



## Brief Communication



# Development and Roll-Out of A Coronavirus Disease 2019 Clinical Pathway for Standardized Qualified Care in Public Hospitals in Korea

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## ABSTRACT

Despite the coronavirus disease 2019 (COVID-19) vaccination roll-out, variant-related outbreaks have occurred repeatedly in Korea. Although public hospitals played a major role in COVID-19 patients' care, difficulty incorporating evolving COVID-19 treatment guidelines called for a clinical pathway (CP). Eighteen public hospitals volunteered, and a professional review board was created. CPs were formulated containing inclusion/exclusion criteria, application flow charts, and standardized order sets. After CP roll-out, key parameters improved, such as increased patient/staff five-point satisfaction scores (0.41/0.57) and decreased hospital stays (1.78 days)/medical expenses (17.5%). The CPs were updated consistently after roll-out as new therapeutics drugs were introduced and quarantine policies changed.

**Keywords:** SARS-CoV-2; COVID-19; Pandemics; Clinical pathways; Hospitals, public

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#### Ethics statement

Institutional review board of this study was exempted, for it involves no greater than minimal risk to participants and it is a secondary research using information, which is recorded in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects and the investigators neither contact the subjects, nor the investigators re-identify subjects.

#### Conflict of Interest

No conflict of interest.

The first case of coronavirus disease 2019 (COVID-19) was reported in Wuhan, China, in December 2019, and it has since spread across the globe [1]. As a result, on March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic [2].

In Korea, the first case of COVID-19 was reported in March 2020 [3]. As of March 24, 2022, there have been a total of 10,822,836 confirmed cases and 13,902 deaths [4]. As the number of patients increased rapidly, the Korean government designated dedicated COVID-19 hospitals (DCH) according to the Infectious Disease Control and Prevention Act; 8,177 beds existed in 72 DCHs as of July 2021 [5, 6]. DCHs are typically local accountable hospitals with an average of 288 beds, whereas tertiary hospitals in Korea have an average of 1,073 beds [7, 8]. Therefore, specialized pulmonologists or infectious disease doctors are generally not available in DCHs; additionally, doctors in various fields have been engaged in COVID-19 patient care at DCHs. As COVID-19 is a novel infectious disease, standards of care are constantly evolving, and the incorporation of frequent updates on COVID-19 management into the practice of DCHs at the appropriate time is not feasible.

A clinical pathway (CP) is the main instrument for managing clinical processes based on the Clinical Practice Guideline (CPG). The CPG provides evidence-based medical knowledge to support physicians in their specific situations. Both propose a standardization of medical care processes to improve clinical care. In contrast to the CPG, a CP includes all activities of clinical care and administrative processes such as education, diet, medication, etc. As a CP is typically developed for formal organizational objectives, it is more focused on the economic dimension [9]. The Ministry of Health and Welfare and the Center for Public Healthcare (CPH) at the National Medical Center have carried out a CP project for public hospitals based on the Plan for Strengthening the Public Healthcare System (December 2020) and the Second Master Plan for Public Healthcare (2021 – 2025) [10, 11]. CPs aim to supporting hospitals in performing appropriate treatment. A total of 52 CPs have been developed and distributed since 2014 and have been managed through the web-based Public Healthcare CP Monitoring System ([www.pubcp.or.kr](http://www.pubcp.or.kr)), through which a COVID-19 CP is also available.

Korea has managed the COVID-19 epidemic effectively from the beginning through its “test and treat” policy, and 31.1% of the population has been vaccinated at least once as of July 15, 2021 [12]. In contrast to most countries, every confirmed case of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has been quarantined either in hospitals or in facilities designated by the Korean response system. However, due to the global epidemic of the Delta variant, more than 1,000 new confirmed cases per day have been reported in-Korea since mid-July 2021 [13]. As a result, until herd immunity is achieved in Korea, reinforcement of the issue of COVID-19 patient management is necessitated. As one countermeasure against COVID-19 resurgence, the Ministry of Health and Welfare and the CPH decided to develop and roll out a COVID-19 CP for DCHs in Korea.

As a first step, a survey was sent to all public hospitals and some private hospitals regarding the demand for COVID-19 CPs and their willingness to participate. As a result, 18 hospitals (17 central public hospitals and one national university hospital) responded affirming their interest in participation. Of these hospitals, the 256-bed Seosan Medical Center, a DCH, was selected for the development of the first draft of the CP because the volume of the facility and its human resources were representative of all participants [14]. The draft CP was developed based on actual COVID-19 care practice in operation and consisted of inclusion/exclusion criteria, an application flow chart, and standardized order sets. For

**Author Contributions**

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efficient roll-out and follow-up, participants were divided into five regions according to their proximity and characteristics. Additionally, a review board (RB) was created consisting of one representative doctor who was a COVID-19-specialist and who was responsible for organizing the CP application in each region as well as another specialist, typically someone working at a tertiary hospital, who was recommended by the Korean Society of Infectious Diseases for each region.

The draft CP was reviewed by the RB, and a pair of CPs were developed, one for asymptomatic cases (CP-A) and the other for symptomatic cases (CP-S), in consideration of clinical features and therapeutic measures. After the revision of the RB, the CP was disseminated to 18 participating hospitals and was modified to fit each institution. A secondary review was then conducted by the RB, and controversy arose regarding five issues; the recommendation of monoclonal antibody (mAb) use, the use of mAbs with vaccine recipients, the recommended target of anti-thrombotic therapy, the use of antibiotics, and the definition of high-flow oxygen therapy. These issues were decided by a vote within the RB (**Supplementary Table 1**), and the standardized COVID-19 CP was finalized, consisting of inclusion/exclusion criteria (**Supplementary Table 2**), an application flow chart (**Fig. 1**), and standardized order sets (**Supplementary Table 3**) for each of the CP-A and CP-S. The CPH rolled out the standardized CP to 18 institutions on July 15, 2021, and they applied it to their practice after customizing it to their situations. To measure the performance of the CP, a patient/staff satisfaction survey, data on length of hospital stay, and medical expense data were collected. Target subjects were selected from pre-CP and on-CP cohorts by the participating hospital CP managers, and the satisfaction survey results of 939 patients/846 staff members as well as the hospital stay/medical expenses data of 4,731 patients were collected through October 3, 2021, from 16 DCHs. Data were not available for two hospitals at which COVID-19 patient care was discontinued. An independent t-test was utilized for statistical analysis using SPSS version 27 (IBM Corp., Armonk, NY, USA). Statistical significance was defined at a 95% confidence interval (two-sided). Patient/staff satisfaction was measured using a five-point scale, and the mean patient satisfaction score (SSc) improved by 0.41 points after CP application ( $P < 0.001$ , **Table 1**). While the SSc improvement was not significant among patients from DCHs with <200 beds, the mean SScs after CP application did not differ by DCH bed number, and the mean patient SSc of DCHs with <200 beds was already higher than that of other groups before the CP application

**Table 1.** Changes in the parameters after COVID-19 clinical pathway (CP) roll-out

	Pre-CP	On-CP	Difference in mean	P-value
Patient satisfaction (five-point scale)	4.07 ± 0.71 (n = 565)	4.48 ± 0.56 (n = 374)	0.41	<0.001
<201 beds	4.37 ± 0.65 (n = 293)	4.48 ± 0.65 (n = 117)	0.11	0.137
201 - 500 beds	3.69 ± 0.61 (n = 192)	4.48 ± 0.51 (n = 216)	0.79	<0.001
>500 beds	3.91 ± 0.65 (n = 80)	4.47 ± 0.48 (n = 41)	0.56	<0.001
Staff satisfaction (five-point scale)	3.38 ± 0.67 (n = 471)	3.95 ± 0.63 (n = 375)	0.57	<0.001
Nurse	3.38 ± 0.64 (n = 398)	3.96 ± 0.63 (n = 312)	0.58	<0.001
Doctor	3.28 ± 0.73 (n = 24)	4.19 ± 0.49 (n = 17)	0.91	<0.001
Etc.	3.31 ± 0.88 (n = 49)	3.76 ± 0.68 (n = 46)	0.45	0.006
Hospital stay length (day)	12.14 ± 6.50 (n = 3,234)	10.36 ± 2.36 (n = 1,497)	1.78	<0.001
<201 beds	10.42 ± 3.29 (n = 1,125)	9.35 ± 2.92 (n = 485)	1.07	<0.001
201 - 400 beds	12.59 ± 6.69 (n = 1,339)	10.99 ± 1.93 (n = 544)	1.6	<0.001
>400 beds	13.87 ± 8.72 (n = 770)	10.67 ± 1.76 (n = 468)	3.2	<0.001
Medical expense (1,000 Korean Won)	3,347 ± 2,459 (n = 3,234)	2,761 ± 944 (n = 1,497)	586	<0.001
<201 beds	2,501 ± 1,149 (n = 1,125)	2,398 ± 841 (n = 485)	103	0.075
201 - 400 beds	3,516 ± 2,353 (n = 1,339)	2,917 ± 1,076 (n = 544)	599	<0.001
>400 beds	4,289 ± 3,447 (n = 770)	2,957 ± 755 (n = 468)	1,332	<0.001

Values are presented as mean±standard deviation and independent t-test was used for comparison.



1.78 day and 586,000 Korean Won, and these changes were statistically significant for both parameters ( $P < 0.001$ ). Additionally, the decrease in the mean of both parameters was largest in DCHs with  $> 400$  beds, and the decrease in medical expenses was not significant in DCHs with  $< 200$  beds. However, the pre-CP values of both parameters for  $< 200$ -bed DCHs were smaller than those for the larger DCHs (data not shown), which may be related to the underlying comorbidities and COVID-19 severity. The CPH is planning for further analysis including this information as well as treatment outcome after hospital discharge.

Various healthcare authorities are issuing COVID-19 guidelines in respect to treatment of the disease [15, 16], and local guidelines are also available in Korea [17, 18]. However, the healthcare system and the availability of therapeutic measures to manage COVID-19 are quite variable even within a single country. As previously mentioned, the majority of moderate to severe, non-critical COVID-19 patients are cared for in public hospitals in Korea. While they provide qualified care during normal times, human resources and medical supplies have been limited during the pandemic period. Therefore, it is not feasible that frequent updates in terms of knowledge and recommendations regarding COVID-19 can be incorporated into the practice of public hospitals in a timely manner as the main aim of the public hospital is to provide standardized general medical services rather than high-end medical care. During the recruitment of COVID-19 CP participants, many healthcare workers in public hospitals echoed these sentiments and agreed that peer-reviewed standardized practice protocols contribute to providing qualified care to COVID-19 patients. Additionally, patient/staff SSc improved, and length of hospital stay and medical expenses decreased significantly. This may be due to the standardization of patient care protocols following CP application.

As new SARS-CoV-2 variants with higher transmissibility have been imported into Korea, major prevailing strains have changed, and a massive outbreak of the omicron variant occurred in Korea in early 2022. Because of the dynamic nature of the epidemic and the introduction of novel drugs to treat COVID-19, the therapeutic drug guidelines have been changed frequently, and quarantine requirements have been lifted. The feature of high variability in novel infectious disease is the major limitation of this COVID-19 CP. To overcome this, the CP has frequently been updated, six times since its initial roll-out in September 2021 as of March 25, 2022 (**Supplementary Table 4**). Updated CPs were rolled out to participating hospitals and simultaneously posted on the CPH webpage ([www.pubcp.or.kr](http://www.pubcp.or.kr)). This CP generation-application platform may be utilized for future outbreak events as well.

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## SUPPLEMENTARY MATERIALS

### Supplementary Table 1

Controversial issues decided by the voting within the review board

[Click here to view](#)

### Supplementary Table 2

Inclusion/exclusion criteria

[Click here to view](#)

### Supplementary Table 3

Standardized order sets

[Click here to view](#)

### Supplementary Table 4

Update list of COVID-19 clinical pathway

[Click here to view](#)

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