

Analysis of community-acquired COVID-19 cases in Taiwan

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Abstract

Background: The demographic characteristics and transmission dynamics of the community-acquired coronavirus disease 2019 (COVID-19) cases in Taiwan were analyzed for more effective control and prevention of the community transmission of this novel disease.

Methods: Open-access data and press releases on COVID-19 in Taiwan were collected on the website of the Taiwan Centers for Disease Control. All 55 community-acquired cases of COVID-19 confirmed from January 28 to April 12, 2020, in Taiwan were included. Basic demographic characteristics, symptom presentation, infection source, route of identification, and transmission dynamics were analyzed.

Results: Of the 55 cases, 52.7% were female and 74.5% were between 20–59 years of age. One-sixth (16.4%) of community-acquired cases were asymptomatic. More than half (58.2%) of the cases were identified via contact tracing. The median incubation period was 6 days (range 1–13 d) and the median serial interval was 4 days (range –3–24 d). Twenty-six cases (47.3%) were transmitted from presymptomatic cases, 11 cases (20%) from symptomatic cases, and 2 cases (3.6%) from an asymptomatic case. The contagious period of symptomatic cases was from 7 days before to 15 days after the onset of symptoms.

Conclusion: The high proportion of asymptomatic cases and the transmissibility in the presymptomatic and asymptomatic periods make control of COVID-19 challenging. Protective measures such as social distancing, wearing face masks, and hand washing are mandatory to prevent community transmission.

Keywords: Asymptomatic infections; COVID-19; Disease transmission, infectious; Severe acute respiratory syndrome coronavirus 2; Taiwan

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerging in Wuhan, China, in December 2019,¹ became a global pandemic and spread to 188 countries with >10 million confirmed cases and 505 thousand deaths reported as of June 30, 2020.² The COVID-19 outbreak in Taiwan was well-contained by enforcement of proactive border control measures^{3–5} and Taiwanese cooperation with the recommended precautions such as maintaining social distancing, wearing face masks, and hand-washing. Taiwan has had no additional community-acquired cases of COVID-19 reported after April 12, 2020, although imported cases have been identified sporadically. As of June 18, 2020, a cumulative total of 446 cases of COVID-19 have been confirmed in Taiwan, including 355 imported cases, 55

community-acquired cases, and 36 cases among the naval crew members aboard the Panshih fast combat support ship of the Dunmu fleet.

COVID-19 was listed as a notifiable disease by the Taiwan Centers for Disease Control (CDC) on January 15, 2020. Hospitals and clinics must notify the health authorities of any COVID-19 cases and send specimens (either throat swab or sputum) to the Taiwan CDC for laboratory confirmation by reverse transcriptase polymerase chain reaction (RT-PCR). The patients who test positive for SARS-CoV-2 are admitted and isolated until viral clearance. Local health agencies conduct investigations and contact tracing within 24 hours of positive confirmation. All contacts are quarantined at home for 14 days for further monitoring, and close contacts or contacts showing symptoms are tested for COVID-19.

For more effective control of this novel disease and prevention of community spreading, we collected the data from community-acquired cases of COVID-19 in Taiwan to analyze the basic demographic characteristics, symptom presentation, infection source, route of identification, and transmission dynamics.

2. METHODS

2.1. Data collection

Open-access data and press releases concerning COVID-19 cases in Taiwan were collected from the Taiwan CDC website.⁶ The press releases, which included attached files, provided detailed

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information of the confirmed COVID-19 cases in Taiwan, such as category (imported or community-acquired), citizenship, sex, age group, travel history, contact history, date of disease onset, symptom presentation, date of specimen collection for COVID-19 testing and notification to health authorities, date of disease confirmation, and route of identification. The date of disease onset was defined as the date of symptom onset, incubation period as the time between exposure and symptom onset, and serial interval as the time interval from symptom onset of the primary case to symptom onset of the secondary case. A negative serial interval indicates an earlier onset of symptoms in the secondary case than in the primary case.

All 55 community-acquired cases of COVID-19 confirmed in Taiwan from January 28 to April 12, 2020, were included in this study. The relevant data from the imported cases and the cases aboard the Panshih fast combat support ship were used for comparison.

2.2. Statistics

Descriptive statistics and plots of age group, sex, incubation period, serial interval, days from the symptom onset of the primary case to the exposure of the secondary case, days from symptom onset to disease confirmation, and reproduction number (*R*) were performed using PASW Statistics 18 (SPSS, Chicago, IL, USA). Categorical data were compared using the chi-squared test. The *R* of the community-acquired cases was compared with the *R* of imported cases using a Student's *t*-test. A two-tailed *p* value of <0.05 was considered statistically significant. The plot of number of cases by date of symptom onset and infection source was drawn using Microsoft Excel 2013 (Microsoft Corporation, Redmond, WA, USA).

3. RESULTS

3.1. Basic characteristics and route of identification

Of the 55 community-acquired cases, 90.9% were Taiwanese, 52.7% were female, and 74.5% were between 20 and 59 years of age (Fig. 1). Of these 55 cases, five were foreign nationals (French, American, German, Austrian, and Indonesian).

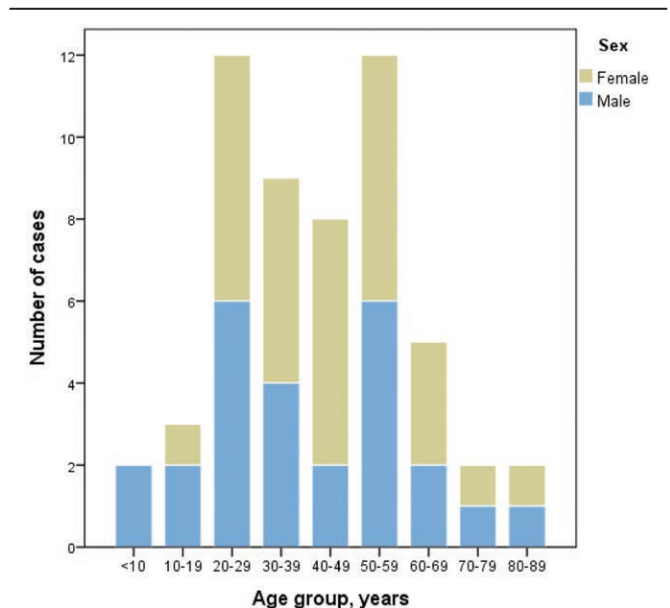


Fig. 1 Age and sex distribution of the 55 community-acquired COVID-19 cases in Taiwan.

Twenty-two (40%) of the cases were reported by hospitals and 32 cases (58.2%) were identified via contact tracing. One case (1.8%) was proactively found by the Taiwan CDC by testing the specimens of patients who were reported to have had severe complicated influenza but had tested negative for influenza (Table 1).

3.2. Symptom presentation

Only 54.5% of the community-acquired cases presented with fever. Two-thirds (65.5%) of the cases had respiratory symptoms including the following: cough (47.3%), sore throat (23.6%), rhinorrhea or nasal congestion (21.8%), dyspnea (5.5%), and chest tightness (1.8%). Some cases had influenza-like symptoms, such as malaise (14.5%), myalgia (7.3%), or headache (1.8%). Three cases (5.5%) had the neurological manifestations of anosmia or ageusia. Five cases (9.1%) had gastrointestinal manifestations,

Table 1.

Characteristics of the 55 Community-acquired COVID-19 Cases in Taiwan

	n	%
Sex		
Female	29	52.7
Male	26	47.3
Age group (y)		
<10	2	3.6
10-19	3	5.5
20-29	12	21.8
30-39	9	16.4
40-49	8	14.5
50-59	12	21.8
60-69	5	9.1
70-79	2	3.6
80-89	2	3.6
Citizenship		
Taiwanese	50	90.9
Non-Taiwanese	5	9.1
Route of identification		
Hospital notification	22	40.0
Contact tracing	32	58.2
Testing the specimens of patients notified as severe influenza	1	1.8
Infection source		
Confirmed or probable imported cases	22	40.0
Other community-acquired cases	23	41.8
Unknown	10	18.2
Site of disease transmission		
Household	17	30.9
Friends/family visit or dinner	10	18.2
Hospital-acquired	9	16.4
Workplace (excluding hospitals)	5	9.1
School or class	4	7.3
Unknown	10	18.2
Infectious period		
Symptomatic transmission	11	20.0
Presymptomatic transmission	26	47.3
Asymptomatic transmission	2	3.6
Unknown	16	29.1
Reproduction number		
0	43	78.2
1	7	12.7
2	2	3.6
3	1	1.8
4	1	1.8
5	1	1.8

such as diarrhea (5.5%), vomiting (1.8%), or abdominal pain (1.8%). One case (1.8%) had ocular pain (Table 2).

Nine cases (16.4%) did not develop symptoms but were identified through contact tracing. The asymptomatic proportions of the community-acquired cases, the imported cases, and the cases aboard the Panshih fast combat support ship were 16.4%, 3.9%, and 30.6%, respectively ($p < 0.01$) (Table 3).

3.3. Sites of disease transmission

Of the community-acquired cases, 30.9% were infected at home, 18.2% while visiting or dining with friends/family, 16.4% were hospital-acquired, 9.1% were infected in the workplace (other than a hospital), and 7.3% were infected in school or while taking a class (Table 1).

3.4. Infection source

Twenty (36.4%) community-acquired cases were infected by confirmed imported cases from the United States (eight cases), China (two cases), Egypt (two cases), Greece (two cases), France (one case), Netherlands (one case), Philippines (one case), Spain (one case), Turkey (one case), and Indonesia (one case). One of the community-acquired cases was infected by probable imported cases of COVID-19 from the United States, but they returned to the United States before laboratory confirmation could be performed. Another community-acquired case

was infected by a probable case of COVID-19 from Zhejiang, China, who had tested positive for SARS-CoV-2 antibodies. Twenty-three (41.8%) cases were infected by other community-acquired cases. Ten (18.2%) cases had an unknown infection source (Table 1).

3.5. Incubation period and serial interval

The median incubation period for 27 of the cases was 6 days (range, 1-13 d; mean, 6.0 d; SD 3.1 d) (Fig. 2). The median serial interval for 31 of the cases was 4 days (range, -3-24 d; mean, 5.1 d; SD, 5.6 d) (Fig. 3). Two cases had negative serial intervals, and two cases had a zero-serial interval.

3.6. Infectious period

Twenty-six cases (47.3%) were infected in the presymptomatic period of the primary cases. Eleven cases (20%) were infected in

Table 2.
Symptom Presentation in the 55 Community-acquired COVID-19 Cases in Taiwan

Category and Presentation	n	%
Generalized symptoms		
Fever	30	54.5
Chills	2	3.6
Malaise	8	14.5
Myalgias	4	7.3
Respiratory symptoms	36	65.5
Cough	26	47.3
Sore throat	13	23.6
Rhinorrhea, nasal congestion	12	21.8
Chest tightness	1	1.8
Dyspnea	3	5.5
Neurological symptoms	5	9.1
Anosmia or ageusia	3	5.5
Headache	1	1.8
Dizziness	1	1.8
Gastrointestinal symptoms	5	9.1
Diarrhea	3	5.5
Abdominal pain	1	1.8
Vomiting	1	1.8
Ophthalmic symptoms		
Ocular pain	1	1.8

Table 3.
Asymptomatic Proportion of Laboratory Confirmed COVID-19 Cases in Taiwan

Category	Confirmed Cases		Asymptomatic Cases	
	n	% ^a	n	% ^a
Imported	355	3.9	14	3.9
Community-acquired	55	16.4	9	16.4
Panshih fast combat support ship	36	30.6	11	30.6

^a $p < 0.01$ between all three categories, using a chi-squared test.

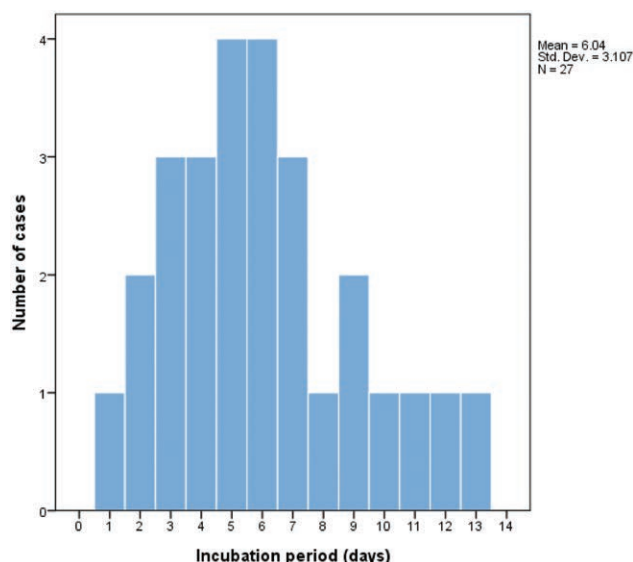


Fig. 2 Incubation period for 27 community-acquired COVID-19 cases in Taiwan.

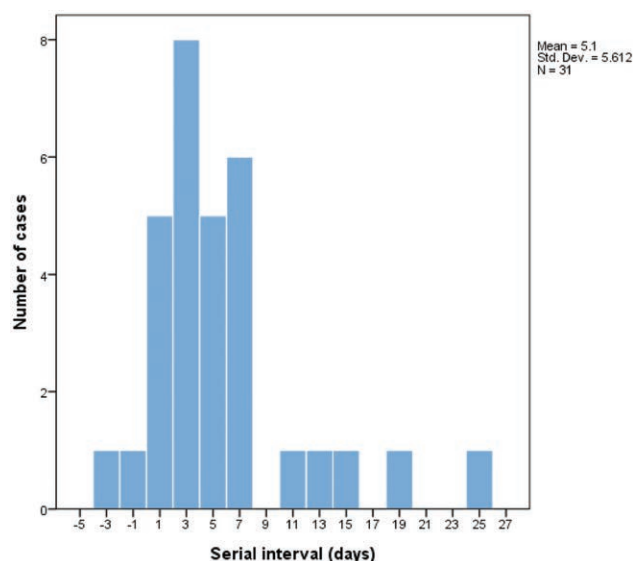


Fig. 3 Serial interval of 31 community-acquired COVID-19 cases in Taiwan.

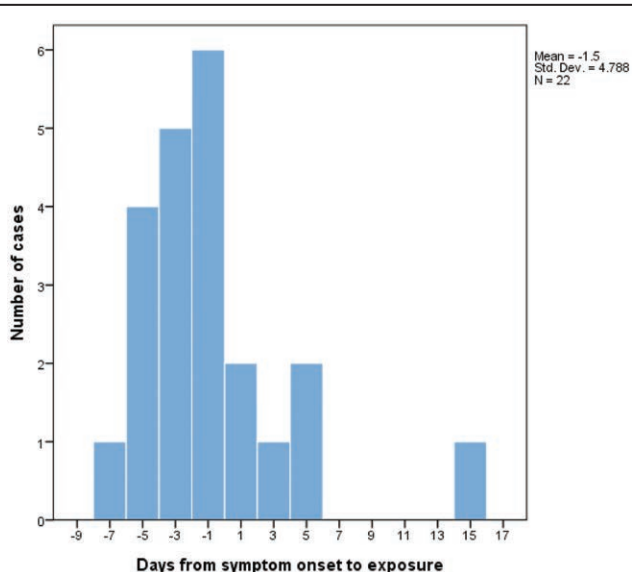


Fig. 4 Days from the symptom onset of the primary cases to the exposure of 22 community-acquired (secondary cases) COVID-19 cases in Taiwan.

the symptomatic period of the primary cases. Two cases (3.6%) were infected by an asymptomatic imported case. There was no available data for sixteen cases (29.1%). The median time from the symptom onset of the primary cases to the exposure of the secondary cases was -2 days (range, -7-15 d; mean, -1.5 d; SD, 4.8 d) for 22 of the cases (Fig. 4).

3.7. Reproduction number

Forty-three cases (78.2%) did not have secondary transmission events. Twelve cases transmitted the disease to 23 secondary cases, yielding an R of 1.92 (range, 1-5) for those 12 cases and 0.42 (range, 0-5) for all 55 cases.

One case, a woman over 50 years of age who was infected by the cleaning staff in a hospital during an emergency room visit, had an R of 5. She transmitted the disease to three nurses and two of her family members during hospitalization. One of the infected nurses further transmitted the disease to one patient and a family member of another patient in the same ward.

A total of nine COVID-19 cases was confirmed in this cluster of hospital-acquired infections.

Another case, a taxi driver over 60 years of age infected by a passenger just returning from Zhejiang, China, had an R of 4. He transmitted the disease to his four family members during the Lunar New Year family dinner and died of pneumonia complicated with acute respiratory distress syndrome on the date of the diagnosis. Two of his four infected family members remained asymptomatic.

The R of the community-acquired cases was significantly higher than that of the imported cases (0.42 vs 0.06; $p < 0.05$).

3.8. Time from symptom onset to disease confirmation

The mean time from symptom onset to confirmation by RT-PCR was 8.1 days (range, 0-28 d; SD, 7.7 d) for the 46 symptomatic cases. The mean time from exposure to confirmation by RT-PCR was 15.6 days (range, 4-29 d; SD, 8.4 d) for the nine asymptomatic cases (Fig. 5).

3.9. Case fatality rate

There were three deaths among the 55 community-acquired cases and four among the 355 imported cases. The case fatality rate of the community-acquired cases was significantly higher than that of the imported cases (5.5% vs 1.1%; $p < 0.05$).

4. DISCUSSION

Overemphasis on travel or contact history in the early diagnostic criteria of COVID-19 resulted in the missed diagnosis of some community-acquired cases. After the Taiwan CDC found the first community-acquired COVID-19 case on February 15, 2020, by testing the specimens of patients reported to have severe complicated influenza, the diagnostic criteria for COVID-19 was broadened accordingly. The new criteria included patients with unexplained pneumonia that did not improve with antibiotic treatment or patients with respiratory symptoms that did not improve after several outpatient visits. Several community-acquired clusters of COVID-19 infections were identified after this broadening of the diagnostic criteria. The earliest disease onset of the community-acquired cases was on January 22, 2020 (Fig. 6), for a woman over 60 years of age without any travel or contact history. She visited the local clinic several times due to a cough and fever before she was hospitalized for pneumonia

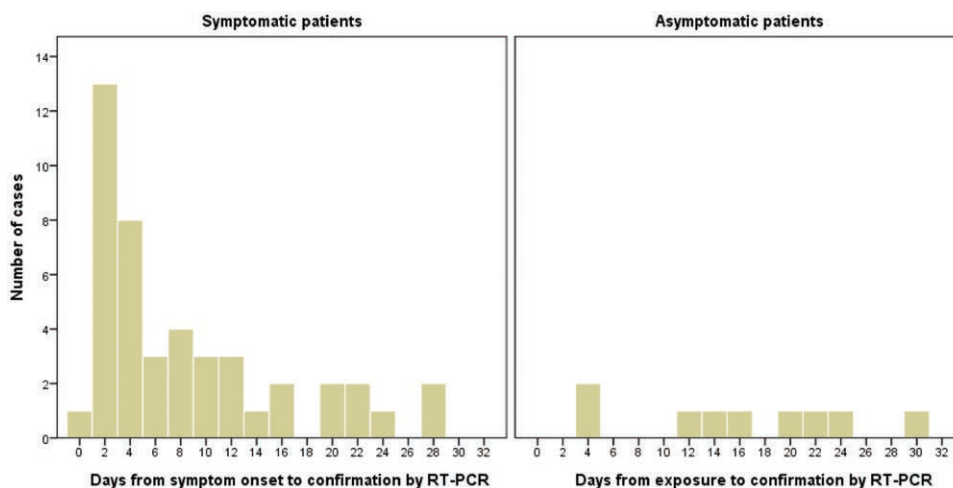


Fig. 5 Time from symptom onset (or exposure) to laboratory confirmation by RT-PCR for the 55 community-acquired COVID-19 cases in Taiwan. RT-PCR = reverse transcriptase polymerase chain reaction.

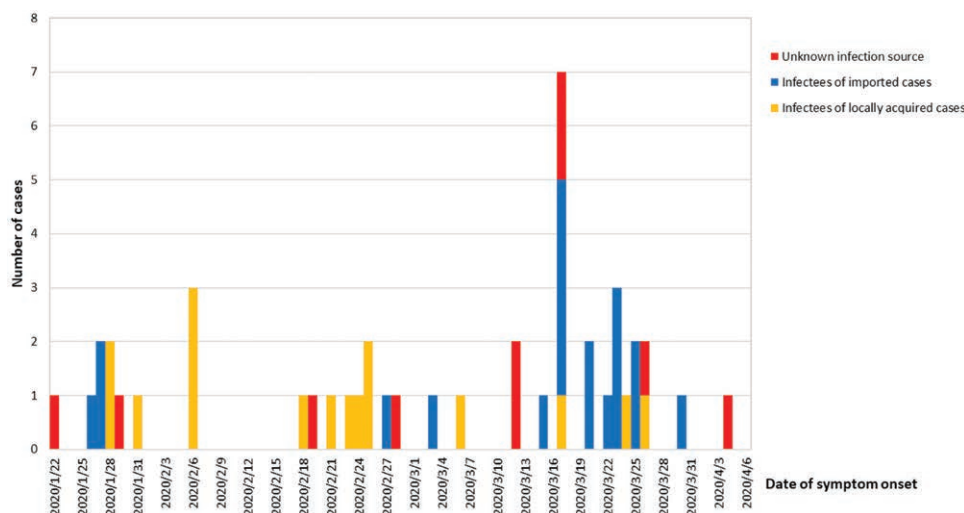


Fig. 6 Date of symptom onset and infection source of community-acquired COVID-19 cases in Taiwan (asymptomatic cases are not shown).

with acute respiratory distress syndrome. SARS-CoV-2 infection was confirmed 28 days after the onset of disease. Two of her family members were infected with COVID-19; one had mild symptoms and the other was asymptomatic.

The higher R and higher case fatality rate of the community-acquired cases compared with the imported cases was probably due to the delayed diagnosis and older age of the patients.

The symptoms of the COVID-19 cases were not limited to respiratory tracts. One-third (34.5%) of the community-acquired cases did not have respiratory symptoms. A small portion of the cases had neurological or gastrointestinal symptoms.⁷ One-sixth (16.4%) of the community-acquired cases and one-third (30.3%) of the cases aboard the Panshih fast combat support ship were asymptomatic. The asymptomatic proportion of COVID-19 cases was reported to be between 12% and 30.8%.^{8–10} The low asymptomatic proportion (3.9%) in the imported cases might be due to the symptom-based testing strategy. Only symptomatic travelers were tested for COVID-19 during airport screening. Travelers who did not display symptoms during the 14-day home quarantine were not tested for COVID-19, except if they were close contacts of confirmed cases. On the contrary, all close contacts of the community-acquired cases and all 377 naval crew members aboard the Panshih fast combat support ship were tested, regardless of the presence of symptoms or not. Asymptomatic cases are proved to have transmissibility.^{11–13} Symptom-based screening strategies may miss some asymptomatic cases.¹⁴ The cluster of COVID-19 infections in the Panshih fast combat support ship was suspected to be derived from asymptomatic cases on board. There might be undetected asymptomatic cases in the community and the number of the community-acquired cases might be underestimated. That is the limitation of this study.

The serial intervals were shorter than the incubation periods in many of our community-acquired cases, which suggested presymptomatic infection.^{15–18} Presymptomatic cases have similar transmissibility as symptomatic cases.^{19,20} The contagious period of COVID-19 cases in this study was from 7 days before to 15 days after symptoms onset (Fig. 4), which is compatible with the evidence that the viral loads of COVID-19 patients is highest from 6 days before to 9 days after symptoms onset.²⁰

In conclusion, the high proportion of asymptomatic cases and the transmissibility in the presymptomatic and asymptomatic periods make controlling COVID-19 challenging. Protective measures such as social distancing, wearing face

masks, and hand washing are mandatory to prevent community transmission.^{21,22}

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