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

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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.

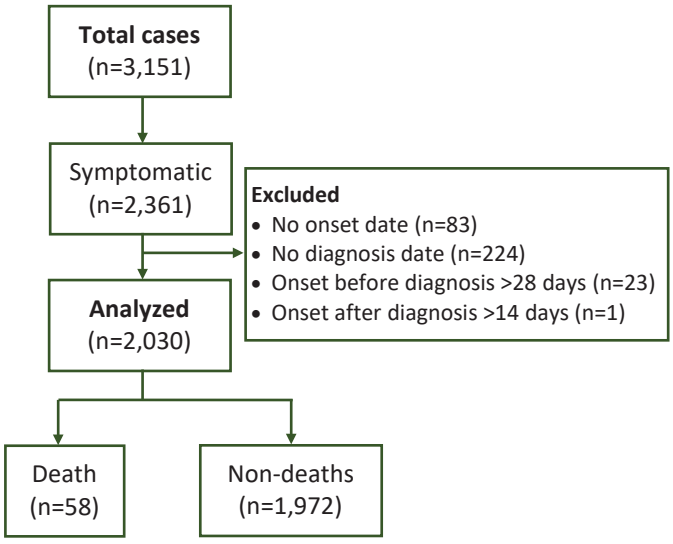

Figure 1. Flow diagram of the study

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.

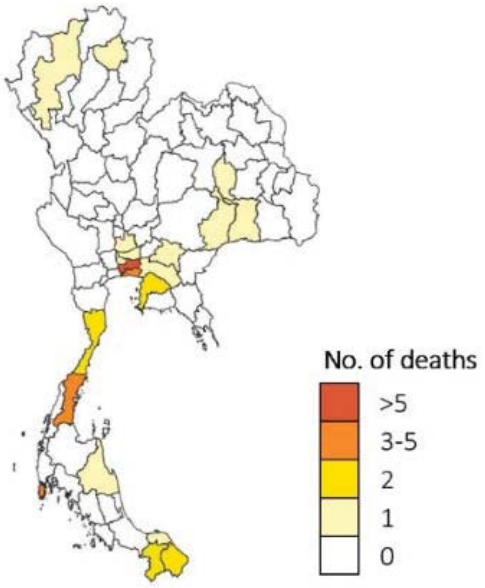

Figure 2. Number of deaths with COVID-19 by province of isolation/death (n=58)

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).

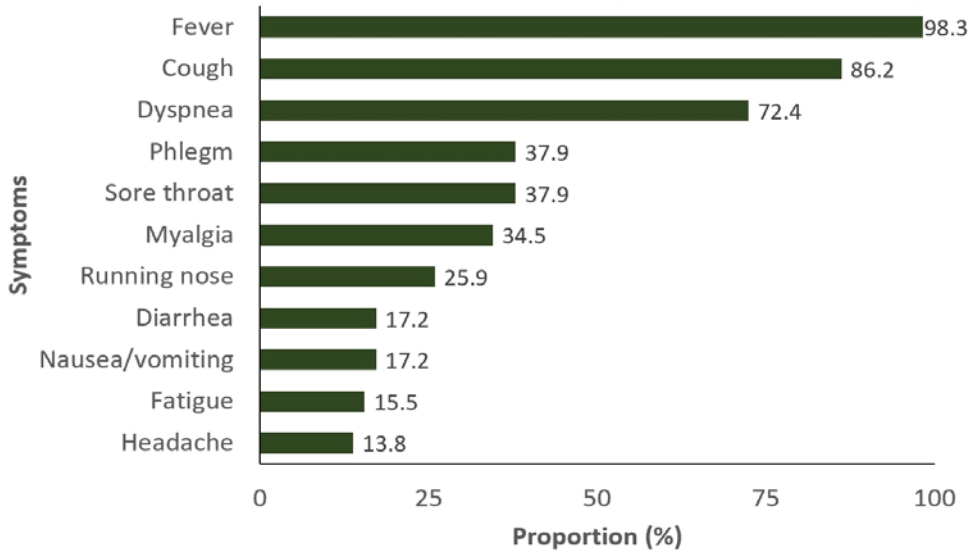

Figure 3. Symptoms of COVID-19 deaths at admission, January–June 2020, Thailand (n=58)

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.

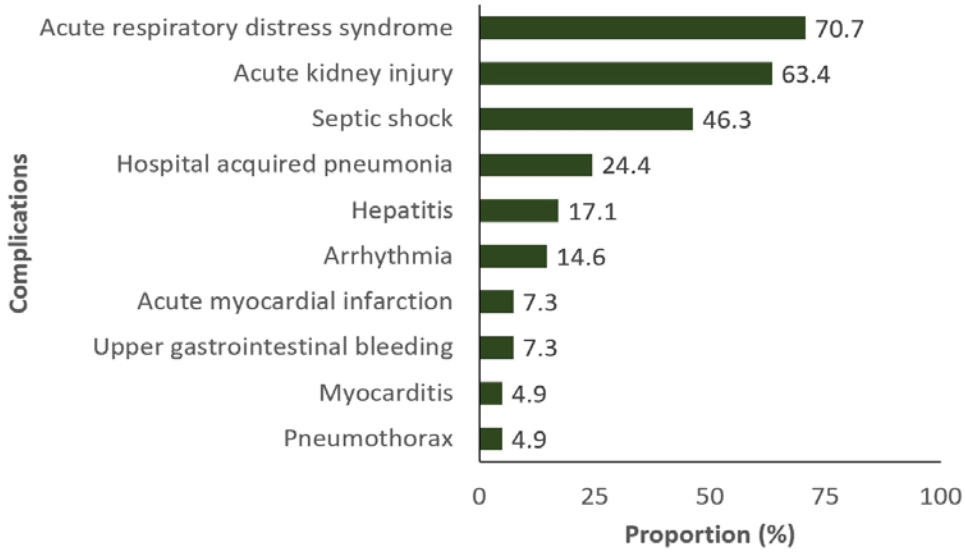

Figure 4. Complications of COVID-19 deaths, January–June 2020, Thailand (n=41)

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.

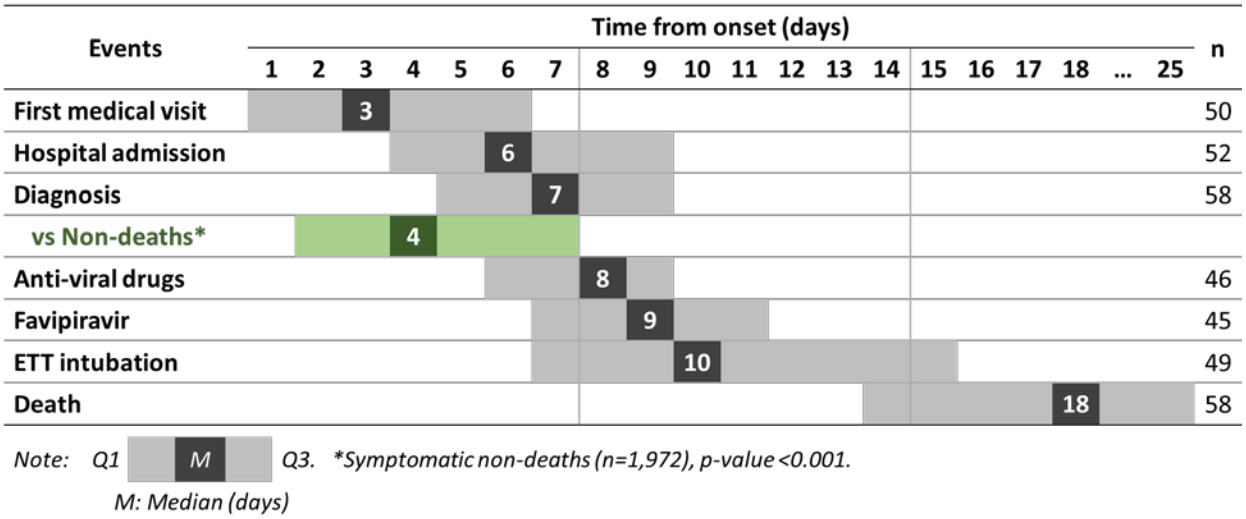

Figure 5. Median time and interquartile range from onset date to events

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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