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Operation and Management of Seoul Metropolitan City Community Treatment Center for Mild Condition COVID-19 Patients

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ABSTRACT

Background: In response to the disaster of coronavirus disease 2019 (COVID-19) pandemic, Seoul Metropolitan Government (SMG) established a patient facility for mild condition patients other than hospital. This study was conducted to investigate the operation and necessary resources of a community treatment center (CTC) operated in Seoul, a metropolitan city with a population of 10 million.
Methods: To respond COVID-19 epidemic, the SMG designated 5 municipal hospitals as dedicated COVID-19 hospitals and implemented one CTC cooperated with the Boramae Municipal Hospital for COVID-19 patients in Seoul. As a retrospective cross-sectional observational study, retrospective medical records review was conducted for patients admitted to the Seoul CTC. The admission and discharge route of CTC patients were investigated. The patient characteristics were compared according to route of discharge whether the patient was discharged to home or transferred to hospital. To report the operation of CTC, the daily mean number of tests (reverse transcription polymerase chain reaction and chest X-ray) and consultations by medical staffs were calculated per week. The list of frequent used medications and who used medication most frequently were investigated.
Results: Until May 27 when the Seoul CTC was closed, 26.5% (n = 213) of total 803 COVID-19 patients in Seoul were admitted to the CTC. It was 35.7% (n = 213) of 597 newly diagnosed patients in Seoul during the 11 weeks of operation. The median length of stay was 21 days (interquartile range, 12–29 days). A total of 191 patients (89.7%) were discharged to home after virologic remission and 22 (10.3%) were transferred to hospital for further treatment. Fifty percent of transferred patients were within a week since CTC admission. Daily 2.5–3.6

Disclosure
The authors have no potential conflicts of interest to disclose.

Author Contributions
Conceptualization: Kim BG, Song KJ. Data curation: Lim CS, Chai YJ, Lee JK, Kim SH. Investigation: Lim HJ. Resources: Choi YJ, Lee JK, Kim SH. Supervision: Lim CS, Kim BG, Song KJ. Writing - original draft: Lee SY, Lim HJ. Writing - review & editing: Song KJ.

consultations by doctors or nurses and 0.4–0.9 tests were provided to one patient. The most frequently prescribed medication was symptomatic medication for COVID-19 (cough/sputum and rhinorrhea). The next ranking was psychiatric medication for sleep problem and depression/anxiety, which was prescribed more than digestive drug.
Conclusion: In the time of an infectious disease disaster, a metropolitan city can operate a temporary patient facility such as CTC to make a surge capacity and appropriately allocate scarce medical resource.

Keywords: COVID-19; Community Treatment Center; Surge Capacity; Disaster

INTRODUCTION

A disaster is a major public health problem.[1] A medical disaster is a situation where needs of health care overwhelm the ability of a community to meet the demand for that.[2] In addition to disaster such as typhoons and floods that traditionally caused a lot of casualties, emerging infectious disease is becoming an major global disaster with increasing population mobility around the world.[3] Severe acute respiratory syndrome (SARS) in 2002 and influenza A (H1N1) in 2009 caused many patients worldwide, and in 2015, Middle East respiratory syndrome (MERS) spread in Middle east Asia and Korea.[4,5]

With the pandemic of coronavirus disease 2019 (COVID-19) in 2020, infectious disease patients have exploded worldwide.[6] The rapid increase of the patients led to a shortage of medical resources such as negative-pressure isolation unit and ventilators.[7] Not only COVID-19 patients, but also patients with other disease did not receive adequate treatment due to lack of medical resources and deaths increased.[8,9] Although in all kinds of disasters the rapid increase of patients can lead to a shortage of medical resources, this problem is more serious in an infectious disease disaster.[8,10] Because it not only prevents patients receiving adequate treatment, but also spreads infection and increase the patients due to the failure of isolation of infected patients.[11] To properly respond to pandemic, surge capacity must be prepared in advance.[12]

Previous studies on disaster response have been mainly conducted on first aid and emergency response for suddenly occurring emergency patients.[13,14] In the case of infectious disease disaster, most of the studies were about changes in healthcare use or relocation of resources in hospital.[15,16] As with COVID-19 in 2020, it is uncommon that large number of patients exceeding the capacity of hospitals require continuous medical treatment. Despite the importance of building surge capacity for the treatment and isolation of infectious patients, there is insufficient research on how to prepare and operate surge capacity in a community.

To respond the shortage of medical resource due to COVID-19 outbreak, the Korean government introduced a temporary patient facility called community treatment centers (CTCs). CTC is an intermediate model between home and hospital that isolate and monitor patients in a facility previously used as accommodation.[17] Several studies were published on the model of CTC and the characteristics of mild condition patients admitted to CTC.[17-19] However, as a disaster response facility in the community, it was unknown that what proportions of patients were admitted to the CTC in the community and how many tests were performed and how many medications were prescribed for mild patients. The Seoul Metropolitan Government (SMG) operated Seoul Tae Neung CTC (Seoul CTC) in cooperation with the

one municipal hospital for mild condition COVID-19 patients in Seoul. The purpose of this study was to investigate patient care and facility operation at a temporary patient facility for infectious disease pandemic in a metropolitan city.

METHODS

This is a cross-sectional observational study using a retrospective medical records review data.

Study setting

In Korea, the outbreak spread at a religious facility in February. As the patient suddenly surged in Daegu city and its surrounding North Gyeongsang province, there was a shortage of hospital. Nearly 2,300 people were left waiting for admission and at least two patients died before admission.[20] With the growing need for expanding patient facilities, in March 2020, the Korean government decided to run CTC. By converting existing accommodation facility, the patient was quarantined in a room equipped with a toilet and medical staff were dispatched from the hospital.[17] Chest X-ray (CXR) and reverse transcription polymerase chain reaction (RT-PCR) test were performed with portable X-ray equipment to determine patient deterioration and virologic remission. To minimize the risk of infection transmission, telemedicine was used to provide patient consultation using smartphone video-call.[17]

Admission targets of CTC are mild condition patients with minimal or no symptoms according to the criteria of the Korea Centers for Disease Control and Prevention (KCDC). When the patients were diagnosed, critically ill patients were admitted to the hospital and mild condition patients were admitted to the CTC through triage. Patients in CTC were transferred to the hospital when symptoms worsened, and patients in hospital were transferred to CTC when symptoms improved to reserve hospital resources. According to the guideline of the Korea CDC, If the RT-PCR test was negative twice every 24 hours, the patients were released from quarantine and discharged to home.[17]

Seoul is the capital city of Korea, with a population of 10 million at 605 km^2. There are 279 hospital including 7 public hospitals. During the COVID-19 epidemic, as a metropolitan city with a high population density, not only patient influx from abroad but also small infection spread continued in the community.[21,22] To respond COVID-19 outbreak, SMG operated 82 testing centers and designated 5 public hospitals as dedicated COVID-19 hospitals. In March 16, after large call center outbreak, SMG implemented its own CTC for mild condition patients in Seoul.[22]

Intervention – Seoul CTC

The residence facility for sports players outside the city (Taeneung national athelete village) was converted to CTC (Seoul CTC). The Seoul CTC has a total of 208 rooms and was able to hospitalize 208 patients. SMG was in charge of overall operation of the CTC and the Seoul Metropolitan Government Boramae Medical Center, a municipal hospital, was in charge of the medical operation and dispatched medical staffs to CTC. Every day, 5 doctors worked during the day and one worked at night. All of the doctors were specialists. Since the specialty of the doctors was not specifically restricted, all specialists in all departments of Boramae Medical Center were dispatched with a set duty. Nurses worked in 3 shifts, with 4 nurses in the daytime and 2 nurses in the evening and at night-time. Routinely, 3 times of consultation (1 by doctor and 2 by nurse) was provided a day using a smartphone video-call function. If vital

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signs or symptom worsening were observed during the consultation, the doctor in charge of the patient at that time comprehensively judged the findings and decided to transfer to the hospital. When medical staff determined that a psychiatric consultation was necessary during the routine consultation, psychiatric consultation was provided by psychiatric specialist in the hospital by video-call. The CTC did not provide an anti-viral agent for COVID-19 but provided 21 symptomatic medications (**Supplementary Table 1**). Antipyretic drugs were provided to all patients at the time of admission, and other drugs were provided in necessary daily base. CXR was performed at the time of admission and repeated as needed. RT-PCR test was conducted regularly (24 hours after negative result and 3 days after positive result). The Seoul CTC was closed on May 27 according to the decrease of COVID-19 patients in Seoul.

Study population

According to the criteria by KCDC, mild and asymptomatic patients were admitted to CTC. The criteria for asymptomatic are as follows; alert, < 50 years old no underlying disease, non-smoker, and < 37.5°C without antipyretic drugs. The criteria for mild are alert and meeting one or more of the follows; < 50 years old, one or more underlying diseases, and < 38°C with antipyretic drugs.[17] The following patients were classified as high-risk groups and were not admitted to CTC; > 65 years old, oxygen saturation < 90% in room air, severe underlying disease such as cancer, pregnancy, on dialysis, very obese, and transplanted patients.

All 213 patients who were admitted to Seoul CTC during the operation period of Seoul CTC (from March 16 to May 27) were included in the study.

Variables and measures

The following information was collected through a retrospective medical records review.; 1) Patient demographics (age and sex), 2) CTC information (admission date, discharge date [if transferred, transfer date], duration from diagnosis to admission, route of admission [hospital, home, and other CTC], and route of discharge [hospital and home]), 3) COVID-19 related information (symptom at admission [cough, fever, sputum, rhinorrhea, sore throat, chest pain, dyspnea, and other symptom], result of RT-PCR test [negative and positive], and result of initial CXR). The result of CXR was classified into 3 categories.; normal, pneumonia suspicion, and nonspecific lesion. Nonspecific lesion included things like old tuberculosis sequelae.

Statistical analysis

Patient demographics of death and CTC admission among all patients in Seoul until the end of CTC was given in percentage. The patient characteristics according to the route of discharge were compared. The length of stay and period from diagnosis to admission were shown by median and interquartile range (IQR). Consultations provided by doctor, nurse, and psychiatric specialist were combined to calculate the average daily number of consultations each week. Number of CXR and RT-PCR test were combined to calculate the average daily number of tests each week. The medication used were presented in the order of frequency of prescription. The negative rate of all RT-PCR test and characteristics of patients who were prescribed medication more than 30 times were investigated.

Ethics statement

The study was approved by the Institutional Review Boards (IRB) of Seoul Metropolitan Government-Seoul National University Boramae Medical Center (IRB No. 30-2020-093) and the requirement for informed consent was waived.

Table 1. Patients of Seoul metropolitan city and Seoul CTC

Variables	Seoul metropolitan city		Seoul CTC
	Total	Death, No. (%)	Admission, No. (%)
Total	803	4 (0.5)	213 (26.5)
Sex			
Female	383	0 (0.0)	111 (29.0)
Male	420	4 (1.0)	102 (24.3)
Age, yr			
0–9	11	0 (0.0)	0 (0.0)
10–19	41	0 (0.0)	8 (19.5)
20–29	268	0 (0.0)	114 (42.5)
30–39	139	0 (0.0)	42 (30.2)
40–49	116	1 (0.9)	28 (24.1)
50–59	126	0 (0.0)	21 (16.7)
60–69	57	1 (1.8)	0 (0.0)
70–79	31	0 (0.0)	0 (0.0)
≤ 80	14	2 (14.3)	0 (0.0)

CTC = community treatment center.

RESULTS

Study population

Till May 27, when Seoul CTC was closed, 26.5% (213 patients) of 803 COVID-19 patients in Seoul were admitted to CTC. 42.5% of twenties and 30.2% of thirties were admitted to CTC. It is 35.7% of 597 newly diagnosed patients in Seoul during the 11 weeks of operation (March 16–May 27) (**Table 1**).

Total 35.2% (n = 75) of patients were admitted from home directly after diagnosis and 64.3% (n = 137) who recovered after hospital treatment were transferred from the hospital. Patients of 89.7% (n = 191) were discharged to home and 8.5% (n = 18) were transferred to hospital due to worsening conditions. Four patients (1.9%) did not recover until the end of CTC operation and were transferred to hospital (**Fig. 1**).

The maximum of 14 patients were admitted to CTC a day, and a total of 127 patients stayed when CTC had the largest number of patients (**Fig. 2**).

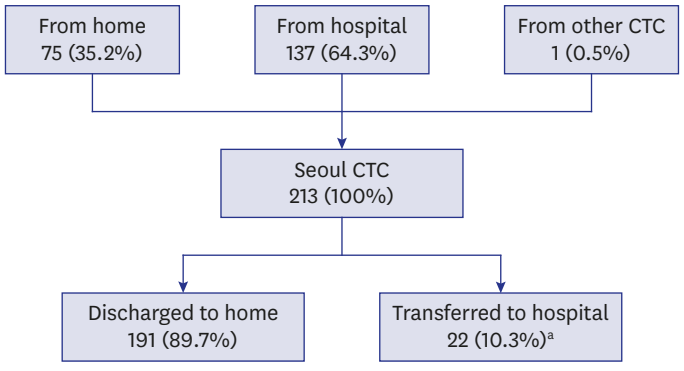

Fig. 1. Route of admission and discharge of Seoul CTC.
CTC = community treatment center.
[a]4 patients who did not have virologic remission until the closing of the Seoul CTC transferred to the hospital on May 27.

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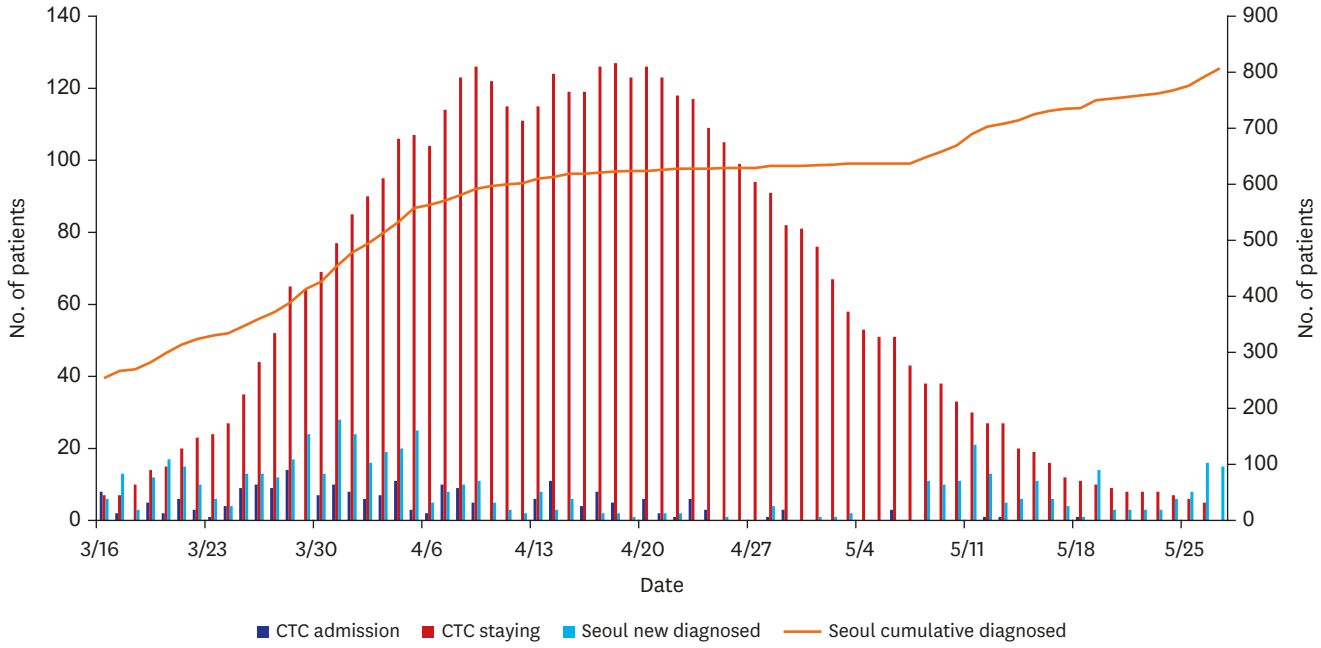

Fig. 2. Trends of number of patients – Seoul CTC and Seoul metropolitan city.
CTC = community treatment center.

Patient characteristics by discharge route

The median length of stay in CTC was 21 days (IQR, 12–29 days). Half (50.0%) of 22 patients transferred to the hospital were within a week of admission. The patients who discharged to home after recovering were most likely to stay at CTC for 3–4 weeks (24.6%), and 6.8% (n = 13) were stayed for more than 6 weeks. Among the patients transferred to the hospital, 45.5% (n = 10) had normal CXR in first, and 13.6% (n = 3) showed pneumonia suspicion. Among the patients discharged to the home, 82.2% (n = 157) had normal CXR in first, and 8.4% (n = 16) showed pneumonia suspicion in first (**Table 2**).

Patient consultation and examination

A weekly average of at least 13.7 patients and a maximum of 121.9 patients stayed at CTC. Depending on the number of patients, 2.5 to 3.6 consultation per patient were provided daily. The psychiatric consultation was conducted 0.9 to 2.9 times a day. The number of tests also differed from week to week depending on the number of patients, and average of 0.7 to 9.3 CXR and 1.9 to 46.6 RT-PCR test per day were performed. For one patient, 0.4 to 0.8 tests were performed daily (**Table 3**).

Medication prescription of CTC

Except antipyretic medication (acetaminophen) which was given to all patients routinely, the most frequently prescribed medications were symptomatic drug for cough/sputum and rhinorrhea, the typical symptoms of COVID-19. Psychiatric medication for sleep problem and anxiety/depressive symptoms was prescribed more frequently than digestive drug (**Table 4**).

The patients who received the most medications were received drug 128 times for 27 days, average of 4.7 drugs per day. The most frequently received medication was digestive drug. The second and third patients were received 3.2 and 2.0 drugs per day, respectively. The most frequently received medications were psychiatric medication for both (**Supplementary Table 2**).

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Table 2. Patient characteristics by route of discharge

Characteristics	Total, No. (%)	Hospital transfer, No. (%)	Home discharge, No. (%)
Total	213 (100.0)	22 (100.0)	191 (100.0)
Sex			
Female	111 (52.1)	11 (50.0)	100 (52.4)
Male	102 (47.9)	11 (50.0)	91 (47.6)
Age, yr			
10–19	8 (3.8)	0 (0.0)	8 (4.2)
20–29	114 (53.5)	10 (45.5)	104 (54.5)
30–39	42 (19.7)	3 (13.6)	39 (20.4)
40–49	28 (13.1)	6 (27.3)	22 (11.5)
50–59	21 (9.9)	3 (13.6)	18 (9.4)
Median (IQR)	28.0 (23.0–38.0)	33.5 (23.0–46.0)	28.0 (23.0–37.0)
Length of stay, wk			
< 1	28 (13.1)	11 (50.0)	17 (8.9)
1–2	35 (16.4)	2 (9.1)	33 (17.3)
2–3	41 (19.2)	4 (18.2)	37 (19.4)
3–4	48 (22.5)	1 (4.5)	47 (24.6)
4–5	23 (10.8)	1 (4.5)	22 (11.5)
5–6	23 (10.8)	1 (4.5)	22 (11.5)
6–7	10 (4.7)	0 (0.0)	10 (5.2)
7–8	5 (2.3)	2 (9.1)	3 (1.6)
Median (IQR)	21.0 (12.0–29.0)	7.5 (3.0–20.0)	22.0 (13.0–30.0)
Duration of diagnosis to admission, wk			
0	101 (47.4)	12 (54.5)	89 (46.6)
1	52 (24.4)	7 (31.8)	45 (23.6)
2	25 (11.7)	1 (4.5)	24 (12.6)
3	20 (9.4)	1 (4.5)	19 (9.9)
4	8 (3.8)	0 (0.0)	8 (4.2)
5	2 (0.9)	1 (4.5)	1 (0.5)
Unknown	5 (2.3)	0 (0.0)	5 (2.6)
Median (IQR)	7.0 (0.0–14.0)	5.5 (0.0–8.0)	7.0 (0.0–15.0)
Route of admission			
Hospital	137 (64.3)	13 (59.1)	124 (64.9)
Home	75 (35.2)	9 (40.9)	66 (34.6)
Other CTC	1 (0.5)	0 (0.0)	1 (0.5)
Symptom at admission			
Cough	51 (23.9)	6 (27.3)	45 (23.6)
Fever	11 (5.2)	2 (9.1)	9 (4.7)
Sputum	44 (20.7)	4 (18.2)	40 (20.9)
Rhinorrhea	30 (14.1)	1 (4.5)	29 (15.2)
Sore throat	16 (7.5)	2 (9.1)	14 (7.3)
Chest pain	6 (2.8)	2 (9.1)	4 (2.1)
Dyspnea	2 (0.9)	1 (4.5)	1 (0.5)
Others[a]	25 (11.7)	4 (18.2)	21 (11.0)
Initial CXR			
Pneumonia suspicion	19 (8.9)	3 (13.6)	16 (8.4)
Nonspecific lesion	18 (8.5)	4 (18.2)	14 (7.3)
Normal	167 (78.4)	10 (45.5)	157 (82.2)
Not done	9 (4.2)	5 (22.7)	4 (2.1)
Medication use, median (IQR)			
Total	3 (1–9)	4 (1–8)	3 (1–9)
Per day	0.2 (0.1–0.5)	0.8 (0.4–1.2)	0.2 (0.1–0.4)

IQR = interquartile range, CTC = community treatment center, CXR = chest X-ray.
[a]Others: myalgia, general weakness, diarrhea, nausea, etc.

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Table 3. Weekly average number of consultation and test per day

Weeks	Date	No. of patients	Patient consultation					Test			
			Doctor	Psychiatric	Nurse	Total	Per patient	CXR	RT-PCR	Total	Per patient
1	3/16–3/22	13.7	14.1	1.0	24.6	39.7	2.9	4.4	1.9	6.3	0.5
2	3/23–3/29	44.4	45.3	2.4	87.4	135.1	3.1	8.4	10.9	19.3	0.4
3	3/30–4/5	89.9	91.1	2.0	177.3	270.4	3.0	9.3	23.4	32.7	0.4
4	4/6–4/12	116.4	119.0	1.9	235.0	355.9	3.1	6.0	36.0	42.0	0.4
5	4/13–4/19	121.9	125.0	2.1	246.6	373.7	3.1	6.1	42.7	48.9	0.4
6	4/20–4/26	113.9	119.9	2.9	238.0	360.7	3.2	5.9	46.6	52.4	0.5
7	4/27–5/3	78.4	84.9	2.3	167.9	255.0	3.3	7.0	34.9	41.9	0.5
8	5/4–5/10	43.9	47.9	2.7	95.4	146.0	3.3	4.1	22.1	26.3	0.6
9	5/11–5/17	21.6	24.6	1.7	49.1	75.4	3.6	3.6	12.7	16.3	0.8
10	5/18–5/24	8.7	9.4	0.9	18.9	29.1	3.3	0.7	5.6	6.3	0.7
11	5/25–5/27	5.3	6.0	1.7	10.3	18.0	3.3	1.0	3.7	4.7	0.9
Total	3/16–5/24	65.3	68.1	2.0	134.0	204.1	3.2	5.6	23.7	29.2	0.5

CXR = chest X-ray, RT-PCR = reverse transcription polymerase chain reaction.

Table 4. Frequent medication prescription of CTC

No.	Symptoms	Medication (n = 1,990)	Values, No. (%)
1	Fever/pain control	Acetaminophen ER[a]	389 (19.5)
2	Cough/sputum	Ambroxol	230 (11.6)
3	Rhinorrhea	Pseudoephedrine/triprolidine	178 (8.9)
4	Sleep problem	Melatonin	163 (8.2)
5	Psychiatric	Trazodone HCl	140 (7.0)
6	GI/Digestive	Famotidine	132 (6.6)
7	Cough/sputum	Theobromine	113 (5.7)
8	Rhinorrhea	Hydroxyzine HCl	112 (5.6)
9	Psychiatric	Escitalopram	103 (5.2)
10	Fever/pain control	Ibuprofen/arginin	93 (4.7)
11	GI/digestive	Almagate	89 (4.5)
12	Sputum	Erdosteine	61 (3.1)
13	GI/digestive	Phazyme	51 (2.6)
14	Etc	Chlorhexidine gluconate	48 (2.4)
15	GI/digestive	Metoclopramide HCl	25 (1.3)
16	GI/diarrhea	Dioctahedral smectite	22 (1.1)
17	GI/constipation	Agio granule	15 (0.8)
18	GI/digestive	Hyoscine-N-butylbromide	10 (0.5)
19	GI/constipation	Magnesium oxide	9 (0.5)
20	Etc	Mupirocin	7 (0.4)

CTC = community treatment center, GI = gastrointestinal.
[a]Acetaminophen was given to all patients at admission.

DISCUSSION

A quarter of total COVID-19 patients in Seoul were admitted to the CTC. Total 13.6% of CTC patients were admitted to the CTC directly. The median length of stay was 21 days and 7% were stayed for more than 6 weeks. During the operation period, 10% were transferred to the hospital and 90% were recovered and discharged to home. One patient had average of 3 consultation and 0.5 tests (CXR or RT-PCR) per day. The most frequently used medications were symptomatic drug for common symptoms of COVID-19 (cough/sputum and rhinorrhea). Psychiatric medication for sleep problem and anxiety/depression were used more than digestive drug.

Excess of available resources for resources in need is a key factor in defining disaster.[2] In many types of disasters with mass casualties, medical supply shortage can occurred.[8,23] Since lack of medical resources during the pandemic can leads to an increase in fatality,

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preparing surge capacity in advance is crucial to cope with disaster.[9,24] Previous studies on disaster response focused on emergency room or redistributing of hospital resources for suddenly increasing emergent patients.[25,26] In case of infectious disease, however, treatment of patients does not end with first aid and need continued care till virologic remission.[27] In addition, the patients with infectious disease needs to be treated and isolated at the same time.[28] However, few studies were conducted on the preparation and operation of surge capacity in actual pandemic situation.[27]

During the global COVID-19 pandemic, different countries responded in different ways. China urgently built new hospitals and other countries quarantined patients in their home without hospitalization.[27,29] The Korea government chosen to create a new concept of patient facility for mild condition patient rather than hospitals to allocate medical resource appropriately according to severity. The existing accommodations were used to isolate patients and medical staff monitored patients via telemedicine.[17] Korea expanded medical resources in this way and distributed valuable hospital resources to critically ill patients. Through this securing surge capacity and proper triage, Korea showed low fatality rate of 2% until August 2020 despite the early surge of COVID-19 patients in February.[30,31]

Seoul CTC is a community model of surge capacity for mild cases in COVID-19 pandemic. Previous studies reported that mild condition patients can be safely managed at the CTC.[18,19] However, it is unknown how the CTC actually operated in test, medication prescription, and consultation and what role it played in the community during the pandemic. To prepare and respond second wave of COVID-19 epidemic and future emerging infectious disease disaster, analysis of operation of actual CTC and information of patient triage in the community is needed.

Seoul metropolitan city prepared surge capacity on two levels, operating 5 hospitals as COVID-19 dedicated hospital and one CTC for 10 million citizens. One-quarter of patients of Seoul metropolitan city managed at the CTC. In patients aged 20–40s, 40% were hospitalized at CTC. By operating CTC for mild cases, Seoul was able to prioritize scarce hospital resources to severe cases. Through this triage and resource allocation according to severity, Seoul has a low fatality rate in Korea where the overall COVID-19 fatality rate is low.[31,32] Since CTC is a facility for mild cases, the Seoul CTC was operated with minimal manpower, medical equipment and medications. When video-consultation was provided to quarantined patients 3 times a day, few additional consultations were needed except for psychiatric consultation. The Seoul CTC did not perform blood tests and provided only the minimum tests (RT-PCR and CXR) to manage patients with respiratory viral infections. Although RT-PCR test was performed up to 23 times in one patient, usually patients got the RT-PCR or CXR once every 2 days on average (**Supplementary Table 3**). Of the 21 medications stored in Seoul CTC, the most frequently prescribed drugs were for the symptoms of COVID-19 itself. The next most frequently used medication was a psychiatric drug, not a general drug like a digestive drug. Although only one patient had a psychiatric medical history (adjustment disorder), but isolated patients frequently complained of sleep problem and anxiety/depression. Isolated patients may need psychiatric support in addition to treatment for infectious disease.[33]

Most patients (90%) were safely managed and discharged from the CTC, which was operated with minimal equipment and medications. One tenth (10%) of patients classified as mild condition at first and admitted to the CTC were exacerbated and transferred to hospital. This is higher than other studies reported that 2%–3% of patients were transferred to the

hospital.[17-19] One patient complained of a suicidal idea was transferred to a hospital with a psychiatric specialist. The rest of patients were exacerbated by COVID-19 symptoms such as fever and chest pain and transferred to a COVID-19 designated hospital. As reported in other studies, no patient died until the end of CTC operation. Patients transferred to the hospital were older, had more suspicion of pneumonia on initial X-rays, and had more daily average medication use than those who were discharged to home.

Adequate patient triage and resource allocation are critical factor to respond disaster.[1,34] In a metropolitan city with a population of 10 million, through operating the two-stage surge capacity consisting of dedicated COVID-19 hospitals and CTCs, allocating scarce hospital resources to critically ill patients was possible. Because the CTC is a remodeling facility of existing accommodation, it has the advantage of being able to adjust the open and close according to the COVID-19 spread trend. Most of CTCs, which had operated more than 20 during the COVID-19 surge, closed due to the decrease in patients. However, there are also disadvantages to be considered in the CTC operation. The first is the possibility of an emergency. In hospital, medical staff frequently visit patient room and closed circuit televisions (CCTVs) are installed in isolation units. However, since CTC is also a living space for patients, we were not installed CCTV in the room. While this did not happen during the operation period, it can be difficult to detect and respond to an emergency. The second is that since it is not a facility with negative pressure applied, it cannot completely prevent the spread of infection. There have been no reports of transmission of infection in the CTC. The third is a security issue related to the telemedicine. As telemedicine was first used for infectious disease disaster, a commercial video-call program was used instead of using a secured program. In the future, it is necessary to develop and use a security program to protect patient privacy.

Some experts warn of the second wave of COVID-19 in winter season and there is always a risk of emerging infectious disease with rapidly increasing patients.[35] Despite several limitation, CTC has a role as a facility that enables appropriate medical resource allocation by rapidly increasing patient capacity in disaster. By monitoring mild condition patients in CTC, it is possible to reduce mortality by focusing valuable medical resources on critically ill patients. To respond pandemic disaster with large number of patients, multi-level surge planning and flexible patient facility plan such as CTC should be prepared in advance.

This study has several limitations. First, this study was conducted at one CTC in one region. Depending on the rate of disease transmission and patient severity, the operation of CTC may be varied. Further, the Seoul CTC is a facility for respiratory viral infection with many mild condition patients.[36] The need of consultation, tests and medications may vary according to the type of disaster. Seconds, this study investigated only process and patients of CTC. To comprehensively understanding the need of surge capacity of the community, it is necessary to analyze the hospital and CTC together. Since many studies conducted on hospital treatment of COVID-19, this study focused on the newly implemented patient facility called CTC.

In conclusion, In the COVID-19 pandemic, a metropolitan city can operate a temporary patient facility such as CTC with minimal staff, equipment, and medications. Preparing a two-stage surge capacity consisting of hospital and CTC can assist proper triage and allocating medical resources to the patients who need it most.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1

List of medication of Seoul CTC

Click here to view

Supplementary Table 2

Patients list with frequent medication prescription

Click here to view

Supplementary Table 3

RT-PCR result according to the operation period

Click here to view

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