COVID-19 Special Issue 1

A COVID-19 Outbreak in A County, Republic of Korea

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Abstract

A total of eleven coronavirus infection-19 (COVID-19) cases were reported on April 5th, 2020 after the first confirmed case was reported in A County on March 24th, 2020. A County is Chungcheongnam-do Province. The Chungcheongnam-do rapid response team and the A County Health Center conducted an epidemiological survey to identify the outbreak, determine the extent of the outbreak, prevent transmission, and prevent further outbreaks.

This report examined the epidemiological investigation process of the eleven confirmed case by using the data of the A County Health Center and the on-site epidemiological investigation report of the rapid response team. In addition, this report calculated and analyzed the general characteristics.

The report found that nine out of the eleven confirmed cases occurred at a church gathering. Furthermore, an epidemiological survey confirmed that some of the church's congregation wore masks with inadequate protection and many worshippers did not observe social distancing. A complete survey was conducted on April 1st for the individuals who attended the last worship which is on March 22nd to confirm cases and then conducted total complete survey on April 3rd for the rest in the church, but there were no additional confirmed cases. Out of the eleven cases, one was an imported case and one was a confirmed case from a community with no epidemiological connection.

The report found the following general characteristics of the eleven confirmed cases. There were-five males (45.5%) and, six females (55.5%). The average age was 49.8 (21-78) with a median age of 48. Ten cases were domestic (90.9%), and one case was an imported case from Britain (9.1%). In terms of initial symptoms, six cases (25.0 %) had fever or heat sensation, five had cough or sputum (20.8 %), and four patients (16.7 %) had chills. The initial symptoms of the confirmed cases were mostly minor and non-specific and were not significantly much different from known COVID-19 cases. A total of 121 people were classified according to the guidelines as contact persons of the eleven confirmed cases. The contact cases were managed by A County Health Center. This report concluded that locations that foster large gatherings, such as those found in religious facilities, must be managed by establishing effective response strategies and by sharing epidemiological and clinical analysis data on COVID-19.

Keywords: Coronavirus Disease-19 (COVID-19), Church, Outbreaks, Epidemiological monitoring

Introduction

In South Korea, by midnight on April 12, 2020, a total of 10,537 positive cases of coronavirus disease 2019 (COVID-19) had been recorded, with 217 deaths [1]. From the first reported case on January 20 to February 20, when an outbreak related to the Shincheonji religious group started, the average number of new positive cases per day was 1.5 [2]. However, with the surge in cases due to the community outbreak among Shincheonji followers in the Daegu and Gyeongbuk region, the number of new cases per day peaked at 813 on February 29. Subsequently, the central government's infection control and social distancing measures reduced the number of new cases, which dropped to 25 by April 13. However, additional localized outbreaks have been

reported in relation to closed spaces where close contact among people occurs for a prolonged period of time, such as a church in Seongnam, a church in Suwon, and a church in Busan. Similarly, outbreaks have been reported in other countries in closed spaces where frequent person-to-person contact occurs, such as a jail in China and residential care facilities in the United States [3].

Chungcheongnam-do Province first reported a case in Gyeryong on February 21, and subsequently had outbreaks of 102 cases in relation to a Zumba dance facility in Cheonan and eight cases in the Seosan industrial complex. On April 10, 138 positive cases were reported. A community outbreak in relation to a church was identified during the epidemiological investigation of 11 positive cases in A County from March 24 to April 5. Nine cases were tied to the church, one case was imported, and one case was due to an unrelated community infection. This report presents the results of the epidemiological investigation of 11 COVID-19 cases in A County from March 24 to April 5, 2020. The process of the epidemiological investigation is described using data from the A County health clinic and the field epidemiological investigation report from the rapid response team. General characteristics, the epidemic curve, and relationship diagrams were calculated for analysis.

Result

Process of the epidemiological investigation

The first and second positive cases in A County, Chungcheongnam-do Province on March 24 were a married couple. Case #1 had experienced muscle pain and fever since March 20. After a few days, the symptoms worsened, so the patient remained at home without going out. The patient suspected COVID-19 infection once the symptoms did not improve and tested positive for COVID-19 at a testing center in a hospital in A County on March 23. Case #2 experienced fever starting on March 21 and tested positive together with case #1. Case #1 did not report any activities outside of the home since a day prior to symptom onset, and contact tracing was conducted to determine the location of exposure (e.g., the workplace, church, home, or the supermarket that case #2 visited). The final list of contacts included two family members, 32 employees in the workplace (an insurance company), two insurance clients, and four church members.

The third positive case identified on March 27 was a contact of case #2. Case #3 was already in quarantine at home, so the three family members that shared the home were classified as contacts. The fourth case, who was identified on the same day, was an imported case that did not have epidemiological relevance to the church.

The epidemiological investigation concluded that the fifth positive case identified on March 30 was not linked to the church and classified the case as unidentified community infection.

The epidemiological investigation of case #6, who was identified on March 31, confirmed that case #6 attended the same church as cases #1 to #3. The identified contacts of case #6 included one family member, one medical provider (as case #6 visited a medical facility), two other patients at the medical facility, and one acquaintance. Case #7, who was identified on the same day, was a contact of case #2 who was already in quarantine and did not have any further contacts.

On April 1, COVID-19 was detected in two other church members (cases #8 and #9). The epidemiological investigation of case #8 identified one family member and two shop owners in a market as contacts. For case #9, the contacts included one family member, six people in a restaurant, one person in a hair salon, and one acquaintance.

Case #11, who was identified on April 5, was the spouse of case #6 and a member of the church related to the outbreak. 4on April 1, but subsequently experienced COVID-19 symptoms and received a second test on April 5 that came back positive. Case #11 did not have any further contacts.

The number of contacts of the 11 confirmed cases was 121, including 13 family members who lived with the positive cases, 33 colleagues, four church members, 13 acquaintances, and 49 community contacts. Those who were listed as contacts were ordered to quarantine for 14 days by the health clinic. If the contacts experienced COVID-19-related symptoms during self-quarantine, they could immediately get tested at a testing site. The locations visited by the confirmed cases were sterilized immediately.

Among the 11 confirmed cases in A County that were identified from March 24 to April 5, 2020, nine were related to the church, with the rest being one imported case and one epidemiologically unrelated case of unidentified community

Table 1. Demographic characteristics of eleven COVID-19 confirmed cases in A County, Republic of Korea (n=11)

Characteristics		n	%
Sex			
	Male	5	45.5
	Female	6	55.5
Age			
	20–29	1	9.1
	30–39	2	18.2
	40–49	3	27.3
	50–59	2	18.2
	60–69	1	9.1
	≥70	2	18.2
	Mean±SD	49.8±16.5 (Median 48.0)	
Nationality			
	Korean	10	90.9
	The United Kingdom	1	9.1
Sings and Symptoms at on onset (can be duplicated)			
Respiratory Symptom			
	Fever, Heat sensation	6	25.0
	Sore Throat	2	8.3
	Cough or Sputum	5	20.8
	Runny nose	1	4.1
Other symptoms			
	Muscle ache	3	12.5
	Chills	4	16.7
	Vomiting	2	8.3
	Headache	1	4.1

infection. While investigating the cases related to the outbreak in the church, it was identified that social distancing was not adhered to inside the church and that some church members did not wear masks properly. Thus, the common exposure date was set as March 22, which was the date of the last service. When two of the church members were first identified as COVID-19 cases, the risk exposure for those who attended the same service on the same date was regarded as low, so the entire church was not designated as at risk. However, since COVID-19-positive cases were reported both among church members identified as contacts and those who were not identified as contacts, all 190 church members who attended the service on March 22 were tested, and two additional positive cases were identified. To find hidden infection cases, all 390 registered members of the church, including 190 who attended the service on March 22, were tested, but there were no further positive cases. The list of church members was compared to the list of Shincheonji followers, but none of the church members were associated with the Shincheonji religious group. The remaining two of the 11 total positive cases were checked for relevance to the church. One case started experiencing symptoms on the same day as arrival and thus did not have any epidemiological relationship with the church. The other case was a church-goer, but went to a different church that did not have epidemiological relevance to the church where the outbreak was identified.

Since the date of symptom onset only differed by one day between case #1 and #2, who were a married couple and shared a daily routine, it was hypothesized that they were infected by an unknown index case and started the outbreak. In order to investigate the exact route of infection, global positioning system (GPS), which is a satellite location system, and Drug Utilization Review (DUR), which is a service to ensure the safety of drug prescriptions, records were analyzed. The results suggested that cases #1 and #2 had no history of traveling abroad or to Daegu and did not visit any locations other than the ones reported.

General Characteristics

Among the 11 confirmed cases, five were male (45.5%), and six were female (55.5%). The mean, median, and range of age

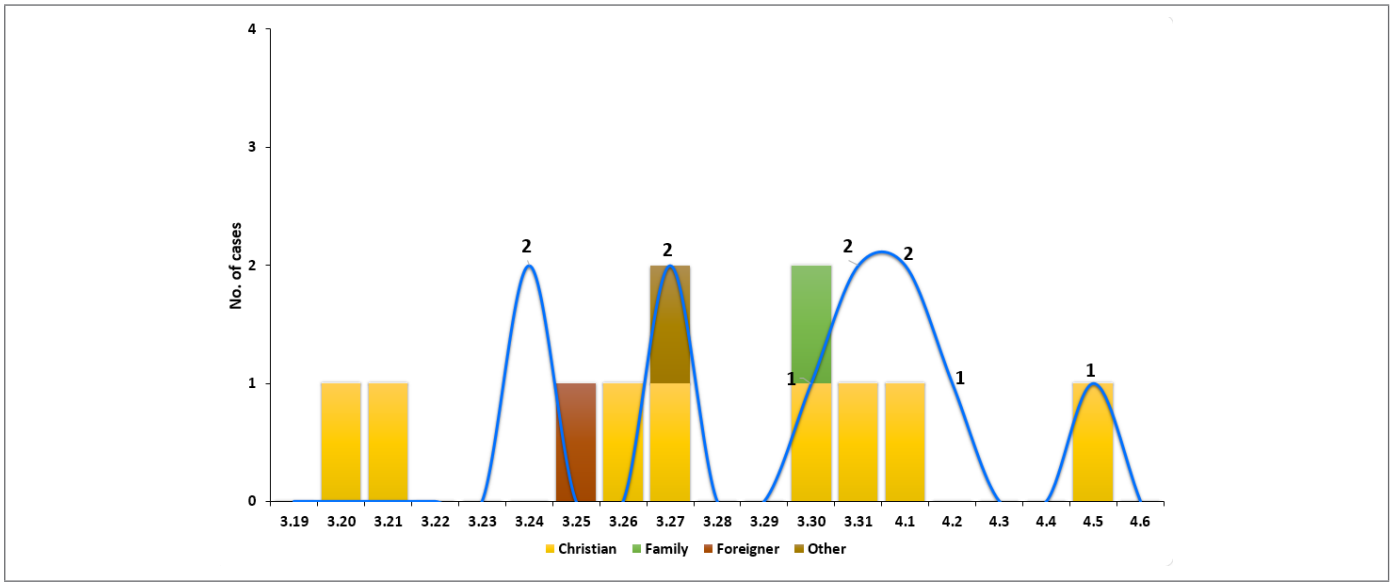

Figure 1. The epidemiological curves of the Signs and symptoms of the eleven COVID-19 cases at the onset date in A County, Republic of Korea

were 49.8 years, 48 years, and 21 to 78 years, respectively. Three cases were in their 40s (27.3%); two were in their 30s, 50s, and 70s, respectively (18.2% in each category); and one each was in their 20s or 60s (9.1% in each category). Ten of the patients were A County residents, and one was British. The initial symptoms reported by the confirmed cases were fever or heat sensation in six cases (25.0%), cough or phlegm in five cases (20.8%), chills in four cases (16.7%), muscle pain in three cases (12.5%), sinus pressure in two cases (8.3%), vomiting in two cases (8.3%), and one case each for runny nose and headache (4.1% each) (Table 1).

Epidemic Curve

The first symptoms were recorded on March 20, 2020, and the onset of symptoms (bar graph) continued through April 5, with a relatively even distribution throughout this period. The dates of the positive tests (line graph) were also dispersed like the onset of symptoms, with two positive tests from March 20 to 21, four from March 25 to 27, four from March 30 to April 1, and one on April 5 (Figure 1).

Relationship Diagram

As shown in the relationship diagram of the 11 confirmed cases in A County, Chungcheongnam-do Province from March 24 to April 5, cases #1 and #2 were infected by an unknown index case. Cases #3 and #7, who were in the church broadcast room with case #2 during the March 22 church service, tested positive. Cases #8 and #9, who attended the same service on the same day and sat directly in front of and behind case #6 in the worship room, also tested positive. Family members of case #6 (case #11) and case #9 (case #10) were infected. Case #4 was an

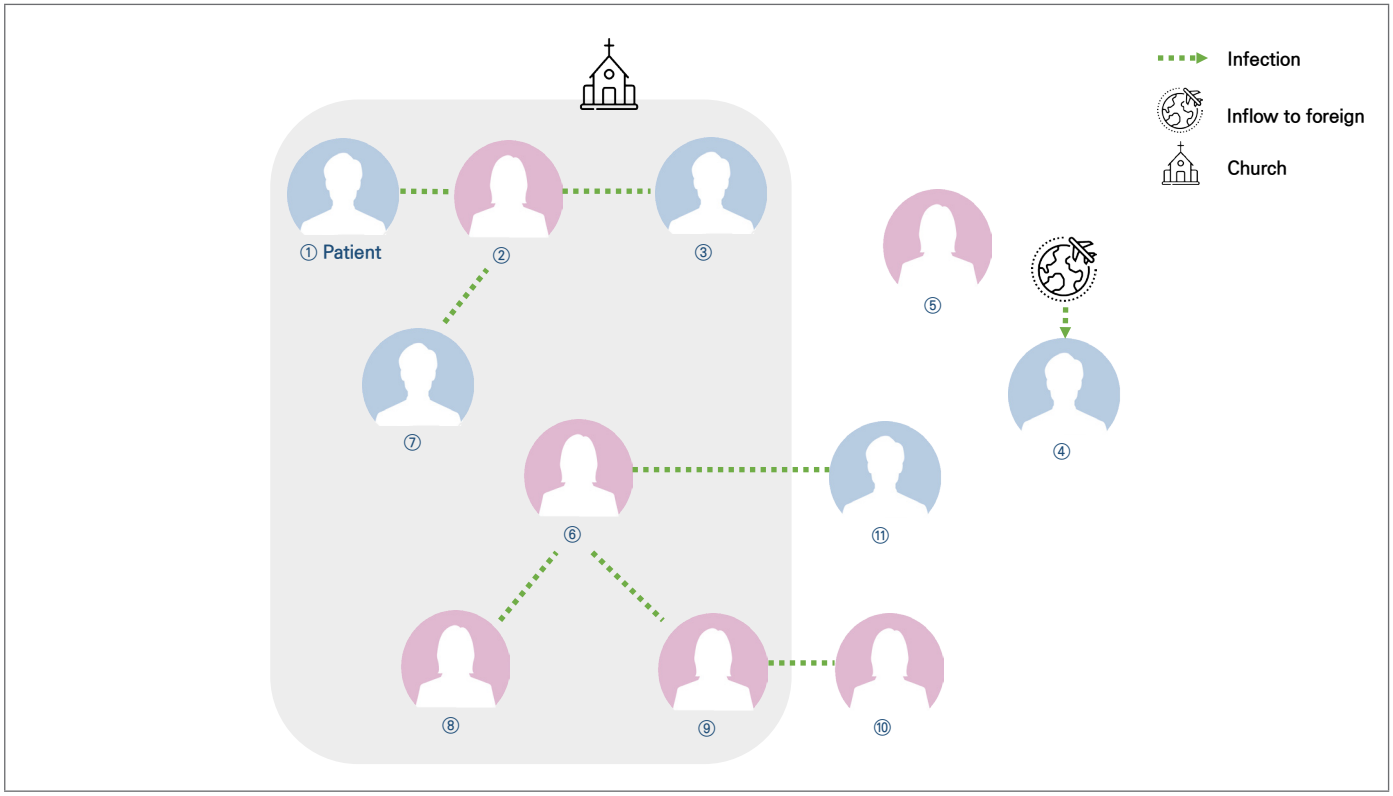

Figure 2. Relationship diagram of the first Coronavirus Disease-19 (COVID-19) cases in A County, Republic of Korea

imported case, from whom no community infections resulted. Case #5 was infected from an unknown case, did not show epidemiological relevance to the church where the outbreak occurred, and did not result in further community infection (Figure 2).

Conclusion

From March 24 to April 5, 2020, 11 COVID-19 cases were confirmed in A County. Nine of these cases occurred in relation to a church, and the remaining two occurred sporadically. In the church where the outbreak was identified, the initial infections occurred through religious activities among church members, and the infection was transmitted to the families of church members, resulting in an outbreak. This finding demonstrates that ordinary religious activities in various religious groups, not just Shincheonji activities, can lead to outbreaks of COVID-19. Religious activities in church include reading Bible verses aloud and singing hymns in a closed space with close contact and little to no movement for about 1 hour. Since COVID-19 is transmitted through droplets, these characteristics make an outbreak highly likely if a church member is infected with COVID-19. The remaining two cases were an imported case and an infection from an unknown source with no epidemiological relation to the church. The sex ratio among the 11 confirmed cases was even, and the age range was broad. The primary symptoms were consistent with known COVID-19 symptoms, including high rates of fever or heat sensation and respiratory symptoms such as cough and phlegm.

The vast majority (81.5%) of all COVID-19 cases in South Korea (as of April 13) were related to community outbreaks in spaces where many people are concentrated and droplets are easily produced, such as religious groups, care facilities and hospitals, and call centers. In the church in A County where the outbreak occurred, a high risk of exposure to droplets was identified, as there was less than 2 m of distance between church members and suboptimal mask wearing [1].

Although the rate of new COVID-19 cases is reducing in response to control measures by the central government and intense social distancing measures, local outbreaks can occur anywhere, and in order to prevent further outbreaks, it is necessary to analyze and share the processes of epidemiological investigation and epidemiological information from any outbreaks that occur, including these confirmed cases in A County, Chungcheongnam-do Province.

During the epidemiological investigation, the response guideline was revised on April 2, and the criterion for identifying contacts was revised from those who contacted a case 1 day before symptom onset to those who contacted a case 2 days before symptom onset. If the epidemiological investigation of the first patients in A County had initially been conducted according to the revised guidelines, everyone who subsequently was identified as positive from the church community would have been classified as contacts, and early detection and minimization of contacts would have been possible.

Although the number of COVID-19 cases in South Korea is showing a downward trend, the occurrence of multiple localized outbreaks associated with church groups shows that the spread of COVID-19 in religious facilities should be contained by avoiding in-person services, recommending online services, and making sure that COVID-19 prevention measures (wearing masks, checking temperature, social distancing, sterilizing the space, using hand sanitizers, and listing participants) are adhered to during in-person services. The results of this study were based on the results of the epidemiological investigations that have been conducted so far, meaning that the results of the analysis might change depending on further investigation.

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① What was previously known?

Local outbreaks of COVID-19 in religious groups in South Korea started with the religious activities of the Shincheonji group.

② What is newly added?

The report demonstrated that usual religious activities in various religious groups can lead to an outbreak of COVID-19. Religious activities in church include reading Bible verses aloud and singing hymns in a closed space with close contact and little to no movement for about 1 hour. Since COVID-19 is transmitted through droplets, these characteristics make an outbreak highly likely if a church member is infected.

③ Implications?

Since there have been several outbreaks related to churches, the spread of COVID-19 in religious facilities should be contained by avoiding in-person services, recommending online services, and making sure that COVID-19 prevention measures (wearing masks, checking temperature, social distancing, sterilizing the space, using hand sanitizers, and listing participants) are adhered to during in-person services.

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