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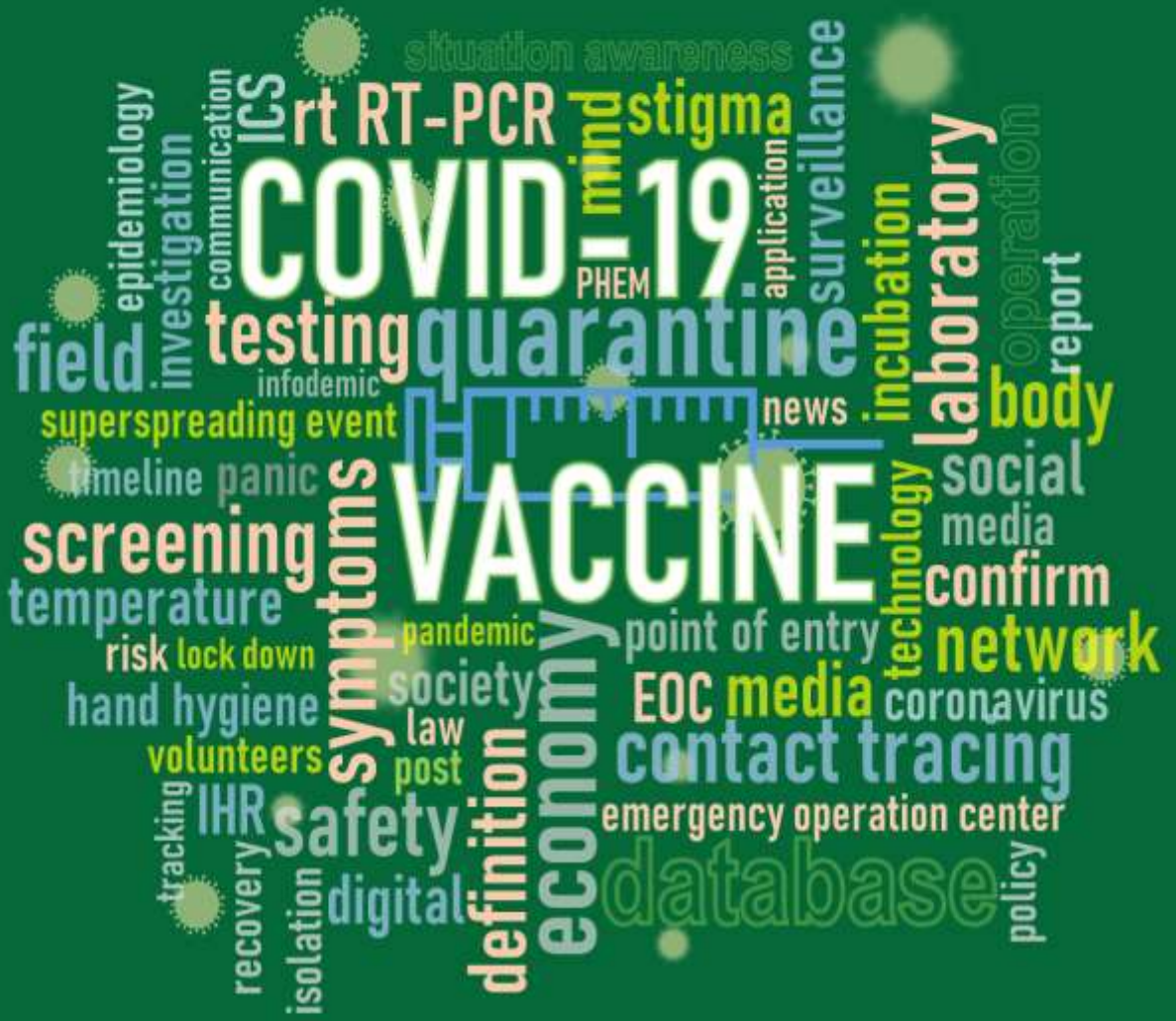

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Field Epidemiology Training Program, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Tiwanond Road, Talad Kwan Subdistrict, Muang District, Nonthaburi 11000, Thailand

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

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

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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

Risk Communication in the Time of COVID-19

Angela Song-En Huang, Chief Editor

We have been taught the principle of risk communication is to provide accurate information for people to act on.[1]

It has been more than a year since COVID-19 was recognized. At first, it is a disease with much unknown. But over the last 12 months, there has been publications, both in the mainstream media and the scientific literature, on the transmission, severity, treatment, and prevention of the disease. As the disease spread from Wuhan, China, to neighboring countries, then worldwide, we have learned that without early implementation of quarantine of people exposed to SARS-CoV-2 and isolation of patients confirmed to have COVID-19, the disease can spread rapidly, overwhelming the healthcare and public health system.

While the public health system has the capacity to contain the disease, every effort should be given to conduct contact tracing and infection source finding. To be effective in these case-based interventions, public health practitioners must investigate the whereabouts, contacts, and personal protective equipment used by each patient during the 14 days prior to COVID-19 symptom onset to the time the patient was isolated. Investigators would then need to contact people who might have been the infection source or have been exposed to the virus, to test or put these people under quarantine. For patients to share personal information such as their movement and their contacts, trust must be established between the investigator and the patient. The understanding is that personal information provided to the investigator will be kept confidential. On the other hand, we can also implement population-based interventions, which include border control, quarantine, social-distancing, and wearing masks.[2] Providing accurate, trustworthy information that encourages compliance with case-based and population-based intervention is necessary for such interventions to be effective.

For case-based intervention, as contact tracing is conducted, rumors about patients may sometimes be circulated on the internet or leaked to the media by those being investigated. When reporters probe for additional information at press conferences based on rumors, confidential information might inadvertently become public knowledge. Such breach of confidentiality results in the loss of credibility of public health practitioners on maintaining patient confidentiality, which may lead to the breakdown of communication between investigators and patients, and may hinder future investigations. Sometimes, this may also lead to the unintentional identification of patients. This problem is not unique to Taiwan. In South Korea, where details of patients' itinerary are publicized, even though the government withheld names and addresses, the identities of patients might still be worked out by the public. This had led to harassment both online and in person.[3,4] The debate of releasing personal identification information of COVID-19 patients had occurred in other countries also.[5,6]

Indeed, in risk communication, only information pertinent for the target audience, i.e., the general public, to take action need to be divulged. However, when confidential information, which might only feed the media's appetite for a juicy story, is withheld, the government might be accused of not being transparent, raising suspicion of the government from the general public.

For population-based interventions, quarantining people from specific regions or with specific jobs, we may have unintentionally stigmatized entire nations or people of certain occupations. By doing so, we may cause people who feel stigmatized against to hide their illness, be less willing to seek healthcare, thus increasing the risk of disease spread.[7]

At an age when anyone could be a sleuth using the internet, or hide behind a fake account to harass others, it is particularly important that patient information is given judiciously to prevent patients from being identified or stigmatized. However, enough information must be provided so that the public could take necessary steps to protect themselves.

While we strive for transparency in risk communication during COVID-19, we should not provide "information that unnecessarily violates the privacy and confidentiality rights of individuals" or "information that might lead to undue stigmatization of individuals or groups within society".[8] For each piece of information which we provide, we must choose carefully and use words precisely, so that we can effectively communicate risk of disease and earn the trust of the public to comply with disease prevention measures.

As vaccines against COVID-19 roll out worldwide, we are beginning to see reports of adverse events following immunization (AEFI) being reported. Without proper response to reports of AEFI, vaccination coverage could be negatively affected. Timely, accurate, and transparent communication about the benefits, risks, and safety of vaccination is necessary to maintain public confidence in immunization programs which may lead to the eventual end of the pandemic.

The principle of risk communication is still to provide accurate information for people to act on.

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Epidemiological Characteristics and Medical Visits of the First 58 COVID-19 Deaths, January–June 2020, Thailand

Chanatip Chailek[1]*, Pantila Taweewigyakarn[1], Nirandorn Yimchoho[1], Nipapan Saritapirak[1], Chawetsan Namwat[1], Narumol Sawanpanyalert[2]

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

2 Medical Emergency Response Unit, Department of Medical Service, Ministry of Public Health, Thailand

*Corresponding author, email address: chailek.ch@gmail.com

Abstract

During the first wave of the coronavirus disease (COVID-19) epidemic in Thailand, 3 Jan to 22 Jun 2020, there were 3,151 confirmed cases and 58 related deaths. This study aimed to describe epidemiological characteristics of the deaths and explore risk factors using a retrospective cohort study design. A COVID-19 related death was defined as a confirmed COVID-19 case who died from a clinically compatible illness. We collected data from investigation reports and medical records using a semi-structure questionnaire and retrieved secondary data from the Department of Disease Control's database. Of the 58 deaths, the median age was 58 years (interquartile range (IQR) 50-70), 44 were male, and underlying disease was found in 44, hypertension being the most common. The median time from onset to diagnosis date was 7 days (IQR 5-9) compared to 4 days (IQR 2-7) in recovered cases. Six were nosocomial infections and of the remaining 52, 36 had visited a medical facility at least once before they were hospitalized. Male, elderly, and delayed diagnosis were found to be positively associated with death. Early detection of COVID-19 cases should be strengthened in health care facilities throughout Thailand.

Keywords: male, elderly, aged, COVID-19, delayed diagnosis, risk factors, Thailand

Introduction

Coronavirus disease (COVID-19) is the third novel coronavirus discovered in the past 20 years, the other two being Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).[1] The case-fatality rates of SARS and MERS were 9.6% and 34.4%, respectively.[2,3] The first cases of COVID-19 were identified in Wuhan City, Hubei Province, China in December 2019, and have since spread to almost every country in the world.[4] As of 2 Mar 2021, there have been 113,472,187 cases reported with a case-fatality rate of 2.2%.[5]

The Department of Disease Control (DDC) of Thailand initiated a surveillance system at airports on 3 Jan 2020 focusing on a patient under investigation (PUI) who had signs and symptoms of COVID-19 with exposure history for further viral testing.[6] The first case outside mainland China occurred in Thailand on 8 Jan 2020.[7] As the pandemic evolved, the DDC amended the definition of a PUI several times depending on the situation in the country. The surveillance response could be characterized in five phases: Phase I, 3 Jan to 11 Feb 2020, involved a surveillance system for travelers from epidemic areas and close contacts of confirmed cases. Phase II, 12 Feb to 19 Mar 2020, the system was extended to cover those who worked closely with tourists who traveled from epidemic areas. Phase III, 20 Mar to 2 Apr 2020, the exposure history included a domestic place where it was announced by a provincial communicable disease committee. Phase IV, 3 to 30 Apr 2020, a crowded area in the community was included in the travel history. Phase V, 1 May to 22 Jun 2020, the definition of symptoms was broadened to cover a person who did not have a fever.[8]

For treatment, the Department of Medical Services (DMS) has established national clinical practice guidelines (CPGs). Favipiravir, a purine analogue

that inhibits the RNA polymerase of RNA viruses, was prescribed in a COVID-19 case for the first time in Thailand on 15 Feb 2020. Using the indication of this drug, CPGs could be divided into 3 phases: Phase I, 3 Jan to 10 Mar 2020, a protocol was mainly symptomatic treatment. Phase II, 11 Mar to 7 Apr 2020, combination therapy was added depending on the severity of the disease. Favipiravir was indicated for severe pneumonia. Phase III, 8 Apr to 22 Jun 2020, Favipiravir could be prescribed early in patients with pneumonia.[9]

As of 22 Jun 2020, Thailand had not reported a domestic case for 28 days. There were 3,151 cases of COVID-19, of which 3,022 had recovered, 71 were still hospitalized, and 58 had died. Epidemiology characteristics of these deaths, which could be used to improve surveillance system and guide treatment options, have never been documented. The objectives of this study were to describe epidemiological characteristics of deaths with COVID-19 in Thailand, determine the case fatality rate (CFR), and to explore risk factors associated with dying from COVID-19.

Methods

Descriptive Analysis Study

We conducted a cross-sectional descriptive study on the 58 confirmed cases who had died during 3 Jan to 22 Jun 2020. According to the national guideline for surveillance and investigation of COVID-19, a confirmed case was defined as a person who had a positive result on a real-time reverse transcription polymerase chain reaction (RT-PCR) test for SARS-CoV-2 from a reference laboratory in Thailand. The population of this study was all deaths with COVID-19, defined as confirmed case who died between 3 Jan and 22 Jun 2020, from a clinically compatible illness with no period of complete recovery between the illness and death.

Operational Definitions

An adult was defined as a person aged 20-59 years, while an elderly was defined as a person aged ≥60 years. We defined obesity class II as a body mass index (BMI) ≥30 kg/m^2 and ≥35 kg/m^2 for Asian and Non-Asian individuals, respectively.[10] Bangkok metropolitan region (BMR) was an area of Bangkok, and five surrounding provinces, namely Pathum Thani, Nonthaburi, Nakhon Pathom, Samut Prakan, and Samut Sakhon.[11] The first medical visit date was when a case firstly visited a medical facility with COVID-19 symptoms and was used to determine a phase of the surveillance system. For nosocomial infection cases, we used the onset date as a proxy. The diagnosis date was defined as the date that the RT-PCR test for SARS-CoV-2 was reported. We use the diagnosis date to determine a phase of CPG. The CFR was defined as the ratio of cumulative deaths to confirmed COVID-19 cases.[12]

Data Collection

We reviewed reports from a joint investigation team and the medical records and interviewed attending clinicians and infection control nurses using a structured questionnaire. The secondary data were retrieved from a confirmed case database which the Situation Awareness Team of the Emergency Operation Center (EOC) obtained using the Novel corona 2 investigation form. This form was part of the indicator-based surveillance system of the DDC.

Collected variables were (i) demographics, (ii) epidemiological linkage, for instance, exposure history and previous confirmed cases, (iii) medical visit and hospitalization, (iv) clinical features including complications which were reported in a discharge summary, and (v) laboratory investigations, including a chest X-Ray done on the day of admission, ranged from one day before and one day after admission to hospital.

Analytical Study

We used a retrospective cohort study design to identify risk factors for death. The population of this study was confirmed cases in Thailand during 3 Jan to 22 Jun 2020 (n=3,151). Our two main hypotheses were: (i) time from onset to diagnosis between deaths and non-deaths was different, and (ii) epidemiological characteristics and phases of the national CPGs were associated with death. The flow diagram of the study is shown in Figure 1.

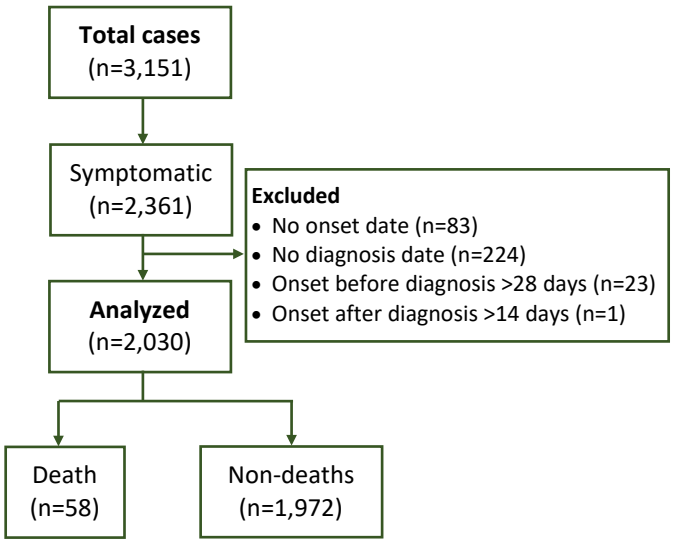

Figure 1. Flow diagram of the study

Statistical Analysis

Categorical variables were presented with frequencies and percentages. Continuous variables were presented with medians and interquartile range or range. Comparison of categorical and continuous variables between groups was done using the Chi-square test and Wilcoxon rank-sum test or Kruskal-Wallis test (if more than 2 groups), respectively. Statistical significance was determined at a *p*-value less than 0.05. STATA version 14.0 was used for all analyses.

We compared the median time from onset to diagnosis between two groups with the Wilcoxon rank-sum test. We carried out a univariate analysis to calculate the relative risk and *p*-value by Chi-square test. The dependent variable was outcome status (death or non-death). The phase of CPG and any other variable with a *p*-value of less than 0.2 from the univariate analysis were selected for the initial multivariable analysis using multiple logistic regression to calculate adjusted odds ratios and 95% confidence intervals.

Results

Descriptive Study

Demographics

Of the 58 deaths were reported, of which 44 were male. The median age was 58 years (interquartile range (IQR) 50-70, range 28-85) and most were Thai (87.9%). The most common underlying diseases were hypertension (46.6%), diabetes mellitus (DM) (39.7%), and dyslipidemia (27.6%). The median BMI among adults (28.9 kg/m^2) was not significantly different from that of the elderly (26.6 kg/m^2), however the proportion of adults with obesity class II was higher than that of the elderly (34.4% versus 11.5%; *p*-value 0.04) (Table 1). There were 34 deaths in the BMR (58.6%) with the remaining deaths occurring in provincial cities around the country (41.4%) as shown in Figure 2.

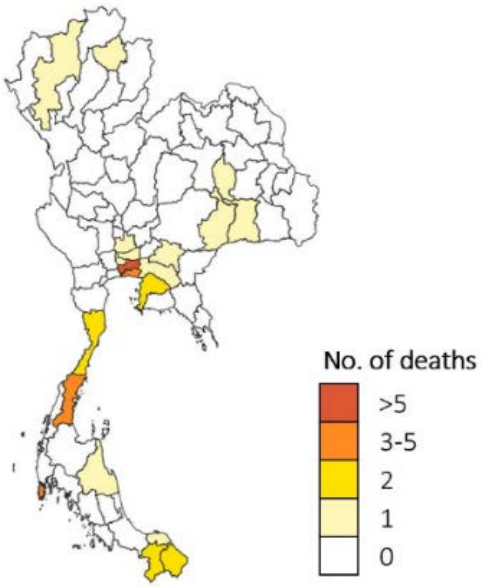

Figure 2. Number of deaths with COVID-19 by province of isolation/death (n=58)

Table 1. Epidemiological characteristics of COVID-related deaths by age group, January–June 2020, Thailand (n=58)

Characteristics	Total (n=58)	Adults (n=32)	Elderly (n=26)
Gender			
Male	44 (75.9)	24 (75.0)	20 (76.9)
Female	14 (24.1)	8 (25.0)	6 (23.1)
Age* (years)			
Median (IQR)	58 (50-70)	50.5 (44-55.5)	72 (68-79)
Nationality			
Thai	51 (87.9)	30 (93.8)	21 (80.8)
Non-Thai	7 (12.1)	2 (6.3)	5 (19.2)
Occupation*			
Unemployed	20 (34.5)	4 (12.5)	16 (61.5)
Self-employed	12 (20.7)	7 (21.9)	5 (19.2)
Employee in a private sector	10 (17.2)	8 (25.0)	2 (7.7)
Temporary employee	5 (8.6)	5 (15.6)	0 (0.0)
Employee in a pub	3 (5.2)	2 (6.3)	1 (3.8)
Public transport driver	3 (5.2)	2 (6.3)	1 (3.8)
Employee in a public sector	2 (3.4)	2 (6.3)	0 (0.0)
Employee in a boxing stadium	1 (1.7)	0 (0.0)	1 (3.8)
Tour guide	1 (1.7)	1 (3.1)	0 (0.0)
Traveler	1 (1.7)	1 (3.1)	0 (0.0)

Table 1. Epidemiological characteristics of COVID-related deaths by age group, January–June 2020, Thailand (n=58) (cont.)

Characteristics	Total (n=58)	Adults (n=32)	Elderly (n=26)
Number of underlying diseases			
None	14 (24.1)	10 (31.3)	4 (15.4)
1	14 (24.1)	8 (25.0)	6 (23.1)
2	9 (15.5)	5 (15.6)	4 (15.4)
≥3	21 (36.2)	9 (28.1)	12 (46.2)
Underlying disease			
Hypertension*	27 (46.6)	11 (34.4)	16 (61.5)
Diabetes mellitus	23 (39.7)	14 (43.8)	9 (34.6)
Dyslipidemia	16 (27.6)	7 (21.9)	9 (34.6)
Obesity class II*	14 (24.1)	11 (34.4)	3 (11.5)
Chronic kidney disease	7 (12.1)	2 (6.3)	5 (19.2)
COPD	4 (6.9)	0 (0.0)	4 (15.4)
Hypo/hyperthyroidism	3 (5.2)	1 (3.1)	2 (7.7)
Cardiovascular disease	2 (3.4)	0 (0.0)	2 (7.7)
Stroke	1 (1.7)	0 (0.0)	1 (3.8)
Cirrhosis	1 (1.7)	1 (3.1)	0 (0.0)
HIV infection	1 (1.7)	1 (3.1)	0 (0.0)
BMI (kg/m^2)			
Median, IQR	27.1 (23.3-30.9)	28.9 (23.5-34.1)	26.6 (22.4-29.2)
Distribution			
<18.5	1 (1.7)	1 (3.1)	0 (0.0)
18.5-24.9	9 (15.5)	3 (9.4)	6 (23.1)
23-24.9	4 (6.9)	3 (9.4)	1 (3.8)
25-29.9	16 (27.6)	7 (21.9)	9 (34.6)
30-34.9	8 (13.8)	6 (18.8)	2 (7.7)
≥35	6 (10.3)	5 (15.6)	1 (3.8)
Missing	14 (24.1)	7 (21.9)	7 (26.9)
Province of isolation/death*			
Bangkok Metropolitan Region	34 (58.6)	23 (71.9)	11 (42.3)
Other	24 (41.4)	9 (28.1)	15 (57.7)
History of exposure			
Traveling from abroad	8 (13.8)	6 (18.8)	2 (7.7)
Contact with a confirmed case	13 (22.4)	8 (25.0)	5 (19.2)
- Household members	12 (92.3)	7 (87.5)	5 (100.0)
- Colleagues	1 (7.7)	1 (12.5)	0 (0.0)
Unidentified local transmission	31 (53.4)	16 (50.0)	15 (57.7)
- Contact with foreigners	8 (25.8)	4 (12.5)	4 (26.7)
- Night club	6 (19.4)	1 (3.1)	5 (33.3)
- Boxing stadium	5 (16.1)	3 (9.4)	2 (13.3)
- Others	12 (38.7)	8 (25.0)	4 (26.7)
Nosocomial infection	6 (10.3)	2 (6.3)	4 (15.4)

*Note: *Difference between age groups were statistically significant (p-value <0.05). BMI: body mass index. COPD: Chronic obstructive pulmonary disease. HIV: Human immunodeficiency virus. IQR: interquartile range.*

Epidemiological linkage

Eight deaths (13.8%) were imported cases, while 50 (86.2%) were locally infected, of which, 13 (22.4%) were from identifiable confirmed cases (12 from a household member). Six were nosocomial infections. The sources of the remaining 31 could not be identified.

Medical visits and hospitalization

Fifty-seven deaths occurred in hospitals with one pronounced dead while travelling home on a train after returning from abroad. Before admission, half of the cases in the BMR visited a private hospital (51.5%) while those in provincial cities visited a community hospital (26.1%) or a clinic (21.7%) as detailed in

Table 2. Of the 50 cases that were admitted, 34 (68.0%) visited a medical facility at least once before admission to hospital.

Nineteen cases did not meet the PUI criteria on their first medical visit. Of the remaining 37, 21 (56.8%) were detected as a confirmed case in phase III, followed by 9 (24.3%), 6 (16.2%), and 1 (2.7%) in phase II, IV and V, respectively.

Table 2. Medical visits of the COVID-19 cases prior to death by province of isolation/death, January–June 2020, Thailand

Medical visits	Total	Bangkok metropolitan region	Other provinces
Type of facility at first visit* (n=56)			
Private hospital	19 (33.9)	17 (51.5)	2 (8.7)
Provincial or center hospital	12 (21.4)	9 (27.2)	3 (13.0)
District hospital	6 (10.7)	0 (0.0)	6 (26.1)
Sub-district hospital	3 (5.4)	1 (3.0)	2 (8.7)
Clinic	8 (14.3)	3 (9.1)	5 (21.7)
Pharmacy	1 (1.8)	0 (0.0)	1 (4.3)
Nosocomial infection	6 (10.7)	2 (6.1)	4 (17.4)
Active case finding	1 (1.8)	1 (3.0)	0 (0.0)
Number of visits before hospitalization (n=50)			
Admitted at the first visit	16 (32.0)	10 (32.3)	6 (31.6)
1 time	19 (38.0)	11 (35.5)	8 (42.1)
2 times	8 (16.0)	5 (16.1)	3 (15.8)
3 times	7 (14.0)	5 (16.1)	2 (10.5)

*Note: *Difference between two groups was statistically significant (p-value <0.05).*

Clinical features

According to Figure3, the most common symptoms at admission were fever (98.3%), followed by cough (86.2%) and dyspnea (72.4%). At presentation, the median body temperature was 37.8°C (IQR 37.0-38.7). The median white blood cell count was 6,670 cell/mm^3 (IQR 5,180-8,130). On chest X-Ray infiltration was found in 85.7%, either unilateral (19.4%) or bilateral (80.6%). Those who did not have infiltration on the first X-ray developed infiltration within 4 days (IQR 3-5) (Table 3). The most common complications were acute respiratory distress syndrome (ARDS), acute kidney injury, and septic shock as shown in Figure 4. The median length of hospital stay was 12 days (IQR 5-17.5).

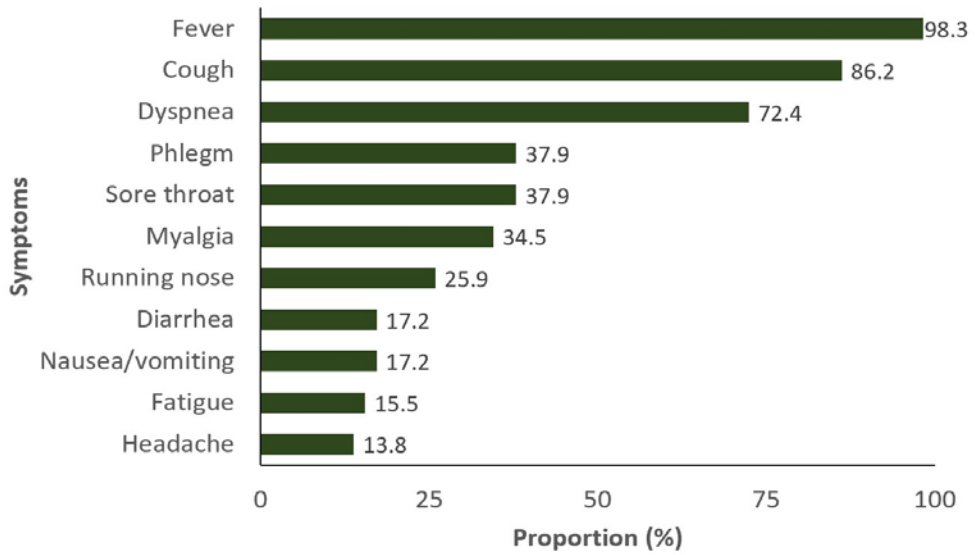

Figure 3. Symptoms of COVID-19 deaths at admission, January–June 2020, Thailand (n=58)

Table 3. Clinical features and laboratory findings at admission of COVID-19 deaths, January–June 2020, Thailand

Clinical features	Median (IQR)	n
Vitals		
Body temperature (°C)	37.8 (37.0-38.7)	54
Systolic blood pressure (mmHg)	131 (120-148)	50
Diastolic blood pressure (mmHg)	77.5 (70-86)	50
Pulse rate (min)	90 (84-104)	49
Respiratory rate (min)	20 (20-24)	50
Oxygen saturation (%)	95 (88-97)	47
Laboratory findings		
Hematocrit (%)	40.5 (34.5-45.0)	48
WBC (cell/mm^3)	6,670 (5,180-8,130)	49
N: L Ratio	4.6 (2.8-9.3)	49
Platelet (x10^3/mm^3)	179 (137.5-224.5)	48
BUN (mg/dL)	22 (12-34)	46
Creatinine (mg/dL)	1.1 (0.9-1.6)	46
Chest X-Ray findings on an admission – n (%)		
No infiltration	6 (14.3)	42
Infiltration	36 (85.7)	
- Unilateral infiltration	7 (19.4)	36
- Bilateral infiltration	29 (80.6)	
Complications – n (%)	41 (70.7)	48

Note: WBC: White Blood Cell. N: L: Neutrophil-to-lymphocytes. BUN: Blood urea nitrogen.

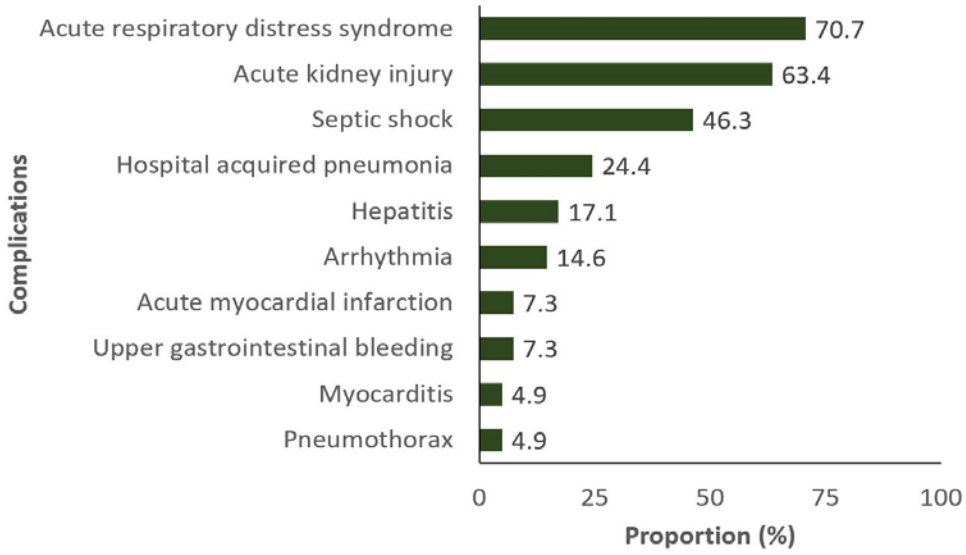

Figure 4. Complications of COVID-19 deaths, January–June 2020, Thailand (n=41)

Duration from onset

Figure 3 shows a graphical presentation of the duration from symptoms onset to important events. The darker shaded squares represent the median time to the event while the lighter shaded squares represent the interquartile range. As shown in the figure, the median time from symptoms onset to first medical visit was 3 days (IQR 1-6), while for admission to hospital was 6 days (IQR 4-9). The median time from symptoms onset to diagnosis among the 1,972 symptomatic survivors was 4 days (IQR 2-7), while among non-survivors was 7 days (IQR 5-9) with statical significance (p-value <0.001). Among 49 cases intubated, the median time to intubation was 10 days (IQR 7-15) and the median time to death was 18 days (IQR 14-25). These durations were not statistically different between either age group or province of isolation/death.

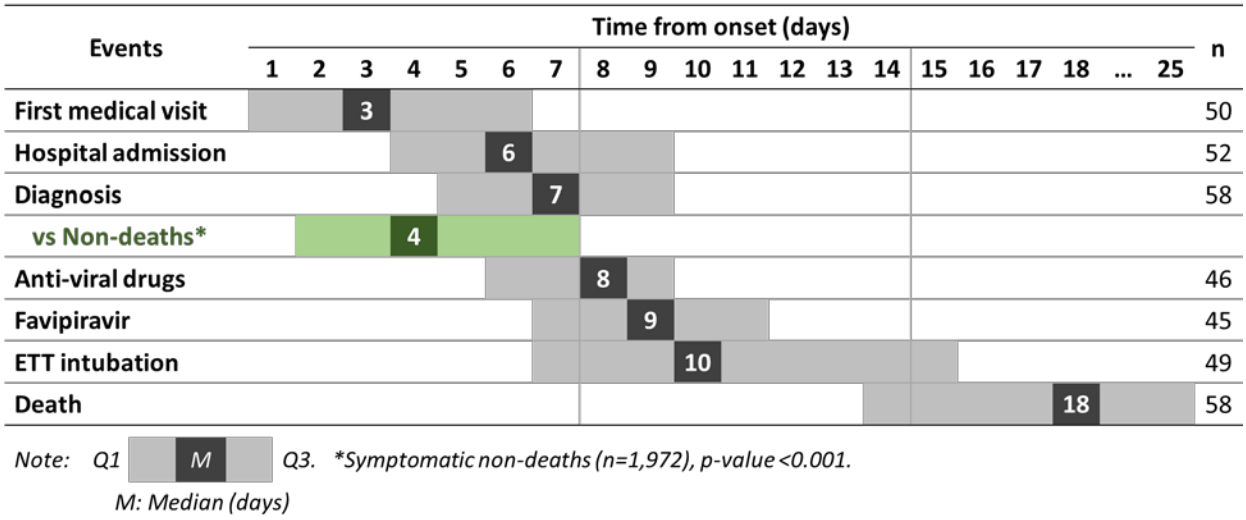

Figure 5. Median time and interquartile range from onset date to events

Specific CFR

The CFR increased with increasing age, of which those aged ≥80 years had the highest rate (25.0%) (Table 4). Patients age younger than 40 years had a CFR of less than 1%. The CFR by time from onset to diagnosis increased with increasing duration. The CFR among cases who were diagnosed within 3 days of symptoms onset was 0.8%, which was 5 times lower than that among those who were diagnosed more than 1 week after onset (*p*-value <0.001). The CFR was 2.5% in phase I, 2.3% in phase II, and 1.0% in phase III, the differences not statistically significant.

Table 4. Case fatality rate of COVID-19, January-June 2020, Thailand

Characteristics	All cases	Deaths	CFR (%)	p-value	n
Gender				0.001	3,151
Male	1,736	44	2.53		
Female	1,415	14	0.99		
Age (years)				<0.001	3,132
Median (IQR)	37 (27-49)	58 (50-70)			
Range	0.1-97	28-85			
Age group				<0.001	3,132
<10	61	0	0.0		
10-19	121	0	0.0		
20-29	825	1	0.1		
30-39	768	4	0.5		
40-49	592	9	1.5		
50-59	432	17	3.9		
60-69	223	12	5.4		
70-79	86	9	10.5		
≥80	24	6	25.0		
Nationality				0.72	3,151
Thai	2,816	51	1.8		
Non-Thai	335	7	2.1		
Province of isolation/death				0.52	3,093
BMR	1,938	34	1.8		
Provincial cities	1,155	24	2.1		

Table 4. Case fatality rate of COVID-19, January-June 2020, Thailand (cont.)

Characteristics	All cases	Deaths	CFR (%)	*p*-value	n
Time from onset to diagnosis				<0.001	2,030
≤3 days	878	7	0.8		
4-7 days	707	25	3.5		
>7 days	445	26	5.8		
Phase of CPG				0.166	2,866
I. 4 Jan-10 Mar 2020	79	2	2.5		
II. 11 Mar-7 Apr 2020	2,208	50	2.3		
III. 8 Apr-22 Jun 2020	579	6	1.0		

Note: BMR: Bangkok Metropolitan Region. CFR: Case fatality rate. CPG: Clinical practice guidelines. IQR: Interquartile range.

Analytic Study

A total of 2,025 confirmed cases were included in the multivariable analysis with the results shown in Table 5. Gender, age group and duration from onset to diagnosis were significantly associated with COVID-19 deaths. Compared to females, males had an odds ratio of 2.3 (95% confidence interval (CI): 1.1-3.9), compared to adults, the elderly had an odds ratio of 7.1 (95% CI: 4.1-12.3) and compared to duration from onset to diagnosis of ≤3 days, duration >7 days had an odds ratio of 6.9 (95% CI: 2.9-16.4) adjusted for the phase of CPG.

Table 5. Results of univariable and multivariable analysis identifying factors associated with COVID-19 deaths, January-June 2020, Thailand

Characteristics	Deaths	Non-deaths	Crude RR	95% CI	Adjusted OR	95% CI
Gender						
Female	14	1,401	1	-	1	
Male	44	1,692	2.56	1.41-4.66	2.31	1.12-3.94
Age group						
Adult	31	2,768	1	-	1	
Elderly	27	306	7.32	4.43-12.11	7.07	4.05-12.34
Time from onset to diagnosis						
≤3 days	7	871	1	-	1	
4-7 days	25	682	4.56	1.96-10.61	4.72	2.00-11.13
>7 days	26	419	7.72	3.32-17.93	6.93	2.93-16.39
Phase of CPG						
I. 4 Jan-10 Mar 2020	2	77	1	-	1	-
II. 11 Mar-7 Apr 2020	50	2,158	0.89	0.21-3.73	0.81	0.18-3.61
III. 8 Apr-22 Jun 2020	6	573	0.40	0.08-2.03	0.59	0.11-3.22

Note: CI: Confidence interval, CPG: Clinical practice guideline, RR: Relative risk, OR: Odds ratio.

Discussion

This study described epidemiological characteristics of 58 COVID-19 related deaths in Thailand during the first wave of the epidemic, 3 Jan to 22 Jun 2020. The majority of deaths were male, and the median age was 58 years. The CFR for males was significantly higher than for females and increased with increasing age. These findings were consistent with the epidemiological study among COVID-19 cases in Mainland China, Korea, Italy, and among inpatients in New York, USA.[13-16] A possible explanation is that the viral entry mechanism requiring S protein-ACE2 binding was affected more by males and older aged people.[17]

Underlying medical conditions, found in more than 75% of our deaths, might be another contributing factor. The most common underlying conditions were non-communicable diseases (NCDs), including hypertension (46.6%). This proportion is higher than that of general population, which was 24.7%.[17] A

previous study in China also found that hypertension was the most common underlying disease, while the second most common was cardiovascular disease (CVD) (22.7%). In Thailand, the percentage of deaths with CVD was only 3.5%. This difference might be due to a disproportion of elderly among deaths between China (81.0%) and Thailand (43.9%).[13]

Obesity is a known risk factor for severe COVID-19, particularly among adults aged <65 years.[18,19] Concordantly, we observed that the proportion of obesity in fatal adults was higher than in fatal elderly. Unfortunately, weight and height are not recorded in Thailand's Novel Corona-2 investigation form. Therefore, we could not include BMI into the multivariable analysis to explore this association.

Among the 58 deaths, we could not determine the exposure history in 31 cases. Since these were all domestic cases, they may have contracted the disease from a crowded area in the community. In early March 2020, there were local transmissions in a night club and a boxing stadium in Bangkok.[20] It should be noted that the surveillance system in phase II (11 Mar to 7 Apr) was extended to include those who worked closely with foreigners.[21]

Our study showed that delayed diagnosis was significantly associated with death. The median duration from onset to diagnosis among deaths was 3 days longer than that among non-deaths with statistical significance. Based on the chest X-rays on admission, most of the deaths had infiltration suggesting that most developed pneumonia before receiving treatment. Furthermore, most of the deaths visited a medical facility at least once before they were hospitalized. This might imply that those patients were not tested for SARS-CoV-2 by RT-PCR at their first medical visit. Early detection could lead to early interventions which is prominent in reducing the mortality rate among COVID-19 patients.[22]

Although the CFR between the three phases of the CPG were not statistically different, the 2.05% reduction in CFR in phase III was clinically significant. Each phase in the CPG represented a different indication for the antiviral drug Favipiravir. The guideline in phase III was revised from earlier phases to include Favipiravir as early treatment for pneumonia. The drug was shown to provide better clinical improvement compared to standard care and gave a benefit on viral clearance in some studies.[23,24]

Limitations

This study had three main limitations. First, the CFR in Thailand may have been overestimated in the initial phase because some mild or asymptomatic cases might not have been detected. Second, we could only control for some confounders that were available for all COVID-19 cases in the DDC database. Important confounders that were not included in the model were underlying diseases, BMI, anti-viral medications, and time from onset to receiving medication. Third, there were some outliers and missing data in the DDC database, such as onset date and report date of RT-PCR test for SARS-CoV-2. The possible invalidity and incompleteness of data might lead to misclassification and information bias.

Conclusion

As of 22 Jun 2020, the overall case fatality rate of COVID-19 in Thailand was 1.8%. Male, elderly, and delayed diagnosis were found to be associated with death. Most of those who died had at least one underlying disease, hypertension being the most common. The median time from onset to diagnosis was 7 days (IQR 5-9), and from onset to death was 18 days (IQR 14-25). More than half of the deaths visited a medical facility before being hospitalized. Deaths in the Bangkok Metropolitan Region had visited a private hospital, while those in other provinces had visited a community hospital or a clinic before their COVID-19 diagnosis.

We recommend that the DDC increases awareness of developing severe disease to high-risk populations which include male and the elderly. Persons with symptoms of COVID-19 should visit a medical facility as early as possible. Secondly, the surveillance system should be strengthened at private hospitals in the BMR, and community hospitals and clinics in other provinces. There should be a flexibility for physicians working in local health facilities to test suspected COVID-19 cases even though they might not meet the PUI criteria at that time. Lastly, underlying diseases and BMI should be considered as required information for an indicator-based surveillance system.

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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

Diagnostic Accuracy of Saliva for SARS-CoV-2 Detection in State-sponsored Quarantine in Thailand

Somrak Sirikhetkon[1], Manash Shrestha[2], Pilailuk Akkapaiboon Okada[3], Kriengkrai Prasert[4], Poolsap Phonsingh[1], Suthee Intharachat[5], Anek Mungomklang[1]*

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

2 Faculty of Social Sciences and Humanities, Mahidol University, Thailand

3 National Institute of Health, Department of Medical Science, Ministry of Public Health, Thailand

4 Nakhon Phanom Provincial Hospital, Nakhon Phanom, Thailand

5 Phramongkutklao Hospital, Army Medical Department, Thailand

*Corresponding author, email address: fetp28@gmail.com

Abstract

The aim of this study was to assess the diagnostic accuracy of saliva for detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) genomes among people in state-sponsored quarantine in Thailand. A cohort of 233 Thais in state-sponsored quarantine in Bangkok was enrolled into the study. Baseline demographic characteristics, presence of underlying diseases, and symptoms related to COVID-19 were collected on day 1 of the quarantine. Saliva specimens and nasopharyngeal (NP) swabs collected on day 7 at the quarantine premises were tested for SARS-CoV-2 RNA by real-time reverse transcription polymerase chain reaction. Overall, the viral RNA was detected in 32 (13.7%) NP swab samples, but only in 12 (5.2%) of the saliva samples. No person had NP negative but saliva positive result. Among the SARS-CoV-2 infected cases, nearly 20% had COVID-19-like illness and around 80% were asymptomatic. Sensitivity and specificity of saliva specimen were found to be 37.5% (95% confidence interval (CI)=21.1-56.3%) and 100% (95% CI=98.2-100%), respectively compared to the NP swab specimens. The area under the receiver operating characteristic curve was found to be 0.7 (95% CI=0.6-0.8). Our findings indicate that despite no false-positives, a high false-negative rate can occur with saliva specimen due to its low sensitivity, which limits its application in ruling out SARS-CoV-2 infection in quarantine settings.

Keywords: nasopharyngeal swab, saliva, SARS-CoV-2, state quarantine, Thailand

Introduction

Thailand was the first country outside of China to report cases of coronavirus disease 2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] In response, the Thai government activated the Emergency Operation Center in January 2020 to mitigate the impact of the disease.[2] Since then, COVID-19 has gone on to become a global pandemic with over 13 million cases and 570,000 deaths, while the disease burden of COVID-19 in Thailand has stalled at 3,844 cases and 60 deaths as of 11 Nov 2020.[3,4]

Following the "Communicable Diseases Act B.E. 2558", all people returning to Thailand are subjected to enter a state quarantine (SQ) as part of the public health response in which they undergo surveillance and monitoring for COVID-19-like illness (CLI) for 14 days.[2] Thai nationals are provided with individual hotel rooms and three daily meals in the SQ sponsored by the government. Laboratory confirmation of the presence or absence of the virus by real-time reverse transcription polymerase chain reaction (rRT-PCR) tests using nasopharyngeal (NP) swabs are conducted twice in the SQ: the first test during initial 3-5 days and the second test during day 10-12 of SQ. However, NP swab collection can be invasive and uncomfortable to many people, and can also pose a risk of infection to the healthcare workers who perform specimen collection due to close contact with the infected cases.[5]

Saliva has been presented as a potential alternative to NP swabs as a non-invasive sample with considerably high sensitivity and specificity for detecting SARS-CoV-2 RNA in recent studies-[6,9] Saliva has many advantages over NP swab as it can be self-collected by individuals with relative precision, reducing the demand for specialized healthcare personnel and personal protective equipment.[5] This can be particularly beneficial in resource-limited settings outside hospitals such as the quarantine facilities. Using data from people in SQ at Bangkok, we tested the feasibility and the diagnostic accuracy of saliva specimens for SARS-CoV-2 detection in field settings.

Methods

Study Setting and Population

SQ measure has been implemented by the Thai government for travelers entering Thailand since 4 Apr 2020. There are 12 hotels designated as SQ in Bangkok which have quarantined 8,541 people till 31 May 2020. This study was conducted among a cohort of Thai nationals in SQ in Bangkok from 22 May to 8 Jun 2020. Three SQ hotels were chosen purposively as they housed Thai returnees from high prevalence areas of COVID-19, such as the USA, European, and the Middle Eastern countries. All individuals aged more than 18 years in the quarantine at the time of this study were included, but those unwilling or unable to provide saliva specimen were excluded.

Study Design and Data Collection

This was a prospective cohort study that entailed a one-time collection of saliva (index test) and NP swabs from the participants. Baseline demographic characteristics, presence of underlying diseases, and symptoms related to COVID-19 were collected from the participants on day 1 of the quarantine. Saliva specimens and NP swabs were collected on day 7 at the quarantine premises. Participants testing positive were sent to designated hospitals for isolation and treatment as per the national guidelines.

Sample Size and Sampling Technique

In a recently conducted study at Ramathibodi Hospital, Mahidol University, Bangkok, the sensitivity of saliva specimens was found to be 84.2% compared to NP and throat swabs.[9] We calculated the minimum sample size for our study using this equation in the general formula:[10]

$$n = \frac{\left[Z_{\alpha/2}\sqrt{(P_0(1-P_0)} + Z_{\beta}\sqrt{P_1(1-P_1)}\right]^2}{(P_1-P_0)^2}$$

Where, α and β are type I and II errors; $Z_{\alpha/2}$ and Z_{β} denote the upper $\alpha/2$ and β percentiles of standard normal distribution (1.96 and 0.84, respectively); P_0 is the sensitivity of null hypothesis, and P_1 is the sensitivity of alternate hypothesis.

The sample size needed to have 95% confidence interval (CI) and 80% power to detect a difference of 7% from 84.2% sensitivity is 232. We enrolled study participants using consecutive sampling until the required sample size was obtained.

Definition

COVID-19-like illness (CLI) was defined as any symptom of fever, cough, shortness of breath, chills, myalgia, sore throat, or loss of taste or smell.

Specimen Collection and Transport

The participants were asked to collect saliva (at least 2 ml) by spitting into a plastic device containing 2 ml of viral transport medium (VTM), after at least one hour of waking up in the morning on an empty stomach (before brushing teeth, eating or drinking anything). The container was covered with a lid, placed in a zip-lock bag, and packed into a foam cooler box. In the afternoon of the same day, NP swab was collected from the participant's posterior nasopharynx using flexible tip swabs by trained healthcare staff donned with standard personal protective equipment (PPE), following universal precautions of infection control. The NP swab was placed in a sterile tube containing 2 ml of VTM and securely covered. Both saliva specimen and NP swabs were labeled with different laboratory numbers and sent in foamed boxes, maintained at 4-8°C, to the Thai National Institute of Health (NIH), Nonthaburi, for rRT-PCR testing.

Specimen Processing and RNA Extraction[11]

The average time from specimen collection to specimen processing was four hours. Laboratory staffs were blinded to the names and participant numbers. Total RNA was extracted from a 200 µl volume of the NP swab solution or saliva sample using the GenTi™ 32 Ultimate Flexible Automatic Extraction System (GeneAll Biotechnology) according to the manufacturer's instructions, and a 50 µl final volume of total RNA was eluted. A negative extraction control was included in each test run to monitor the extraction process, in which the RNaseP RNA must be detected.

Real Time Reverse Transcription-polymerase Chain Reaction[12-13]

The SARS-CoV-2 genomes in the RNA extracts were detected by TaqMan real-time quantitative RT-PCR (qRT-PCR) targeting the RNA dependent RNA

polymerase (RdRp) gene, nucleoprotein (N gene), and Ribonuclease P (RNaseP RNA) using the COVID 19 RT-PCR reagent kit from the Department of Medical Sciences, and the Bio-Rad, CFX96 Real-time PCR Detection System (USA). The duplex reaction targeted RdRp gene and RNaseP RNA, while the uniplex reaction targeted N gene as described previously.[14,15] The sequences of primers and probes are shown in Table 1. A 20 µl volume of each reaction was composed of 5 µl of RNA template, 5 µl of 4X CAPITAL qPCR Probe Mix, primers and probe, 6.3 µl of enhancer mix (30% Tween 20 + 50% glycerol), and 1 µl of 20X RTase with RNase inhibitor. The reaction consisted the step of reverse transcription at 50°C for 30 minutes, polymerase enzyme activation at 95°C for 2 minutes, and followed by 45 cycles of DNA denaturation at 95°C for 15 seconds, annealing and extension at 55°C for 45 seconds.

Table 1. The primer and probe sequences for SARS-CoV-2 qRT-PCR diagnostic assays

Target gene	Primer/Probe	Sequence (5' -> 3')	Reference
RdRp	WH-NIC IN-F	CTCACCTTATGGGTTGGGATTATC	Okada[11]
	WH-NIC IN-R	AGTGAGGCCATAATTCTAAGCATGT	
	WH-NIC IN-P	FAM-TAAATGTGATAGAGCCATGCC-BHQ1	
N	WH-NIC N-F	CGTTTGGTGGACCCTCAGAT	Okada[11]
	WH-NIC N-R	CCCCACTGCGTTCTCCATT	
	WH-NIC N-P	FAM-CAACTGGCAGTAACCA-BHQ1	
RNaseP	RNaseP-F	AGATTTGGACCTGCGAGCG	WHO[12]
	RNaseP-R	GAGCGGCTGTCTCCACAAGT	
	RNaseP-P	HEX-TTCTGACCTGAAGGCTCTGCGCG-BHQ1	

Interpretation

The cycle threshold (Ct) values of ≤40 was considered as positive "genome detected", and those >40 were considered negative or "genome not detected". In case the Ct value for the test or control probe was undetermined or greater than the threshold, the experimental result was considered "invalid".

Data Analysis

Descriptive statistics were carried out and presented in terms of frequency and percentage for categorical variables; and mean and standard deviation for continuous variables. Differences in baseline characteristics between participants testing positive for SARS-CoV-2 on the reference test were assessed using Fisher's exact test (for categorical variables) and t-test (for continuous variables). Sensitivity, specificity, positive predictive value, negative predictive value, area under receiver operating characteristic (ROC), and their 95% confidence intervals were calculated to assess the diagnostic performance of saliva specimens in comparison with NP swabs. Statistical significance was set at p <0.05 and all data analyses were conducted using STATA software version 14.2 (StataCorp LP, College Station, TX, USA).

Ethical Considerations

Verbal consent was obtained from all participants and this study followed the principles of the Declaration of Helsinki. Ethical clearance was not required as this study was considered as a part of the routine investigation in the national public health response to the emergency situation of COVID-19.

Results

Participant Characteristics

In total, 235 eligible participants were approached and two persons declined to provide saliva specimen (Figure 1). Therefore, 233 participants were enrolled in the study with a mean age of 37.2 years (standard deviation, 11.2 years). A majority of the participants were male (180; 77.2%), with no underlying disease (216; 92.7%), and had no CLI symptoms (225; 96.6%) (Table 2). The prevalence of SARS-CoV-2 infection was 13.7% (32/233) based on the rRT-PCR with the NP swab samples, and 5.2% with the saliva samples. Among the positive cases with NP swab samples, 18.8% (6/32) had CLI and 81.2% (26/32) were asymptomatic. The participants who tested positive for SARS-CoV-2 in the reference test using NP swab were comparatively older and had more CLI symptoms than those who tested negative (Table 2).

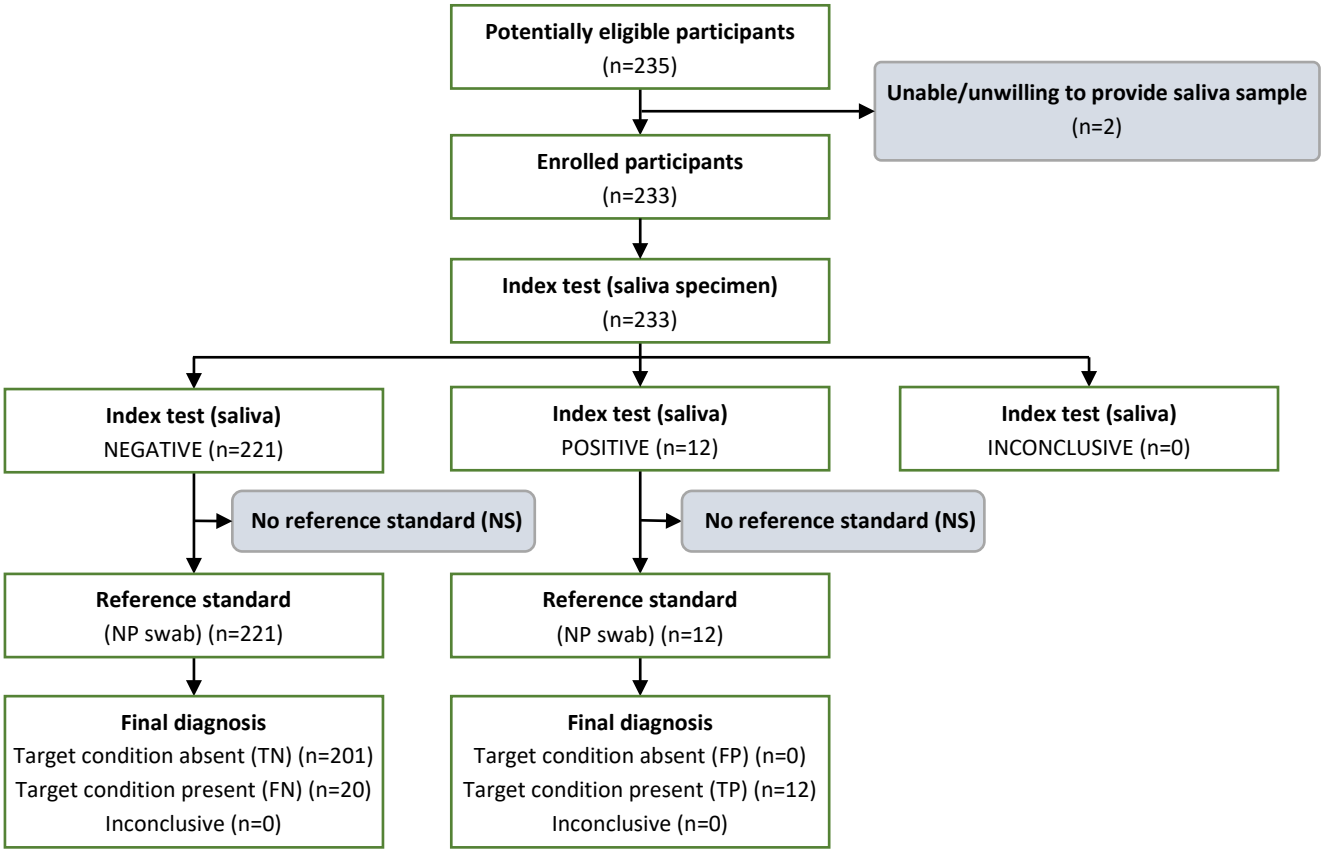

Figure 1. Study flow-diagram

Table 2. Characteristics of participants providing specimens for SARS-CoV-2 detection in state-sponsored quarantine, 22 May to 8 Jun 2020, Bangkok, Thailand (n=233)

Characteristics	Total N=233 n (%)		SARS-CoV-2 infection (Nasopharyngeal swab result)				*p*-value
			Positive (n=32)		Negative (n=201)		
			n	%	n	%	
Age (year) [mean (SD)]	37.2 (11.2)		41.4 (8.1)	-	36.5 (11)	-	0.023[a]
Gender							
Male	180	(77.2)	29	90.6	151	75.1	0.068
Female	53	(22.8)	3	9.4	50	24.9	
State quarantine site							
N Hotel	204	(87.5)	19	59.4	185	92.0	<0.001
P Hotel	9	(3.9)	5	15.6	4	2.0	
B Hotel	20	(8.6)	8	25.0	12	6.0	
Underlying disease							
No	216	(92.7)	30	93.8	186	92.5	0.679
Yes	17	(7.3)	2	6.3	15	7.5	
Diabetes Mellitus	2	(11.8)	0	0.0	2	1.0	
Hypertension	2	(11.8)	1	4.5	1	0.5	
Dyslipidemia	1	(5.9)	0	0.0	1	0.5	
Allergy	5	(29.4)	0	0.0	5	2.5	
Sinusitis	1	(5.9)	1	4.5	0	0.0	
Asthma	2	(11.8)	0	0.0	2	1.0	
Pulmonary Tuberculosis	1	(5.9)	0	0.0	1	0.5	
Others	3	(17.6)	0	0.0	3	1.5	
CLI symptoms							
Yes	8	(3.4)	6	18.8	2	1.0	<0.001
No	225	(96.6)	26	81.2	199	99.0	

Note: [a]p-value from t-test, other p-values from Fisher's exact tests.

Diagnostic Performance of rRT-PCR of Saliva

Saliva sample were rRT-PCR detected for SARS-CoV-2 in 12 cases, whereas the NP swab found 32 positive cases among the participants (Figure 1 and Table 3). Using NP swab as the reference standard, the sensitivity and specificity of saliva samples were 37.5% (95% CI=21.1-56.3%) and 100% (95% CI=98.2-100%), respectively (Table 4). Similarly, positive predictive value was 100% (95% CI=73.5-100%) and negative predictive value was 91% (95% CI=86.4-94.4%). The area under the ROC curve was found to be 0.7 (95% CI=0.6-0.8).

Table 3. Comparison of saliva samples with nasopharyngeal swabs for SARS-CoV-2 detection in rRT-PCR

	Positive n (%)	Negative n (%)
Saliva sample result	12 (5.2)	221 (94.8)
Nasopharyngeal swab result	32 (13.7)	201 (86.3)

Table 4. Diagnostic performance of saliva specimens for SARS-CoV-2 detection compared to NP swab specimens

Diagnostic characteristic	Percentage (%)	95% confidence interval	
		Lower bound	Upper bound
Sensitivity	37.5	21.1	56.3
Specificity	100.0	98.2	100.0
Positive predictive value	100.0	73.5	100.0
Negative predictive value	91.0	86.4	94.4
Area under ROC curve	68.8	60.2	77.3
Likelihood ratio (positive)	-	-	-
Likelihood ratio (negative)	62.5	47.8	81.7

Discussion

We tested the diagnostic accuracy of self-collected saliva for SARS-CoV-2 rRT-PCR among Thai nationals in state quarantine at Bangkok and found that while its specificity was high, the sensitivity was very low. The findings of this study provide important implications to exercise caution in using saliva in place of NP swabs for the detection of SARS-CoV-2 in quarantine settings.

High specificity and positive predictive value in our study mean that positively identified cases by saliva are most certainly infected with SARS-CoV-2. However, low sensitivity produces a high rate of false-negatives which renders saliva samples inept to rule out the virus infection. False-negative outcomes are more dangerous in SQ as people returning from endemic areas can have high pre-test probability of infection, and when infected persons test negative (especially asymptomatic), they may infect another in the SQ if they do not remain isolated in their own room.[16] Low sensitivity in the final test at the end of SQ period can lead to the release of people with undetected infection, who may go on to infect others in the community.

Our finding of a low sensitivity of saliva for SARS-CoV-2 genome detection is in stark discordance with most prior studies that report the sensitivity of saliva to be near or even better than NP swab.[6,9,17-19] This study showed the sensitivity and specificity of 37.5% (95% CI=21.1-56.3%) and 100% (95% CI=98.2-100%), respectively of the saliva samples; while the other group of Thai investigators showed the sensitivity and specificity of 84.2% (95% CI=60.4-96.6%) and 98.9% (95% CI=96.1-99.9%), respectively compared to the NP swab samples as the reference standard.[9] One likely reason for the difference in the results could be the participant selection. A relatively higher sensitivity of saliva has been found in studies recruiting patients in hospitals, especially in-patients and intensive care units, possibly since hospitalized patients have more acute and severe symptoms, hence, higher viral load in their saliva specimen.[20] In comparison, people in community settings, including quarantine in our study, may have milder symptoms and low viral load in saliva for detection of SARS-CoV-2.[21,22] Given that all Thai returnees require a "fit to fly" certificate before flying back to Thailand, people in SQ are less likely to have severe symptoms, as evident by less than 4% of participants having CLI in our study. Similar to our study, few other studies have also reported a less than optimal sensitivity of saliva in the community for people with mild symptoms.[22,23]

Other factors for the discrepancy of findings may be the quality of saliva collection and the transport medium used.[22] Although we used a standard VTM in our study, prior studies have used different preservation solutions which may have conferred

them with higher protection against degradation of SARS-CoV-2 RNA. Furthermore, people can have psychological stress in quarantine,[24] and prior research indicate that stress can impact the quality and quantity of saliva produced.[25] Stress in SQ could have also affected the participants' capacity to adhere to the instructions for proper specimen collection. Therefore, the compliance of subjects to spit the saliva specimens may have also contributed to the low sensitivity. However, this may be reduced as there was no financial burden for the people in SQ for their food and lodging, and clear instructions were provided in the Thai language.

The strengths of this study lie in the high proportion of asymptomatic cases, less time lag between saliva and NP swab collection, and reduced risk of bias as the index test and reference tests were analyzed without prior knowledge of each's results. Nevertheless, our findings may be limited by lack of clinical correlations and imprecision due to some human errors which might have crept in during sample collection as they were not strictly under ideal research conditions.

Conclusion and Recommendations

In conclusion, despite high specificity, saliva was not sensitive compared to nasopharyngeal swabs in state quarantine (SQ) at Bangkok. As the local transmission of SARS-CoV-2 has ceased in Thailand, the source of infection is limited to imported cases from people returning from high prevalence areas. A high rate of false-negatives in detection of SARS-CoV-2 from saliva specimens in rRT-PCR due to its low sensitivity in our study restricts its probable applicability for large-scale implementation.

While saliva is a potential non-invasive sample for laboratory detection of SARS-CoV-2 due to its practical advantages and may even be essential for cases when NP or throat swabs are contraindicated, larger studies with higher precision are needed for full validation and further confirmation. Until such evidence is available, nasopharyngeal swabs remain the standard, particularly in quarantine or other community settings with low prevalence. Saliva specimen is not recommended for use in the diagnosis of COVID-19 in an individual. It may be used in the field epidemiology for the purposes of investigating and controlling an outbreak that occurs in a big community where the prevalence of the SARS-CoV-2 infection is high.

Conflict of Interest

The authors have no conflicts of interest associated with the material presented in this paper.

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Author Contributions

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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

Evaluation of the National Tuberculosis Database System, "Tuberculosis Case Management (TBCM)", for its Surveillance Function at Mae Sot Hospital, Thailand

Mohammad Fathi Alikhan[1], Witaya Swaddiwudhipong[2], Farong Xu[3], Dhony Kartika Nugroho[4], Lynn Htut Oo[5], Jit Bahadur Darnal[6], Intan Azura Binti Mhd Din[7], Yu Nandar Aung[8], Ni Win Htike[9], Ba Soe Thet[10], Yamin Thaung[11], Sophanith Ung[12], Anyarat Thiptara[12], Phanthanee Thitichai[13], Pantila Taweewigyakarn[13], Thanit Rattanathumsakul[13], Nichakul Pisitpayat[13], Panupong Tantirat[13], Vanlaya Sreathapranai[13], Rapeepong Suphanchaimat[13,14]*

1 Disease Control Division, Ministry of Health, Brunei Darussalam
2 Mae Sot Hospital, Ministry of Public Health, Thailand
3 Beijing Center for Animal Disease Control and Prevention, People's Republic of China
4 Directorate of Animal Health, Ministry of Agriculture, Indonesia
5 Ayeyarwady Regional Public Health Department, Ministry of Health and Sports, Myanmar
6 Royal Center for Disease Control, Ministry of Health Bhutan, Bhuthan
7 Jasin District Health Office, Ministry of Health Malaysia, Malaysia
8 East District Public Health Department, Yangon, Ministry of Health and Sports, Myanmar
9 Aunglan Township Public Health Department, Ministry of Health and Sports, Myanmar
10 Vector Borne Disease Control Division, State Public Health Department, Ministry of Health and Sports, Myanmar
11 Department of Epidemiology, University of Public Health, Myanmar
12 Svay Rieng Provincial Health Department, Ministry of Health, Cambodia
13 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand
14 International Health Policy Program, Ministry of Public Health, Thailand

*Corresponding author, email address: rapeepong@ihpp.thaigov.net

Abstract

Thailand is classified by the World Health Organization as one of a few countries in the world with the highest tuberculosis (TB) burden. The Thai Ministry of Public Health has implemented the 'Tuberculosis Case Management' (TBCM) as the main database for the national TB surveillance. TBCM is designed for case registration and management as well as case reporting and notification. This study thus aimed to evaluate TBCM for its surveillance function. A cross-sectional descriptive study was conducted to review the surveillance function of TBCM during 1 Jan to 30 Jun 2017 at Mae Sot Hospital, Thailand. The study team reviewed the protocols and guidelines of TBCM. The practice of health personnel at the TB clinic was observed to determine the data flow of TBCM. Qualitative and quantitative study methods were employed in accordance with the Center for Disease Control and Prevention's Guidelines for Evaluating Surveillance Systems. We found that TBCM reporting system at Mae Sot Hospital was acceptable, stable and useful in achieving the objectives of TB control program. Sensitivity and positive predictive value of TBCM accounted for 80.8% and 99.4% respectively. The most common reason of miss-reporting was a loss to follow-up after admission or after health exam, particularly amongst non-Thai patients. Timeliness and data quality were concerned attributes that required improvement. TBCM and the in-house medical recording system should be harmonized to mitigate the risk of erroneous coding.

Keywords: tuberculosis, surveillance evaluation, sensitivity, positive predictive value, Tuberculosis Case Management

Introduction

Tuberculosis (TB) is a chronic and potentially lethal infectious disease caused by *Mycobacterium tuberculosis*.[1] In 2016, approximately 1.3 million deaths among HIV-negative people were attributable to TB and additional 374,000 deaths among HIV-positive people. It was estimated that about 10.4 million people fell ill with TB in 2016.[1,2] Thailand is classified by the World Health Organization (WHO) as one of the 14 countries in the world with high TB burden. Each year Thailand presents with about 105,000 incident cases.[3] About 16% of the TB cases are HIV positive.[1]

An effective surveillance system is critical to successful disease control.[4] The ultimate goal of TB surveillance system is to reduce the burden of mortality and morbidity from TB by timely identification and comprehensive treatment as management of contacts.[4,5] There are two main TB surveillance systems in Thailand. First is the national disease surveillance system, R506, which is managed by Division of Epidemiology (DOE), Department of Disease Control (DDC), Ministry of Public Health (MOPH). The R506 comprises not only TB, but also, a vast range of communicable diseases. The other is Tuberculosis Case Management (TBCM) system, which is governed by Division of Tuberculosis (DTB), DDC, MOPH and specifically designed for TB.[6]

It is pertinent that TBCM should be evaluated periodically. In this regard, we used Mae Sot Hospital as a case study to evaluate TBCM for its surveillance function. Mae Sot Hospital is located in Mae Sot, Tak. It is the residence for Thai population, numbering about 150 thousand and non-Thai populations, mostly, Myanmar, numbering about 130 thousand. Mae Sot Hospital is a 420-bedded general hospital. In 2017, there were 185 TB cases amongst Thai Nationals and 136 TB cases amongst non-Thais. The treatment success rate was 87.1% amongst Thais and 81.1% amongst non-Thais.

The objectives of this study are to (i) describe tuberculosis management system at Mae Sot Hospital, (ii) assess the surveillance function of TBCM at Mae Sot Hospital, and (iii) to provide recommendation to improve tuberculosis management system at Mae Sot Hospital. It is hoped that this study can serve as a meaningful lesson for improving TB surveillance for other provinces in Thailand and in other countries with relatively similar context.

Methods

Study Design

We applied a cross-sectional descriptive study. The field data collection was conducted from 31 Jul to 3 Aug 2018. The frame of the evaluation was adopted from 'Updated guidelines for evaluating public health surveillance systems', recommended by the Centers for Disease Control and Prevention (US-CDC).[7]

Study Period

The period of interest was between 1 Jan to 30 Jun 2017.

Population Scope

For qualitative attributes, we collected data by interviewing all persons involved with TBCM in Mae Sot Hospital. For quantitative attributes, we collected data from the medical records, e.g., TB treatment card, outpatient department (OPD) card, and inpatient department (IPD) charts stored in Mae Sot Hospital.

Data Collection Methods and Tools

Qualitative attributes

We reviewed the protocols and guidelines of TBCM in Thailand. The practice of staff at TB clinic of Mae Sot Hospital was observed to enable the team to understand the data flow and the patient flow. In-depth interviews using semi-structured questionnaires were conducted on 13 respondents in the hospital. The interviews were audio taped and transcribed upon verbal consent from the interviewees.

Quantitative attributes

Medical records in inpatient (IP) and outpatient (OP) wards were reviewed. Laboratory and drug logbooks were explored. We also checked health-examination data of migrants from migrant-worker clinic of Mae Sot Hospital. Then we assessed these data against the records in TBCM.

Operational Definitions

A patient would be identified as TB case if he/she was found to meet either of the following criteria: (i) diagnosed as TB by a physician with either one of the following ICD-10 (the 10th revision of the International Classification of Diseases) codes: A15, A16, A17, A18, and A19; (ii) showing positive TB results from either one of the following tests: sputum smear, sputum culture, Xpert MTB/RIF, and Line Probe Assay (LPA); (iii) receiving rifampicin or kanamycin for treating TB, and (iv) showing positive chest radiograph compatible with TB from the health examination at migrant-worker clinic.

Data Analysis

We narratively described the flow of patients suspected of TB and the flow of TB data in the hospital. Then we described usefulness of the system based on the interviews. We applied content analysis for qualitative data and descriptive statistics for quantitative data. For qualitative attributes, we focused on acceptability, flexibility, simplicity and stability. For quantitative attributes, we focused on quality of reporting (completeness and validity), timeliness, sensitivity, positive predictive value (PPV), and representativeness. Details of the quantitative attributes are displayed in Table 1.

We also investigated reasons of miss-reporting by reviewing the medical records and interviewing with the physicians in charge.

Table 1. Definition of quantitative attributes

Attribute	Definition
Data quality	
i. Completeness	No missing of each key variable in TBCM
ii. Validity	Accuracy of selected variables in TBCM, assessed against medical charts
Timeliness of reporting	Time interval between diagnosis and reporting the results to TBCM
Sensitivity	Proportion of the total number of cases in the population under surveillance being detected by TBCM
Positive predictive value	Proportion of cases reported to TBCM that met the case definition of TB
Representativeness	Comparison of the characteristics of cases reported to TBCM with TB cases presenting at Mae Sot Hospital

Ethics Consideration

This research was conducted as part of the routine evaluation of the DOE. Hence ethics clearance was not needed. However, the researcher team always followed research ethics standards. All individual information was anonymised.

Results

Flow of Patient and Data

Figure 1 below shows an overview of patient flow and data flow of TB cases in Mae Sot Hospital. A patient can be diagnosed from general OPD, inpatient wards or specialist departments as well as private facilities and migrant-worker clinic. Initial treatment can either be given as an inpatient or an outpatient based on clinical severity. Meanwhile the data flow started from the TB clinic with the notification of a TB patient. The reporting was performed by a TB clinic officer into TBCM online system. Data from TBCM were exported from the epidemiology unit to the TB coordinators for case management as well as data validation and verification and to Division of Tuberculosis, DDC, for data aggregation.

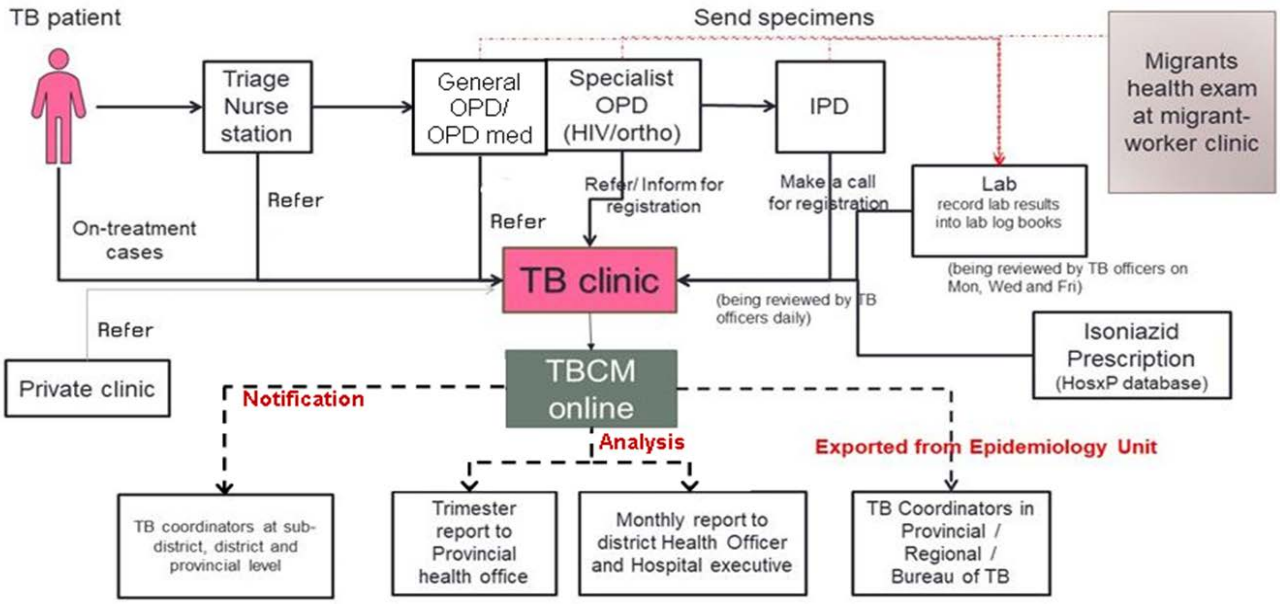

Figure 1. Flow of services for TB patients and data of TB cases at Mae Sot Hospital

Usefulness of TBCM

All of the respondents agreed that TBCM surveillance system helped identify high risk population for active screening and optimize the treatment to match each individual patient's health need.

"Treating TB is an art. Sometimes, I cannot follow the guideline and I need to change the treatment for complicated patients. I used data from personal TB records (from TBCM) to design strategy to take care of TB patients. I can easily ask it from TB manager."…Infectious disease specialist

Qualitative Attributes

Overall, the participants presented relatively positive attitudes towards most qualitative attributes, excepting flexibility. Table 2 displays the results from content analysis on qualitative attributes.

Simplicity

About 64% (7/11; excluding participants coded as 'not applicable') of the respondents reported that the system was simple and user friendly, while approximately a quarter informed that the system was not simple because it had no linkage with other existing reporting systems (such as HOSxP).

"Everything would be easier if all databases were linked together."…Laboratory officer

Acceptability

About 92% (11/12) of the interviewees responded that the system was acceptable and the system also helped them to access the data easily. However, one of the interviewees pointed that the system was less acceptable as part of it required manual entry, which was quite burdensome.

Table 2. Summary of content analysis findings on qualitative attributes

No. of interviewee	Position	Simplicity	Acceptability	Stability	Flexibility
1	Hospital director	1	1	1	-1
2	Infectious disease specialist	1	1	1	-1
3	Doctor in charge of IP care	-1	1	0	NA
4	Nurse in charge of IP care	NA	1	NA	NA
5	Epidemiologist	-1	1	0	-1
6	Paediatrician	NA	NA	NA	NA
7	Paediatric nurse	1	1	NA	NA
8	Laboratory officer	-1	-1	1	-1
9	IT officer (hospital)	1	1	1	0
10	IT officer (TB clinic)	1	1	1	1
11	TB officer/manager	0	1	1	-1
12	TB nurse	1	1	1	1
13	TB health worker	1	1	1	1

Note: 1=Positive attitude, -1=Negative attitude, 0=Neutral, NA=Not applicable, IT=Information and technology

Stability

Four-fifths (8/10) of the respondents viewed that the system was stable because they had back-up plans to support its operation, such as manpower and standard operating procedures. Nobody viewed that the program would be terminated soon since the system was supported by the MOPH.

Flexibility

One-third (3/9) of the respondents mentioned that TBCM was flexible in terms of data reporting as it allowed the officers to edit the individual patient data. However, about half of the respondents (5/9) mentioned that the system was not flexible as they could not edit certain variables online.

Quantitative Attributes

Sensitivity

It is found that of 203 cases that met case definition of TB during the study period, 164 were reported in TBCM. This meant the sensitivity of reporting equated 80.8%.

Positive predictive value

We found that there were 165 cases presented in TBCM. Of these 165 records, 164 met the case definition of TB. This denoted that PPV accounted for 99.4%, Table 3.

Table 3. Presence of records in Tuberculosis Case Management by assessing against the case definition

	Meet case definition	Do not meet case definition	Total
Present in TBCM	164	1	**165**
Not present in TBCM	39	147	**186**
Total	**203**	**148**	**351**

Completeness

Completeness of TBCM in most of the variables, such as, date of birth, gender and sites of infection, was extremely high. However, there were some variables with incomplete recording, particularly, date of treatment starting (84%) and telephone number (52%), Table 4.

Table 4. Completeness of variables in Tuberculosis Case Management, assessed against hospital records

Variable	No. of complete records (N=321)	Percentage
Date of birth	321	100%
Gender	321	100%
Pulmonary/ extra-pulmonary	321	100%
Type of registration (New/relapse)	321	100%
Subdistrict address	315	98%
Date of treatment start	271	84%
Telephone number	166	52%

Validity

Validity was checked by comparing the data in hospital records (HOSxP) against the data in TBCM. Data from the hospital records were used as gold standard. Gender, age and site of infection presented with the largest degree of validity. Treatment and address data showed relatively low percentage, Table 5.

Table 5. Validity of variables in Tuberculosis Case Management, assessed against hospital records

Variable	Number of records with matched variables (N=164)	Percentage
Gender	161	98%
Age	147	90%
Pulmonary/ extra-pulmonary	142	87%
Date of treatment	102	62%
Subdistrict address	109	66%
Identification number	84	51%

Timeliness

Timeliness was assessed by measuring lag time between diagnosis date and reporting date. According to TBCM guideline, a newly diagnosed TB patient should be reported to TBCM within 7 days after diagnosis. Among 164 reports with complete data, 48% of the TB patients in Mae Sot (62/129) met the 7-day benchmark. If the cut-off was extended to 14 days, 71% of the records (92/129) demonstrated timely reporting.

Representativeness

The records in TBCM were almost identical to those in medical charts; for instance, mean age of the patients in TBCM was 47 years, just a year greater than that in medical charts. The most remarkable difference was found in nationality variable (about 5%-margin), Table 6.

Table 6. Representativeness of variables in Tuberculosis Case Management, assessed against hospital records

Characteristic	Reported in medical charts	Reported in TBCM
Age (mean ± standard deviation)	46±18	47±18
Male to female ratio	1.5:1	1.7:1
Sub-district (%) (n/N)		
• In Mae Sot	74% (129/203)	72% (118/165)
• Outside Mae Sot	26% (74/203)	28% (47/165)
Nationality (%) (n/N)		
• Thai	48% (98/203)	53% (87/165)
• Non-Thai	52% (105/203)	47% (78/165)
Sites of infection		
• Pulmonary	87% (176/203)	87% (143/165)
• Extra-pulmonary	13% (32/203)	13% (22/165)

Exploring Reasons of Non-reporting in TBCM

We reviewed medical records to identify reasons of miss reporting of TB cases. There were 39 patients who met TB case definition but were not reported in TBCM. Of these patients, 28 lived outside Mae Sot. Miss-reporting occurred mostly in non-Thai populations, comprising refugees from temporary shelters or cross-border immigrants. The reasons of miss-reporting varied. Loss to follow-up was the most common reason. Some other reasons included being diagnosed as TB for the first time in other hospital units outside TB clinic (e.g., paediatric or orthopaedic units) or death during admission before being reported in TBCM, Table 7.

Table 7. Reasons of miss-reporting in Tuberculosis Case Management

	Residing in Mae Sot (N=11)	Not residing in Mae Sot (N=28)
Thais (N=11)	- Reason unidentified (n=1)	- Loss to follow-up after treatment (n=4) - Died soon after diagnosis (n=1) - Treated at orthopaedic and paediatric wards (n=1) - Reason unidentified (n=4)
Non-Thais (N=28)	- Loss to follow-up after admission (n=2) - Loss to follow-up after migrant health exam (n=2) - Referred to Myanmar (n=2) - Died soon after diagnosis (n=1) - Reason unidentified (n=3)	- Residing in Myanmar (n=4) - Residing in sheltered areas of refugees (n=4) - Referred to other hospitals (n=2) - Treated at orthopaedic ward (n=1) - Reason unidentified (n=7)

Discussion

This study has shed light on the performance of TBCM reporting system at Mae Sot Hospital. Overall, most participants found that TBCM was helpful in terms of resource planning and situation monitoring. Sensitivity and PPV of the system accounted for 80.8% and 99.4%.

These figures are quite satisfactory as they are way greater than the TB surveillance system elsewhere, for instance, 68% sensitivity and 10% PPV in Afghanistan[8] and 27% sensitivity and 7% PPV in Ghana.[9] This might be because Afghanistan and Ghana were low- and middle-income nations where the health system is not yet well established compared with Thailand, which is an upper-middle nation.[10,11]

Our study also found that the quality of data needs improvement in certain variables, for example, nationality, date of treatment, and sub district address. Though, these variables are optional fields for the data entry process of TBCM, they can provide helpful information in monitoring the progress of disease and treatment outcomes. This information coincides with the findings for qualitative attributes; simplicity in particular. To date, the transferring of data from the hospital's electronic medical chart (HOSxP) into TBCM still requires manual entry as HOSxP and TBCM are not automatically linked. There was also a participant pointing that TBCM should allow flexibility in editing some variables. However, this issue needs a deliberate consideration. This is because TBCM is the national database. Hence, it needs to maintain a standardisation of variables across settings (though in the future the developer may improve TBCM by allowing local providers to edit certain variables which do not affect the whole system).

Timeliness of reporting is also important, as delay in reporting can cause delay in prevention and control measures especially in detecting outbreaks or clusters of cases.[7] We found that only half of the cases were reported to TBCM in a timely manner. This discovery coincides with the situation elsewhere. The Ghanaian review found that only 55.6% were reported in a timely manner to the regional level.[9] The delay in reporting might result from many factors, not only a pitfall of TBCM by itself. The hospital staff should consult among each other to identify the root cause of this problem and propose optimal measures to address this issue. For instance, a shortcut communication from the station of diagnosis to the point of data entry should be made in order to speed up the reporting of cases to TBCM.

Another point that is worth mentioning is the miss-reporting of the cases in TBCM. The most common reason was a loss to follow-up. This explanation was logical as the diagnosis of TB sometimes took a long time until the sputum smear or Xpert MTB/RIF results came out, and this requires more than one hospital visit. Hence it is possible that the diagnosis at the first visit of the patient might not meet TB case definition (and the record was not reported to TBCM from the outset) but later the laboratory result showed up as TB. This phenomenon warrants not only the improvement of TBCM reporting system, but the case management of the hospital as a whole. A system to trace and identify contact information of the patients should be in place.

Limitations

There remain some limitations in this study. First, this study is limited to the TB surveillance system in Mae Sot Hospital only. The readers should be cautious in generalising the findings to other settings. Second, the volume of interviewees was quite small. Some participants involved in TB management did not participate in the interview, such as nurses and public health officers at health centres. Third, we had not explored patients with diseases which had clinical course close to TB, such as chronic bronchitis or lung cancer. A more thorough evaluation should incorporate those diseases in the future.

Public Health Recommendations

The TB surveillance system of Mae Sot Hospital should be improved by arranging a training session for hospital staff involved in the TBCM reporting system, especially in the perspective of timeliness and data quality. A case management system that helps track all patients suspected of TB or those awaiting the laboratory results should be introduced in order to minimize the risk of loss to follow-up. Data scientists in charge of TBCM software development of the DDC should work closely with the information-and-technology officers at local hospitals to harmonize TBCM with the in-house medical recording system. This practice also helps mitigate erroneous coding by manual entry.

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Suggested Citation

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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

The First Outbreak of Chikungunya in a Hilly District in Bangladesh, 2018

Nisharga Meraj Chowdhury[1]*, Mallick Masum Billah[1], Anupam Sarker[1], Arifa Akram[1], Tahmina Shirin[1], Meerjady Sabrina Flora[1]

1 Institute of Epidemiology, Disease Control and Research, Bangladesh

*Corresponding author, email address: nisharga786@gmail.com

Abstract

A sudden increase in patients with acute febrile illness (AFI) in Rangamati General Hospital in June 2018 prompted an investigation to confirm the unusual occurrence of this condition, to identify the cause, and to recommend control measures. All patients had acute onset of fever and joint pain. We used our review of hospital records, interviews of active cases in hospital and the community, and environmental and entomological investigations to generate a hypothesis of possible etiologic agents. Blood samples were tested by Polymerase Chain Reaction (PCR) for chikungunya, dengue and Zika viruses. We identified 51 AFI cases in Rangamati Hill District, of which 64.7% were male, 25.5% were aged 21-30 years, and 76.5% were in the community. The outbreak lasted from 27 May to 19 Jun 2018. We concluded that chikungunya caused the outbreak in Rangamati because the AFI cases had fever, joint pain, rash and headache. Twenty-one (41.1%) of the cases were positive for chikungunya virus and *Aedes aegypti* larvae were found in the households near the cases. This was the first report of chikungunya in this municipal area. We recommended increased public awareness to reduce mosquito breeding places near houses, distributing leaflets on chikungunya disease and using insecticide treated nets.

Keywords: AFI, acute febrile illness, chikungunya, outbreak, Bangladesh

Introduction

An acute febrile illness (AFI) is an illness that causes a sudden rise in body temperature and is the body's natural response to invading pathogens.[1] AFI presents as fever and is often accompanied by headache, weakness, dizziness, joint pain, malaise, and rash.[2] It is often the predominant symptom of malaria, dengue, and chikungunya diseases, which are common in Bangladesh.[2]

Since 2005, chikungunya became an emerging public health problem in South Asia.[4] The first chikungunya outbreak in Bangladesh occurred in 2008 in Dhaka City, the capital of the country.[5] Several outbreaks were reported from 2011 to 2017 and there was one large outbreak in Dhaka City in May 2017 and in Chittagong in November 2017.[6]

On 6 Jun, the local health authority of Rangamati Hill District informed the Institute of Epidemiology, Disease Control and Research (IEDCR) about a sudden increase in the past four days of patients with AFI that were admitted to the district general hospital. Rangamati has a population of 600,000 and contains indigenous groups called Chakma, Marma, Tripura or Pangkhua. The township is located on the western bank of Kaptai Lake and has scenic landscapes, making it a popular holiday destination, and has recently experienced vigorous developmental growth.

IEDCR, the institute of the government with the responsibility to investigate outbreaks, responded promptly by sending a team to verify the cause of the outbreak. Malaria was ruled out because the symptoms of the cases were not consistent with those of malaria and the rapid diagnostic test (RDT) for malaria was negative. Chikungunya was suspected based on symptoms and previous chikungunya outbreaks in neighboring regions. Therefore, the objectives of the investigation were to confirm the existence of the outbreak, to identify the organisms causing the disease, and to give recommendations for control measures. The outbreak investigation team arrived in Rangamati on 7 Jun 2018.

Methods

To verify the outbreak and determine its scope and magnitude, the IEDCR team traveled to Rangamati General Hospital to interview patients admitted with AFI and to review their medical records. Eight patients

were identified, interviewed, and their medical records were reviewed. The team also interviewed the doctors and nurses treating the patients. The field investigation was conducted from 27 May to 10 Jun 2018 and the study period was from 27 May to 19 Jun 2018.

The initial definition of a suspected case was any person who presented with fever and lived in the Rangamati municipal area from 27 May to 8 Jun 2018. The team chose 8 Jun as the end date because it guaranteed that the maximum incubation duration from the earliest onset date of the study patients would be 12 days, which is the maximum incubation period for chikungunya. After interviewing the hospitalized patients, the team modified the suspected case definition as any person who presented with fever, joint pain, and/or skin rash and lived in the Rangamati municipal area from 27 May to 8 Jun 2018. The initial end date for case definition was later extended to 19 Jun because, during the 11-day investigation period, the team was notified of four new cases from the hospital. A confirmed case was any suspected case with laboratory confirmation of chikungunya by multiplex Polymerase Chain Reaction (PCR).

The team conducted a house-to-house survey in the community from 8 Jun to 10 Jun 2018 with the help of community health assistants (Figure 1). Our goal was to survey every house in the community. Due to restrictions by military and local government officials, we were not able to travel to all the households.

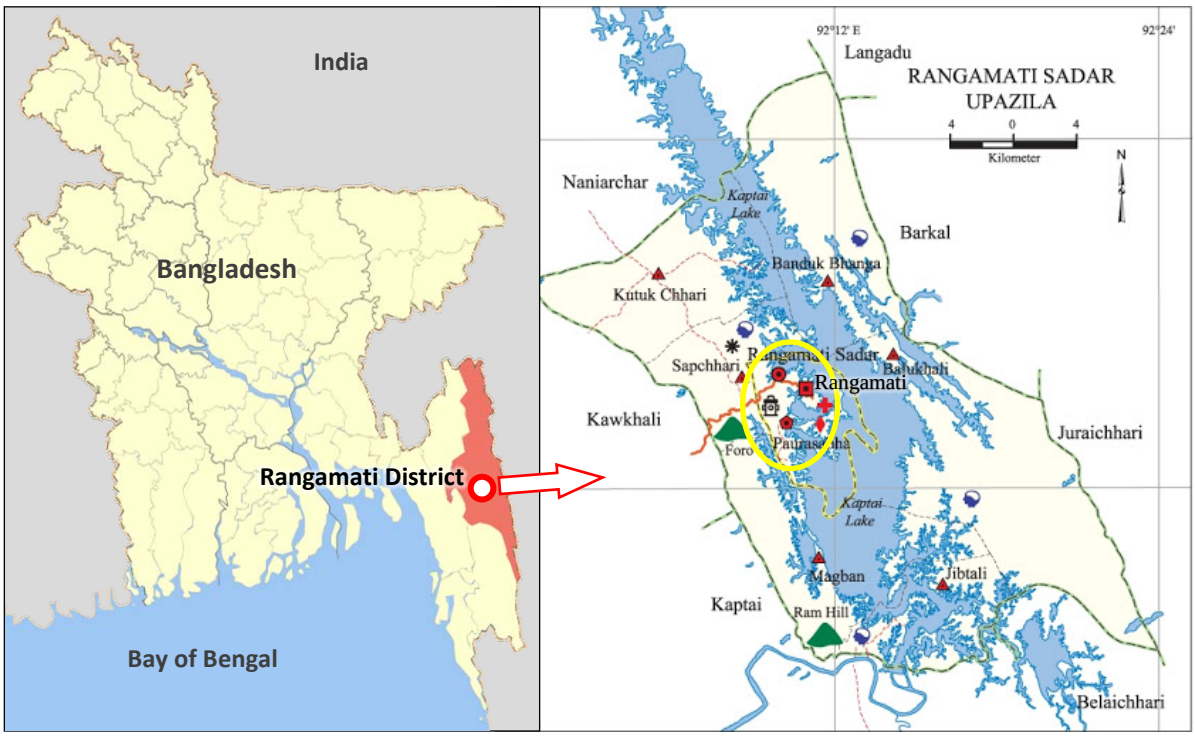

Figure 1. Residences of chikungunya cases in Rangamati municipal area, 27 May to 19 Jun 2018, Bangladesh (n=51)

In each house, we interviewed everyone with AFI using a pre-tested semi-structured questionnaire. The questionnaire was translated to Chitangya, a local language used throughout Rangamati. We collected the respondent's age, gender, address, occupation and religion, symptoms and onset date with detailed history of joint pain. The team also collected information about exposure, affected family members, and place of treatment. Self-reported items such as prescriptions were verified by examining the patient's medical records. Blood samples were collected according to a standard IEDCR protocol from patients who complained of fever for the last five days and tested by PCR for chikungunya, dengue and Zika viruses.

The district entomology officer, his staff and the investigation team conducted an entomological investigation according to WHO guidelines.[7] The guidelines call for dividing the survey area into zones and calculating the house index (HI), which is the percentage of houses that are positive for mosquito larva, the container index (CI), which is the percentage of water holding containers that have mosquito larva and the Breteau index (BI), which is the number of mosquito positive containers per 100 houses.[8] Households included in the entomological survey were randomly selected. Zones were determined by the entomologist and based upon WHO guidelines. A container was considered as wet if it contained at least 5 ml of stagnant water.

Based on the clinical, epidemiological, and environmental data, the team developed a hypothesis that the outbreak was probably a mosquito borne disease. Consequently, biological samples were collected and tested for malaria and dengue. As malaria is an endemic disease in Rangamiti District, patients, who present to the hospital with fever, are routinely tested for malaria. If the rapid malaria test is negative, then AFI case is reported as AFI. Although chikungunya is new to the region, the team included this disease because of the negative test results for malaria and dengue, the fact that symptoms of the cases were consistent with chikungunya, and because the disease has been spreading in the country since being first identified in Bangladesh in 2008.

Data were entered in an excel spreadsheet and descriptive statistics calculated and reported.

This investigation was approved by IEDCR director. Field investigators obtained verbal informed consent from the study subjects before interviewing or collecting blood samples.

Results

Fifty-one suspected cases were identified during 27 May to 19 Jun 2018. We considered this as an outbreak because this was the first-time chikungunya was reported in Rangamati District.

From the interviews with doctors and nurses, the clinical symptoms of patients with AFI were provided. All 51 patients lived in the municipal area. In addition, the number of AFI patients presenting to the hospital had increased over the past month. This helped verify the occurrence of the outbreak and generate the hypothesis.

The team interviewed eight patients who were still hospitalized. A community search resulted in 35 houses with active cases, of which 39 people met the suspected case definition. The response rate was 100%. Among the 51 cases in the study period, 33 were male and 13 were aged between 21 and 30 years (Table 1). Figure 2 presents the epidemic curve. The date of onset for the first case was 27 May with a peak on 4 Jun and the last case on 13 Jun. From 9 to 13 Jun, 4 cases were reported in the hospital. Active surveillance did not identify any cases from 14 to 19 Jun.

Table 1. Demographic distribution of acute febrile illness cases in Rangamati municipal area, 27 May to 19 Jun 2018, Bangladesh (n=51)

Characteristics	Frequency	Percentage
Gender		
Male	33	64.7
Female	18	35.3
Age group (years)		
<10	4	7.8
11-20	11	21.5
21-30	13	25.5
31-40	9	17.6
41-50	7	13.7
51-60	3	5.9
>60	4	7.8
Occupation		
Housewife	14	27.5
Student	14	27.5
Businessperson	8	15.6
Driver	3	5.8
Carpenter	2	3.9
Farmer	2	3.9
Others	8	15.6
Religion		
Muslim	41	80.4
Buddhist	6	11.7
Hindu	4	7.8

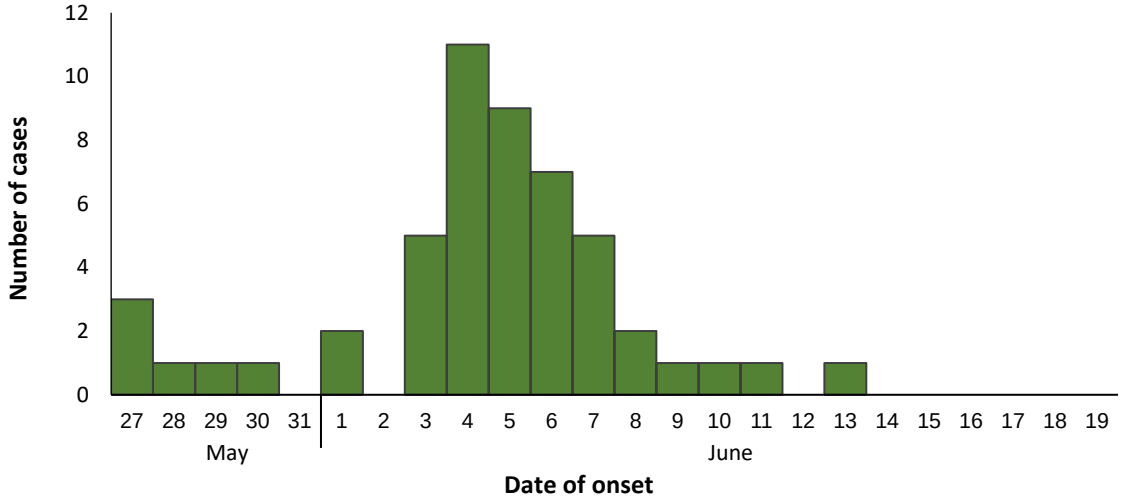

Figure 2. Date of onset of acute febrile illness cases from 27 May to 19 Jun 2018, Rangamati, Bangladesh (n=51)

Housewives and students accounted for the majority of the cases. Other occupations included businesspersons, drivers, carpenters, and farmers. As shown in Figure 3, all cases presented with fever and joint pain while headache, malaise, muscle weakness, itching, and skin rash were reported by less than half of the cases.

The team initially suspected malaria, dengue, and influenza as the cause of the outbreak as these diseases are endemic in the country, are seasonal, and cause symptoms similar to the ones reported by the study subjects. Chikungunya was also considered because it also causes similar symptoms and is spreading in the country.

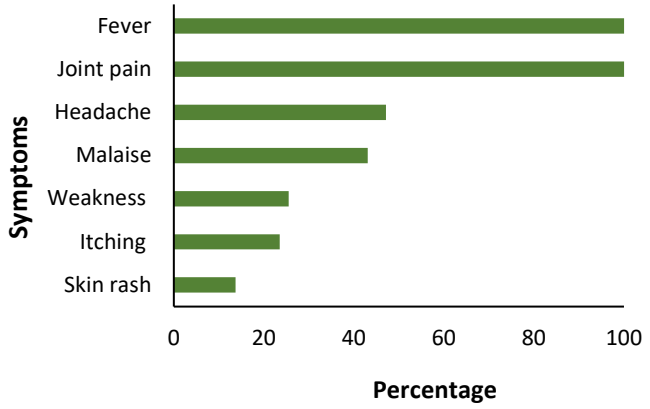

Figure 3. Clinical presentation of AFI patients in Rangamati municipal area, 27 May to 19 Jun, 2018, Bangladesh (n=51)

Among the 51 cases, 21 were laboratory confirmed for chikungunya and none had any history of malaria or dengue. As shown in Table 2, 17 cases sought treatment from a local pharmacy, 13 did not seek any treatment, and only 12 received treatment from a government hospital.

Table 2. Treatment seeking behavior among the acute febrile illness cases in Rangamati municipal area, 27 May to 19 Jun 2018, Bangladesh (n=51)

Treatment place	Frequency	Percentage
Government hospital	12	23.5
Private hospital	9	17.6
Local pharmacy	17	33.3
None	13	25.5
Total	**51**	**100.0**

The team found wet containers (including plastic containers that households used to collect drinking water) in the household areas where mosquito larvae were found with the results summarized in Table 3. With entomological support, the team collected wet containers from houses in five different zones and found *Aedes aegypti* larvae in the house and containers. Among 50 houses surveyed, the house index (HI) was 12.0%, the container index (CI) was 21.4% and the Breteau index (BI) was 18.0%. The entomologists interpreted these levels are characteristics of a high rate of mosquito breeding.

Table 3. Entomological survey of vectors (Aedes sp.) in Rangamati municipal area, June 2018, Bangladesh

Zone	Households inspected	Households positive	Wet containers	Positive containers	House index %	Container index %	Breteau index %
1	10	2	8	3	20.0	37.5	30.0
2	10	2	7	2	20.0	28.6	20.0
3	10	1	9	1	10.0	11.1	10.0
4	10	1	11	3	10.0	27.3	10.0
5	10	0	7	0	0	0	0
Total	**50**	**6**	**42**	**9**	**12.0**	**21.4**	**18.0**

Discussion

A chikungunya outbreak occurred in Rangamati Hill District of Bangladesh in the middle of 2018. This was the first reporting of chikungunya in the district, a hilly rural area in south-eastern Bangladesh that harbors the vector for chikungunya, *Aedes aegypti*. Fifty-one chikungunya cases were identified. Of which 21 were laboratory confirmed for chikungunya. All of the cases had fever and joint pain, and although less than half reported headache and skin rash, these symptoms are typical features of chikungunya-affected patients reported in previous studies.[6] Symptoms and demographic characteristics of cases in this outbreak were similar with cases in other chikungunya outbreaks in Bangladesh.[9] The most common treatment seeking behavior in our patients surveyed was through the local pharmacy. Government and private hospitals were less frequently used because of poor accessibility in Rangamati.

Although chikungunya is new in Rangamati, several outbreaks were reported in Bangladesh in Dhaka City and Chattagram.[6] The current outbreak occurred in May/June 2018 in Rangamati, which borders Chattagram, and we suspect chikungunya may have

spread from Dhaka City to Chattagram and then to Rangamati, where it has never been reported before. Every year many people from all over the country visit the district for sightseeing.[10] This group probably introduced chikungunya to Rangamati.

Studies have shown that chikungunya is an urban vector-borne disease with *Aedes aegypti* being the main vector for spreading the dengue and chikungunya viruses.[1,11-13] The municipal area of Rangamati is experiencing increased development.[10] Consequently, the areas with the most urbanization in Rangamati may be potential breeding sites for this mosquito.[12] Finding chikungunya disease in this area and the presence of *Aedes aegypti* larvae are indicators of spread of chikungunya in newly developed areas of Bangladesh such as Rangamati.

There is an active malaria surveillance programme in Rangamati. An AFI surveillance programme includes chikungunya and other AFI diseases such as dengue. Previous studies have shown that AFI surveillance at the hospital level can identify other vector-borne diseases.[14] We confirmed our cases with a diagnostic PCR test; however, studies have shown that different AFI diseases were identified when a laboratory test for chikungunya were negative.[15] Therefore, strengthening the existing surveillance and laboratory capacity to test for pathogens that cause AFI will enhance monitoring of future AFI outbreaks in this area.

Limitations

Some limitations of this study should be acknowledged. First, safety restrictions did not allow us to sample all households in the affected community. Second, knowledge about the AFI situation in this area could not be evaluated. Third, we did not have sufficient data to infer any association between the high entomological indices and chikungunya. The professional experience of entomologists who participated in the survey stated that the entomological indices were high, indicating a high burden of mosquito-borne diseases.

Public Health Action and Recommendations

According to our findings and the current situation in Rangamati, we recommended that people should be made aware of the presence of mosquito breeding places around their residence and to destroy them to prevent transmission of mosquito-borne diseases. Local Health Authorities, Municipality and District Administrators should increase public awareness on management of mosquito breeding places in household premises. Given these recommendations, the authorities distributed leaflets on dengue and chikungunya disease, had the media inform residents on the current dengue and chikungunya situation in the local area, encourage reporting of AFI to local health authorities, conduct surveys to identify and remove mosquito breeding sites, and distribute insecticide treated nets. People should be encouraged to go to hospital when they are ill because there are skilled doctors who can diagnose and treat chikungunya and medicine can be obtained from the hospital at no charge. This behaviour will also help determine the burden of chikungunya.

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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

Disparity between the Reimbursement and Unit Cost for HIV/AIDS Antiretroviral Treatment for Migrant Patients Insured in the 'Health Insurance Card Scheme', Thailand, 2015-2017

Orawan Prasitsiriphon[1]*, Utoomporn Wongsin[2], Poontavika Naka[3], Sataporn Julchoo[4], Rapeepong Suphanchaimat[4,5]

1 Health Insurance System Research Office, Thailand
2 Global Health and Health Security, Taipei Medical University, Taiwan
3 Department of Statistics, Chulalongkorn Business School, Thailand
4 International Health Policy Program, Ministry of Public Health, Thailand
5 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

*Corresponding author, email address: orawan@hisro.or.th

Abstract

The Health Insurance Card Scheme (HICS), a national insurance scheme for cross-border migrants in Thailand, provides a vast range of benefit packages, including antiretroviral treatment (ART) for HIV/AIDS. This study aimed to assess and compare the reimbursement claimed by the HICS for ART beneficiaries per person against the actual ART unit cost at district, provincial, and regional hospitals. Data were retrospectively collected from two main datasets. The first dataset was used for the calculation for ART reimbursement between 2015 and 2017. There were 148 public hospitals included in the reimbursement analysis. The second dataset was used for calculating the actual ART unit cost. Eight public hospitals were selected for unit-cost calculation. Findings showed that the average ART reimbursement amount per person per year varied between US$ 191.9 and US$ 235.1 while the actual ART unit cost ranged from average US$ 135.8 to US$ 421.0. Though the overall difference demonstrated non-statistical significance by Student t-test, this difference at provincial hospitals exhibited statistical significance (p=0.03) by Mann-Whitney U test. The Ministry of Public Health should update the fee schedule for ART reimbursement to better reflect the providers' actual unit cost and allow the ART reimbursement rate varying by facility types instead of applying the flat-rate system as per the status quo.

Keywords: antiretroviral treatment, HIV/AIDS, migrant, health insurance, costing, reimbursement, unit cost

Introduction

Thailand is a key migrant destination especially for those journeying from Cambodia, Lao People's Democratic Republic (PDR) and Myanmar, so-called CLM nations. The most common reasons for migration among these CLM migrants are seeking improved economic prospects, and accompanying family members. As of June 2018, there were approximately 2.2 million documented migrant workers living in Thailand, plus an unknown figure of those crossing the border without valid travel documents (undocumented migrants).[1] The International Labour Organization (ILO) reported that migrants (including undocumented ones) contributed to about 4.3-6.6% of Thailand's gross domestic product (GDP) in 2010 and represented approximately 4.7% of the employed population.[2]

As migrants and their dependants are inextricably linked with the Thai economy, policies to protect the health of migrants have always been in the political spotlight of Thai governments. One of the most distinct policies on migrant health is the 'Health Insurance Card Scheme' (HICS), which was launched in 2004.[3,4] The HICS is a premium-based insurance scheme under the regulation of the Division of Health Economics and Health Security (DHES), Ministry of Public Health (MOPH). Its target beneficiaries are undocumented migrants, who are mostly engaged in

informal work; while documented migrants, mostly in the formal sector, are already covered by the Social Health Insurance (SHI) like ordinary Thai workers. The MOPH assigns affiliated health facilities to sell the HICS to undocumented migrants. The benefits of HICS insurance are comprehensive, from basic outpatient (OP) and inpatient (IP) care, to high-cost treatment. In 2013, the MOPH expanded the HICS' benefit to cover antiretroviral treatment (ART) for HIV/AIDS[5] with the annual premium at 2,200 Baht (US$ 71) per individual, which was broken down into 1,300 Baht (US$ 42) for general OP and IP care and 900 Baht (US$ 29) for ART and high-cost care. The affiliated health facilities are obliged to transfer the 900-Baht revenue, earmarked for ART and high-cost care, to the MOPH. This serves as a re-insurance system where the MOPH manages the pooled fund for certain services at a national level and reimburses the facilities for ART expenses based on a fee schedule. An example of the fee schedule is presented in Table 1.

Table 1. Example of fee schedule for ART in the HICS, Thailand

Item	Unit	Reimbursed Cost in US$
CD4 test	visit	12.85
Drug resistance test	visit	192.77
Viral load test	visit	43.37
Atazanavir 200 mg per cap (ATV)	tablet	4.53
Darunavir 300 mg per tab (DRV)	tablet	1.97
Lopinavir/Ritonavir (oral solution—60 ml)	bottle	20.84

It is worth noting that, in 2014, right after the coup, there was a significant change in the HICS premium[4] since the government attempted to overhaul the registration process of undocumented migrants and aimed to enroll as many migrants into the HICS as possible. As a result, the HICS premium was reduced to 1,600 Baht (US$ 52) per individual; comprising 1,300 Baht (US$ 42) for general OP and IP care, and 300 Baht (US$ 10) for ART and high-cost care. Another point that is worth mentioning is the 300-Baht ART in this case denotes to ART in OP care only, as the ART for admitted patients is already included in the 900-Baht IP care. Currently, the ART benefit under the HICS consists of antiviral drug treatment and laboratory tests for many HIV/AIDS-related items, including blood chemistry, HIV antibody, polymerase chain reaction (PCR), CD4 cell count, viral load and drug resistance.[6,7]

The ART reimbursement amount was set in 2013 and has not been adjusted since. The 2014 change in premium was made rapidly, in order to recruit many more migrant beneficiaries, without a thorough cost analysis as to whether the HIV/AIDS or ART reimbursement amount really reflected the actual ART unit cost of treatment.[8] This issue is of more concern in recent years because the Global Fund (GF) to Fight AIDS, Tuberculosis and Malaria, which is now supporting about 7,000 undocumented migrants who failed to register with the government, plans to terminate its support to Thailand very soon.[9] This is because the Thai economy has passed the upper-middle income benchmark, making the country ineligible to apply for the next round of funding.[10] To this end, it is very likely that many more HIV/AIDS migrant patients will soon enroll in the HICS.

Thus, the objective of this study was to assess and compare the ART reimbursement amount with the actual ART unit cost provided at health facilities. It is hoped that the results of this study could potentially inform policy makers to improve fee schedules and enable the contracted hospitals to effectively manage their activities and outputs on this budget.

Methods

Conceptual Framework

This study aims to identify the cost of HIV/AIDS across different levels of hospital care, namely district, provincial, and regional hospitals, which are the contracted facilities of the 'Health Insurance Card Scheme'. We calculated the reimbursement amount and compared it with the actual costs to health facilities. The annual ART reimbursement amount was determined by two factors: (1) exposure to risk (the insured migrant workers), and (2) claim payments covered by the ART benefit (antiviral drug treatment and laboratory tests). The actual cost of health facilities was divided into direct and indirect costs. Both the ART reimbursement amount and the actual ART unit cost are expressed in annual per person per year.

The reimbursement (claim) amount was determined by the exposure to risk and claims payments, which represents the number of claims made within a given period. HICS regulations,[7] fixed the claim rate across health facilities. For the actual ART unit costs, it is assumed that the cost of care incurred by the providers varies by the level of facilities. Thus, the analysis of unit cost of care was sub-categorised into levels of care (district, provincial, and regional hospitals).

Study Design and Data Sources

Quantitative analysis of secondary data was used to assess the cost of HIV/AIDS treatment for the HICS. The population included undocumented migrant workers and their dependants aged 7 years and over, who were registered with the HICS. Data were retrospectively collected from two main datasets. The first dataset covered HICS claims between the fiscal years 2015 and 2017, drawn from hospital claims submitted to the DHES website (http://fwf.cfo.in.th). There were 148 public hospitals that made a claim for the HIV/AIDS benefit. The second dataset was obtained from a pilot project that gathered and calculated service unit cost data from volunteer hospitals in 2014.[11] Only eight public hospitals (four districts, two provincials, and two regionals) presented with enough data on HIV/AIDS services to make the analysis feasible.

The first dataset from the HICS data obtained beneficiaries' ID numbers, registration date, expiry date, reimbursement code, service provision date, number of claims and claim payments. In the second dataset, the costs to each hospital were drawn from its financial report, identifying revenues, expenses and service data related to OP HIV/AIDS care (including laboratory tests). The actual cost was further divided into labour cost, material cost and capital cost.

This analysis was based on the following assumptions. First of all, researchers used the diagnosis codes B20-B24, taken from the 10th revision of the International Classification of Diseases (ICD-10), to identify which visits were related to HIV/AIDS care. If an HIV/AIDS patient visited facilities for other purposes, those visits would not be counted in the claim dataset. Secondly, researchers assumed the same standard of care (medicine, human resources, and laboratories) for both Thai and migrant patients. This assumption was grounded in the fact that there was no regulation from the MOPH that indicated different treatments for Thai and migrant patients. Thus, in principle, the ART unit cost for Thai and migrant patients should be the same. Yet, it was difficult to validate this idea in the real clinical practice. This point is covered in the 'Discussion' section.

Data Analysis

ART reimbursement

The ART reimbursement amount expressed in US$ per person per year was calculated as follows. All individual claims for HIV/AIDS in the relevant period were calculated. Then, the total claim was divided by accumulated person-years in the corresponding period. The use of person-years instead of person was because each individual enrolled in the scheme at different time points. The following formula reflects the calculation idea of the ART reimbursement per person per year.

$$\text{ART reimbursement per person per year} = \frac{\text{Total reimbursement in year } t}{\text{Total time spent by insured people in year } t}$$

ART unit cost

For the ART unit cost estimation, a standard costing method stipulated by the MOPH was employed.[7] The procedure was composed of the following steps: (i) cost centre assignment, dividing facility units into supporting cost centres (for instance, finance departments) and service cost centres (for instance, patient wards), (ii) direct cost estimation (including labour cost, material cost, and capital cost), (iii) allocation of cost from supporting cost centres to service cost centres to obtain total cost, and (iv) producing unit cost per visit by diving the total cost by total number of patients, as demonstrated by the following formula.

$$\text{Unit cost per patient} = \frac{\text{Total cost of medicine and laboratory in year } t}{\text{Total patients in year } t}$$

The ART unit cost per patient was computed in each hospital. The researchers then estimated ART unit cost across hospitals; and compared this with the claim cost by Student t-test, using 95% confidence level as a cut-off. In addition to Student t-test, Mann-Whitney U test was applied to accommodate the non-normal distribution pattern of the cost data.

Results

Overall, there were 147 hospitals claims in 2015, with 1,221 persons and 768 patient-years. The number of hospitals making claims was quite stable in 2016 and 2017 comprising of 160 and 159 hospitals, respectively. However, the volume of patients and patient-time increased to 2,997 persons and 2,069 patient-years in 2016, and 1,845 persons and 1,112 patient-years in 2017, respectively. The amount of ART reimbursement amount increased from US$ 164,660 in 2015 to US$ 233,413 in 2016 and then decreased to US$ 156,837 in 2017. The trend of the mean reimbursement amount was similar to the median reimbursement amount.

The hospitals used in this study were classified into district, provincial, and regional hospitals, which contain different 10-120 beds, 120-500 beds, and 500 beds or over, respectively. Overall approximately 34.2%-54.5% of patients with HIV/AIDS were

concentrated in district hospitals. Regional and district hospitals combined treated the majority of patients, especially in 2016-2017. The average cost per person per year varied between US$ 191.9 and US$ 235.1 in 2015, while the median cost per person-years ranged between US$ 162.0 and US$ 223.4. There was a remarkable fall in the reimbursement amount per person per year over the study period, particularly in regional hospitals from US$ 210.7 in 2016 to US$ 172.7 in 2017: almost a one-fifth decrease. The highest reimbursement amount was found in district hospitals in almost all years. The mean reimbursement amount in 2017 was lower than the cost in other years for all facility types (Table 2).

Table 2. Reimbursement amount of HIV/AIDS antiretroviral treatment for outpatient care, Thailand, 2015-2017

Year	Hospital type	Number of hospitals	Number of patients	Total patient-years	Total ART reimbursement amount in US$	ART reimbursement amount per person per year across hospitals in US$	
						Mean (SD)	Median (95% CI)
2015	RH	18	261	173	31,376	207.7 (97.4)	223.4 (134.6, 267.5)
	PH	31	295	188	41,940	191.9 (166.8)	162.0 (92.1, 246.4)
	DH	98	665	407	91,344	235.1 (178.8)	203.9 (141.2, 315.8)
	Total	**147**	**1,221**	**768**	**164,660**	**222.7 (168.5)**	**198.3 (127.9, 300.6)**
2016	RH	21	1,607	1,116	59,693	177.7 (111.1)	174.4 (89.7, 232.4)
	PH	31	365	255	46,710	210.7 (150.3)	209.3 (86.9, 284.1)
	DH	108	1,025	698	127,010	240.1 (156.7)	248.6 (111.1, 315.5)
	Total	**160**	**2,997**	**2,069**	**233,413**	**226.2 (151.1)**	**225.7 (97.5, 301.8)**
2017	RH	20	884	576	36,168	172.4 (146.9)	148.5 (55.1, 306.1)
	PH	32	209	133	32,569	172.7 (127.3)	130.5 (71.0, 276.2)
	DH	107	752	463	88,100	204.9 (148.9)	196.6 (76.7, 314.3)
	Total	**159**	**1,845**	**1,172**	**156,837**	**194.3 (144.5)**	**170.4 (72.8, 308.2)**

Note: RH=Regional Hospitals, PH=Provincial Hospitals, DH=District Hospitals. Foreign exchange rate as of July 2013=31.1 Baht per US$

As the cost data from 2015 onwards were lacking, table 3 shows only the actual ART unit cost in 2015. The overall ART unit cost was US$ 234.2 across hospital types. Provincial hospitals shouldered the greatest unit cost compared to other facility types (US$ 421.0). In contrast, regional hospitals saw the lowest unit cost relative to other facility types (US$ 135.8), likely due to the largest volume of patients. Medicine costs were greater than laboratory costs in almost all facilities (Table 3).

Table 3. Unit cost of HIV/AIDS antiretroviral treatment for outpatient care per individual per year, Thailand, 2015

Hospital types	Number of patients	Share of total cost		Unit cost per person in US$	Unit cost per person across hospitals in US$	
		Medicines	Labs		Mean (SD)	Median (SD)
RH1	1,779	56%	44%	111.3	135.8 (34.6)	246.7 (88.7)
RH2	2,107	86%	14%	160.2		
PH1	741	89%	11%	403.4	421.0 (24.8)	420.9 (24.8)
PH2	1,074	90%	10%	438.5		
DH1	191	92%	8%	304.8	250.2 (110.8)	135.7 (34.6)
DH2	363	49%	51%	161.9		
DH3	473	84%	16%	345.4		
DH4	253	73%	27%	188.7		
Total	**6,981**				**234.2 (124.4)**	**246.7 (124.4)**

Note: RH=Regional Hospitals, PH=Provincial Hospitals, DH=District Hospitals. Foreign exchange rate as of July 2013=31.1 Baht per US$

Confining the analysis to 2014 and 2015, the ART unit cost per patient at health facilities was compared with the claim cost per person from the MOPH. It appeared that the mean unit cost of ART in provincial hospitals was almost double the reimbursement amount. While in district hospitals both costs were almost on par, in regional hospitals the claim cost was about 50% higher than the mean unit cost. However, Student t-test did not indicate a significant difference between the claim cost and the mean unit cost across facility types (Figure 1).

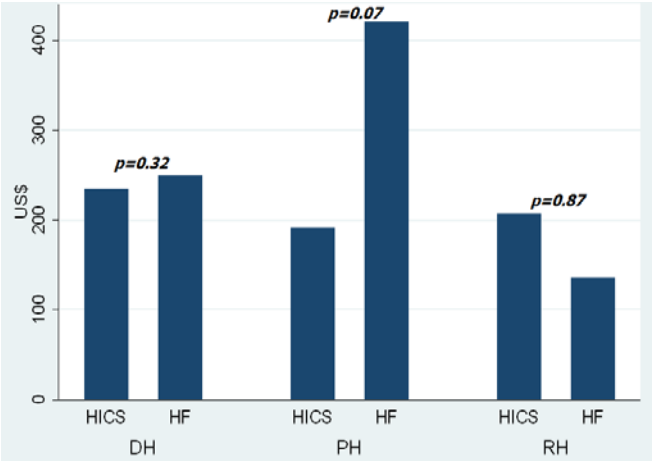

Figure 1. Comparing the mean reimbursement amount of Health Insurance Card Scheme (HICS) and the mean actual cost of Health Facilities (HF) for district hospitals (DH), provincial hospitals (PH), and regional hospitals (RH) for HIV/AIDS antiretroviral treatment by Student t-test, 2015

When median was used instead of mean with an application of Mann-Whitney U test, a statistical significance difference (p=0.03) was observed in provincial hospitals, but not in district and regional hospitals (Figure 2).

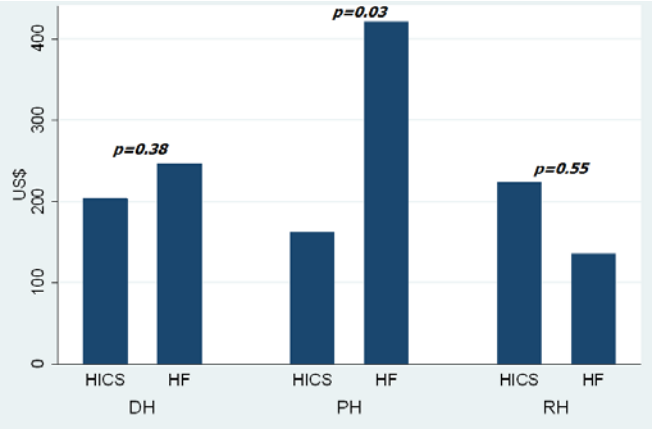

Figure 2. Comparing median reimbursement amount of Health Insurance Card Scheme (HICS) and median actual cost of Health Facilities (HF) for district hospitals (DH), provincial hospitals (PH), and regional hospitals (RH) for HIV/AIDS antiretroviral treatment by Mann-Whitney U test, 2015

Discussion

This research is probably one of the first studies that explored the ART reimbursement amount and the unit cost of care for HIV/AIDS migrant patients since the expansion of the HICS benefit package in 2013.[12] District hospitals appeared to face higher costs compared to other facility types. One possible explanation is that the volume of patients who made claims in district hospitals, although quite large in terms of raw numbers, was quite small relative to the total reimbursement amounts. For instance, in 2016, the total reimbursement in district hospitals amounted to US$ 127,010 for 698 person-years. By contrast, the total reimbursement in regional hospitals amounted to US$ 59,693 for 1,116 person-years, approximately half of the claim in district hospitals, with far larger person-years (1,116 person-years).

A probable reason for the drop in ART reimbursement amount across all facility types in 2017 is that, at the time of the study, claim data from health facilities had not been completely submitted to the MOPH. In other words, there was a lag between incurring the treatment at facilities and submitting the claim requests to the MOPH; thus the 2017 claim data were likely to be underestimates. This issue also points to room for improvement in the HICS reimbursement system. The data reporting system to MOPH should be capable of estimating the reserve account for any losses or events that have happened at local facilities but have not yet been reported.[13]

Despite some differences in ART reimbursement amount across facilities, such margins were trivial relative to the difference in the ART unit costs between facility types. The vast range of ART unit costs across facilities is likely due to (i) difference in cost distribution and (ii) difference in the volume of service users. Hospitals with a greater share of medicine costs tended to face larger unit costs and hospitals with relatively large volume of users (most likely regional hospitals) likely faced lower unit costs compared to others. Provincial hospitals received far fewer HIV/AIDS patients than regional hospitals. This might be because many patients by passed provincial hospitals and went directly to regional hospitals, leaving a smaller volume of patients at provincial hospitals. With the smaller volume of patients, a higher unit cost was likely to occur (as the denominator shrank). However, this assumption is still presumptive evidence and needs much more research to justify it.

No officially published study directly compares the unit cost of treatment among Thais and migrants.

However, theoretically, the unit costs of both populations are likely to be similar, conditional upon the same disease conditions. Nevertheless, in reality, each hospital always exercises its own discretion to set the service charge value. Thus it is likely that hospital charge exhibits remarkable difference across facilities even for the same disease condition.

International literature also indicated that the ART unit cost varied tremendously. Mean ART costs per person per year in sub-Saharan African countries was around US$ 208-231, slightly lower than the findings in this study.[14,15] South Africa had higher unit costs at about US$ 682. The same situation was found in Indonesia, where the unit cost for ART was as high as US$ 473-580.[16] Note that the information here only suggested that service unit cost could vary across service sites. Therefore, it is difficult to judge whether the ART unit cost in this study was 'too high' or 'too low' compared to foreign studies, as each country had its own healthcare system and different studies applied different calculation methods.

Gaps between the ART unit cost and the claim requested can be explained in some ways. First, some treatment activities for HIV/AIDS patients are not codified in the fee schedule (for instance, prescribing antibiotics for opportunistic infections). Second, the current fee schedule does not keep pace with the advances in medicines and laboratory testing (as the fee schedule was set in 2013). Thus, it seems that the providers could not fully recoup the ART cost from the MOPH, which creates a moderate financial risk for the providers.[17,18]

Limitations

First, as very few hospitals participated in the unit cost determining project of Health Insurance System Research Office (HISRO), limiting the generalisability of the findings. Besides, the limited number of hospitals containing unit cost data impeded the application of paired analysis (for example, paired Student t-test or Wilcoxon signed-rank test). Second, the interpretation of the results must be made with caution as this study did not include those beneficiaries who did not present at the hospitals. Therefore, it is difficult to be sure whether the current HICS premium is appropriately set from the actuarial point of view. In other words, this study did not indicate whether the existing premium is too low or too high and this point could not be answered merely by this study. An uplift in the reimbursement amount might address the providers' financial difficulty. However, in the same time it might create economic burden on the MOPH and discourage migrants from enrolling in the scheme. Thirdly, the unit cost calculation in this study followed the MOPH standard guideline. In reality, however, there are many methods for calculating unit cost; for instance, micro-costing technique or activity-based costing technique. Hence, the different calculation methods might lead to different results. Last but not least, other qualitative aspects concerning HIV/AIDS care have not been explored. All of these limitation points warrant further studies.

Recommendations

The MOPH should update the fee schedule for ART and allow it to be adjusted according to the facilities' unit cost. This is like creating a tailor-made fee schedule instead of using the flat-rate schedule as per the status quo. Note that adjusting the fee schedule is not the complete solution to resolve disparities between the reimbursement amount and the facilities' unit cost. Since the calculation of unit cost derived from only eight hospitals (out of about a thousand hospitals affiliated with the MOPH), future studies should include many more hospitals if resources and time allow. A study that compares the present unit cost in other hospitals with the unit cost derived from the eight hospitals presented in this study is of great value. Moreover, here are many other issues that should be explored further in future studies. For instance, whether there is any barrier in accessing HIV/AIDS care across facility types; and what regulation the MOPH should implement to allow better (and more equitable) distribution of patients across different levels of care. Should all of these questions be resolved, it is likely that inequity problems originating from the gap between unit cost and reimbursement amount requested will be minimised.

Conclusion

This study illuminated gaps between reimbursement amount that HICS paid for ART for cross-border migrants and the actual ART unit cost at public facilities in Thailand. Overall, the total reimbursement amount at US$ 222.7 was less than the total unit cost at US$ 234.1 in 2015. The unit cost for HIV/AIDS treatment in provincial hospitals was notably greater than the average reimbursement amount submitted to the MOPH. In contrast, regional hospitals had unit cost of care less than reimbursement amount. The disparity of unit cost across facility types might be explained by inequitable distribution of patients in different levels of care. This study also recommended that the MOPH should update the fee schedule for ART reimbursement to better reflect the providers' actual

unit cost. Also, the ART reimbursement amount should be allowed to vary by facility types instead of adhering to the fixed fee schedule as per the existing situation.

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Declaration of Conflict of Interest

Authors declare no conflicts of interest.

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Ethics Approval

This study obtained ethics approval from the Institute for the Development of Human Research Protections in Thailand (IHRP 834/2561). All data are kept anonymous. Dissemination of the findings can be done only for academic interest without disclosing individual information.

Suggested Citation

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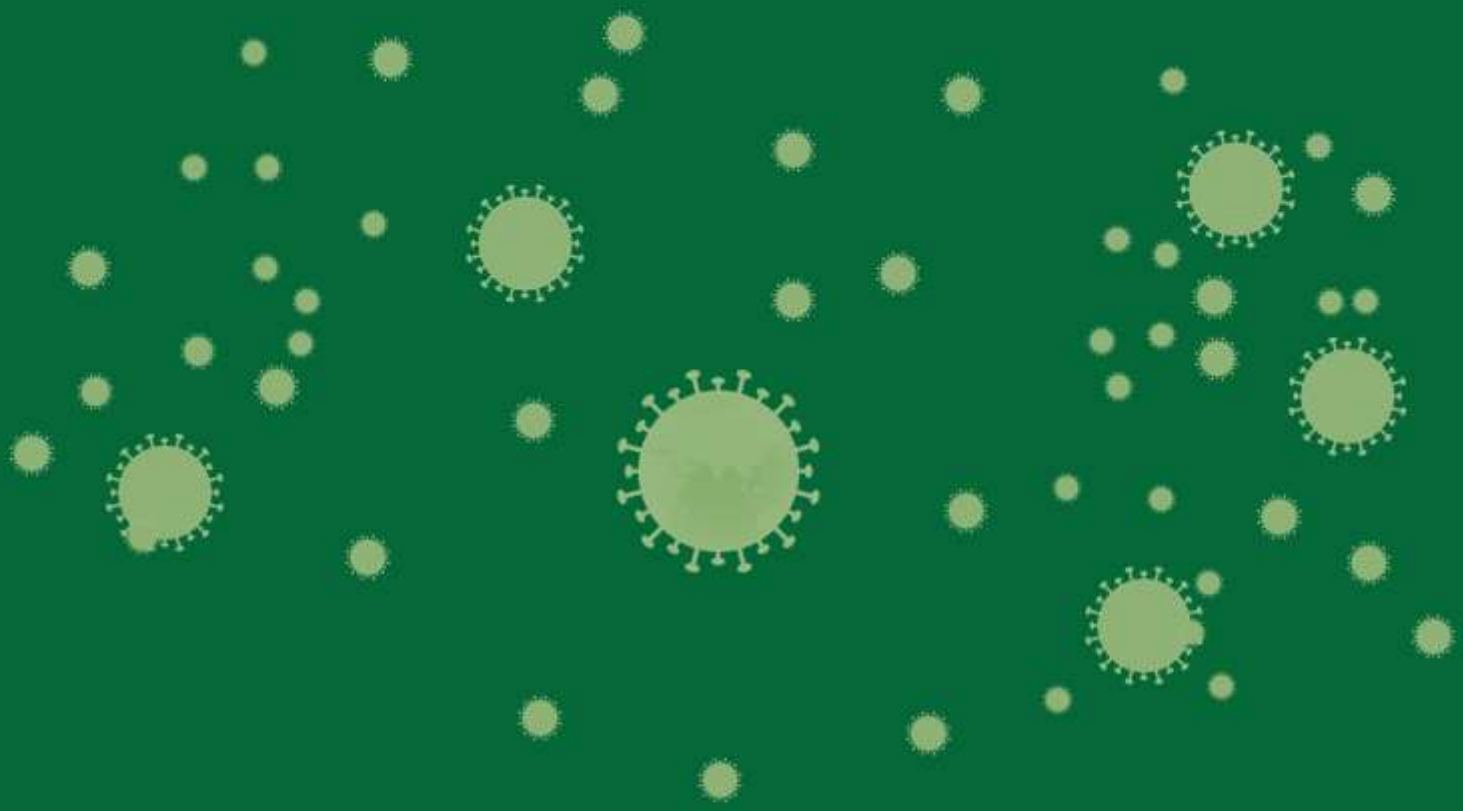

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