในบุคลากรทางการแพทย์ เพื่อจะลดผู้สัมผัสที่มีความเสี่ยงสูงที่จำเป็นต้องได้รับการกักกันเป็นเวลา 14 วัน นอกจากนี้ยังได้เน้นย้ำว่า ระบบกักกันตัวด้วยตนเองจะต้องกระทำอย่างเข้มงวด เพื่อลดความเสี่ยงต่อการแพร่กระจายเชื้อในวงกว้าง

คำสำคัญ: COVID-19, SARS-CoV-2, สอบสวนโรค, ติดตามผู้สัมผัส, ประเทศไทย

Background and Rationale

Since the report of the first case of coronavirus disease 2019 (COVID-19) in December 2019 in Hubei Province of China, the novel virus

(severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2]) has rapidly spread around the world, resulting in several thousands of reported cases and deaths in multiple countries.⁽¹⁾ As of the 15th

of March 2020, the SARS-CoV-2 infected toll over the world expanded beyond 150,000 with over 5,700 deaths; and it seemed that the situation had not reached the acme.⁽²⁾

Thailand has been amongst numerous countries in Asia that has suffered substantially from the COVID-19 pandemic, in terms of health and economy. It was the first country that reported the confirmed case outside China.⁽³⁾ The Department of Disease Control (DDC) of the Ministry of Public Health (MoPH) had activated the Emergency Operation Center (EOC) on the 4th of January 2020. Then on the 22nd January 2020, the EOC was scaled up to the ministerial level. The World Health Organization (WHO) classified Thailand as a country with local transmission and this was confirmed by the emergence of a case that did not have prior travel experience in China on the 30th of January 2020.

According to the EOC protocol, all confirmed cases must be investigated by either the Office of Disease Prevention and Control (ODPC) or the Division of Epidemiology (DOE) of the DDC, MoPH. Source case investigation and contact tracing needed to be undertaken in order to prevent further transmission of diseases.

On the 4th of March 2020, the DOE had received notification from the ODPC Region 6 (Chonburi) that there was an emerging confirmed case of COVID-19 in Chonburi, a major province in the east of Thailand. The patient had a history of contact with a large number of persons, which exceeded the capacity of the local office to perform contact tracing alone. He was the first imported case of

COVID-19 from Europe travelling into Thailand.

The objective of this study was to describe the case investigation by the joint investigation team (JIT), consisted of epidemiological staff from the DOE and the ODPC Region 6. It was hoped that lessons and experience from this investigation were beneficial to provide proper recommendations for effective outbreak control in the future.

Methodology

A case narrative was performed. Data were collected by: (i) in-depth interviews with the case and contacts of the case, and (ii) review of the case's medical records. A roster of contacts was constructed. The interviews mainly took place in a face-to-face manner at the interviewee's workplace. Each interview lasted around 20-30 minutes.

A brief environmental survey at the case's workplace was performed. Nasopharyngeal swab (NPS) and throat swab (TS) were conducted on all high-risk contacts. All specimens were tested by reverse transcription polymerase chain reaction (rt-PCR) at the Department of Medical Sciences (DMS).

The investigation lasted from the 4th to the 6th of March 2020. Then the local authority (ODPC Region 6) followed up with the case and all contacts for another 14 days. All procedures were conducted as part of the investigation specified by the MoPH; therefore, ethic approval was not required. However, all interviewees were assured that their identity would not be disclosed to the wider public except for disease control reasons.

The JIT had triangulated the interview in-

formation with surrounding evidence, including checking the history of travelling of the case by the closed-circuit television in the whereabouts the case had visited.

Results

● *Description of case*

The patient was an Italian male working as a project manager at a construction site of company T in Chonburi. He travelled to his hometown in Italy (Bergamo) on the 14th of February 2020. The case denied a history of travelling outside Bergamo during the 14th - the 29th of February 2020. He also denied the presence of COVID-19 patients in his village. However, the patient informed that his father had mild fever and already underwent a test for COVID-19 at a facility, subsequently reporting negative result. The case then travelled to Milan to catch a flight back to Bangkok on the 29th of February 2020.

Upon the entry into Thailand on the 1st of March 2020, he had passed the temperature scan at the immigration control. He then asked a chauffeur to take him from the airport to his accommodation (rented house) in Chonburi. He developed mild fever in the evening and decided to skip the work the day after.

On the 2nd of March 2020, he had mild headache and runny nose while the fever still persisted (temperature = 37.6 °C). He then met a doctor at private hospital Y to undertake NPS and TS. Chest radiography (CXR) and complete blood count (CBC) check were conducted. However, he denied the admission and later returned home despite

the fact that he met the person-under-investigation (PUI) criteria. At that time, the definition of PUI encompassed (i) a person with body temperature of at least 37.3 °C with a respiratory symptom with a travelling history to high-risk areas, or (ii) a pneumonia case with unspecified source of infection.

On the 3rd of March 2020, he was notified by the doctors that the swabs showed positive for SARS-CoV-2. The test was confirmed by two reference labs (DMS and Thai Red Cross Emerging Infectious Disease Health Science Center [TRC-EIDCC], Chulalongkorn University). He then was admitted to Y hospital and referred to Chonburi Regional Hospital afterwards. Note that his temperature appeared to subside (36.3 C°) with minimal respiratory symptoms. A summary of laboratory and CXR findings is shown in Table 1.

● *Contact tracing*

Flight contact

There were 18 flight-crews and pilots combined. All of them had undergone NPS and TS by the public health officers at the immigration control. The test findings revealed negative for SARS-CoV-2. Additionally, 17 passengers were sitting within a two-row perimeter. As of the 6th of March 2020, the JIT could identify a passenger who was a Chinese tourist. NPS and TS were performed on him and the test later revealed negative results. The name list of other passengers was sent to the incident commander (IC) to coordinate with responsible authorities (such as police and border control) to find out the contact information and recruit them for further testing. The investigation team later found that none of the passengers

Table 1 Laboratory findings of the patient

Date tested	Test	Results
2 March 2020	Nasopharyngeal swab	SARS-CoV-2 detected
2 March 2020	Throat swab	SARS-CoV-2 detected
2 March 2020	Complete blood count	Hematocrit = 39%, white blood cell = 4,010 /mm ³ (neutrophil = 49.9%; lymphocyte = 39.2%), platelet = 159,000 /mm ³
2 March 2020	Chest radiography	Normal
4 March 2020	Complete blood count	Hematocrit = 38.9%, white blood cell = 4,000 /mm ³ (neutrophil = 48.9%; lymphocyte = 49.2%), platelet = 188,000 /mm ³
4 March 2020	Chest radiography	Normal

sitting near the case (n=17) were infected.

1 March 2020

The patient met his chauffeur at the airport; then travelled to his accommodation by a private car. The travel took about three hours. During the journey, he and the chauffeur wore face masks all the time. He had a housemate, who was an Italian male aged 50 years. The house had two separate bedrooms with shared common space. In the afternoon, he and his housemate grabbed a taxi to go for a coffee in the city center; then took a taxi back home afterward. The journey between the house and the café lasted about 20 minutes. The time spent with the sellers at the café was very short—therefore, there was no additional high-risk contact at the café. Note that he hired a maid to clean up the house every day, but the maid did not stay overnight at the house.

2 March 2020

He asked the chauffeur to take him to the hospital in the morning. The JIT could identify seven healthcare workers who did not wear

appropriate personal protective equipment (PPE). All of them were classified as high-risk contacts. Note that proper PPE in this setting means N95 mask, face shield and water-resistant gown, for any providers performing physical examination and medical procedures. On the way back home, he dropped by a dispensary to buy a body thermometer, but the time spent with the pharmacist and the sellers there was very short. Accordingly, none of the dispensary staff were categorized as high-risk contacts.

3 March 2020

On the 3rd of March 2020, he asked his chauffeur to take him to the office. On the journey to the office, the chauffeur picked up a friend of his (Thai female, 25 years) from the market. All three people (patient, chauffeur, and chauffeur's friend) spent about 20 minutes together. The patient then entered the office, which was a construction site cabin with a size of 12 m². There were three officers in the cabin at that time. He spent about 5-10 minutes in the cabin. Then the



patient allowed the chauffeur and the female friend to leave and called another friend of him (Thai male, 31 years) to take him to go for lunch. On the way to the restaurant, his friend picked up two more people, an Italian housemate and a Nepali friend. During lunch, the patient was notified by the doctor of Y hospital that he caught COVID-19. He later travelled to the hospital but on the way, he dropped by at a commercial bank for about 10 minutes. The JIT interviewed with the bank staff and the restaurant owner and found no additional high-risk contacts from both sites. The patient was admitted to the hospital since the 3rd of March 2020 in the afternoon. The JIT

interviewed with all hospital staff that had been involved with the patient, and could identify three more healthcare workers who did not wear proper PPE, during the 3rd – the 4th of March 2020. These two were classified as high-risk contacts.

4 March 2020

The patient was later transferred to Chonburi Regional Hospital where a proper negative-pressure room was available. All healthcare workers there wore proper PPE. The patient was treated with chloroquine, darunavir, oseltamivir and ritonavir. Table 2 provides a summary of high-risk contacts involved with the patient during the 1st – the 4th of March 2020.

Table 2 Line listing of high-risk contacts

Contact	Place	Number	Contact date	Results ^ϕ of NPS [§] and TS [#]	Specimen collection date
1. Air crew	Flight	18	29 Feb 2020	Negative	9 Mar 2020
2. Passengers within 2-row apart	Flight	17	29 Feb 2020	Negative on one passenger. ^ξ	6 Mar 2020
3. Italian housemate	House	1	1 Mar 2020	Negative	5 Mar 2020
4. Maid	House	1	1 Mar 2020	Negative	5 Mar 2020
5. Chauffeur	Car	1	1 Mar 2020	Negative	5 Mar 2020
6. HCW*	Private Hospital Y	10	2-4 Mar 2020	Negative	5, 8 Mar 2020
7. Cabin officers	Office	3	3 Mar 2020	Negative	8 Mar 2020
8. Nepali friend	Restaurant	1	3 Mar 2020	Negative	8 Mar 2020
9. Thai friend	Restaurant	1	3 Mar 2020	Negative	8 Mar 2020
10. Friend of the chauffeur	Car	1	3 Mar 2020	Negative	8 Mar 2020
11. Chauffeurs	Taxi	2	1 Mar 2020	Negative	8, 12 Mar 2020
Total number of high-risk contacts = 56					
Total number of high-risk contacts being tested = 40					

Note: * HCW = healthcare worker; [§]NPS = nasopharyngeal swab; [#]TS = throat swab; ^ϕThe test was performed on the fifth day after contacting with the case. ^ξThe other passengers were not tested for NPS and TS during the investigation period (2-4 March 2020). However, the name list of them was submitted to incident commander to coordinate with the immigration control and the police to recruit them for further testing. The investigation team later found that none of the passengers were infected.

It should be noted in total, there were 19 low-risk contacts (14 healthcare workers with proper PPE and two vendors at the dispensary [2 Mar 2020], two workers at the restaurant [3 Mar 2020] and one bank officer [3 Mar 2020]). According to the DDC guideline at that time, low-risk contacts were not required to undertake specimen collection. They were encouraged to perform only self-monitoring and social distancing.

● *Public health actions and control measures*

All high-risk contacts were advised to be quarantined at home for at least 14 days after being contacted despite no detection of SARS-CoV-2. The local healthcare providers in nearby hospitals as well as the staff of ODPC Region 6 were assigned to monitor the symptoms of all high-risk contacts every day. All low-risk contacts were recommended to have a daily checking on the body temperature for 14 days, and to notify the local providers immediately given any symptoms showing up. Self-monitoring and social distancing were emphasized to all contact persons.

Discussion

This study clearly described the process and the importance of an outbreak investigation on a confirmed COVID-19 case. The patient came from Bergamo in Lombardy, Italy, which was one of the most active areas of COVID-19; and at the time of investigation, the number of cases in Italy was skyrocketing.^(4,5) He developed symptoms on the first day upon his arrival in Thailand—this meant he had not been exposed to any infected case in

Thailand about two weeks prior to the immigration. The median incubation period of COVID-19 was about 5 days, and could last for 14 days.^(5,6) Therefore, it was very likely that he was a contacted COVID-19 case from Italy.

This case generated a large number of contacts, partly due to his mobile behavior. Besides, improper PPE application could lead to a number of healthcare workers be high-risk contacts. According to the Thai DDC's guideline on contact tracing, all high-risk contacts needed to undertake NPS and TS to detect SARS-CoV-2; and be quarantined for at least 14 days. This meant the affected hospital might lose its capacity to care for patients suffering from other diseases because of staff shortage.

There are many worth learning lessons from this study. First, a self-quarantine measure should be strictly enforced covering all persons at risk, let alone those who become PUI. Had a self-quarantining measure been strictly enforced on this case, the number of high-risk contacts would have been limited dramatically.^(7,8) Fortunately, most people in the circle of contacts were still identifiable and the JIT could activate the investigation immediately. Yet the situation might turn opposite if the contact circle was enlarged.

Second, all healthcare providers, either in the public or in the private facilities, should be emphasized on the importance of wearing proper PPE. Such practice could divert the risk from high to low, thus, the number of high-risk contacts would have decreased further. This means the MoPH should ensure adequate PPE supply for



all facilities and impose stringent practices on healthcare providers regarding the proper application of PPE.⁽⁹⁾ In addition, health facilities may consider a re-orientation of the structure of the acute respiratory infection (ARI) clinic to minimize both possibility of contacts and contact time.⁽¹⁰⁾ An obvious example that showed the benefit of proper PPE application and the establishment of ARI clinic was demonstrated by a study by Wongsanuphat et al., which described a cluster of imported COVID-19 cases in Chonburi in March 2020, the event that was close to the case story in this study. The index case of that cluster visited a hospital (J) in the province, but the difference from this study was most healthcare staff in J hospital wore proper PPE while providing care to the patient. Besides, J hospital installed a well triage system in an ARI clinic to take care of COVID-19 suspected patients. These practices appeared to hugely reduce the contact period and the number of high-risk healthcare workers. Wongsanuphat et al. also described the benefit of ARI clinic and effective triage system to reduce the number of high-risk healthcare workers. In that study, there were 12 healthcare workers involved with the patients but only three of them were identified as high risk.⁽¹¹⁾ Such a finding showed a stark contrast with this study in which the volume of high-risk healthcare workers was quite large (n=10).

Third, it was very likely that rapid and comprehensive contact tracing was amongst key factors to prevent the risk of COVID-19 spreading. With only a single case, the investigation team was able to identify over 50 high-risk contacts and

most of the contacts were informed to undergo self-quarantining within a few days after the case was notified (except for the passengers sitting near the case). The high number of contacts, on one hand, could be considered a daunting figure pointing toward a huge risk of disease spreading; on the other hand, it could be viewed as the effectiveness of contact tracing as part of the case investigation. The performance of the Thai contact tracing system was comparable to early reports in Singapore and Taiwan where one confirmed case led to approximately 31 and 27 contacts being traced respectively.^(12,13) The bottom line of this statement does not intend to specify which country performs better than another, but rather highlights that in countries with a seemingly well-controlled COVID-19 situation, contact tracing is indispensable. A mathematical modeling study by Kretzschmar et al. suggested that if the tracing could be done without delay, the proportion of COVID-19 transmission per index case could be prevented by 80%.⁽¹⁴⁾ The effectiveness of transmission prevention diminished proportionately with the delay of tracing period. Given a 5-day delay, the effectiveness of transmission prevention was expected to drop to 18%.⁽¹⁴⁾

Last but not least, the contact information of all passengers at risk should be shared with the investigation team without any delay to ensure timely and comprehensive contact tracing. Moreover, there should be mechanism to trace the whereabouts of passengers after flight landing and ask them to undertake further testing if necessary. At the time of writing, such mechanism had not

been in place. However, this problem seemed to be alleviated a few weeks later after the Government endorsed a strict registration measure to all inbound passengers. That was, the incomers needed to register themselves with a mobile application approved by the Government. Then a data sharing platform amongst the airlines, the immigration control, and the DDC was set up.

There remain some limitations in this study. Firstly, it was conducted as part of the routine investigation of the DDC, of which the primary aim was to identify contact tracing and promptly specify proper control measures. Thus, the time spent with each interviewee was quite short, making the data subjected to incompleteness. Secondly, to decide whether a contact was high risk (or not) hugely depended on the memory of the interviewees. In other words, the study was not free from recall bias. However, this limitation might not severely affect the data validity as the investigation took place shortly after the case was notified.

Conclusion and policy recommendations

This study presented a confirmed COVID-19 case. The investigation could identify 56 high-risk contacts. The majority of them (40/56) had been tested for SARS-CoV-2 and all tests revealed negative results. Key findings from this event in combination with other events alike were fed into policy decision making process of the MoPH. The MoPH later launched an emphasizing message on the importance of proper PPE application amongst healthcare providers to minimize the number of

high-risk healthcare-worker contacts who would be subjected to a 14-day quarantine. In addition, the MoPH also underpinned that the self-quarantine measure must be strictly enforced to mitigate the risk of wider disease spreading.

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