

Original Article



Children with COVID-19 after Reopening of Schools, South Korea

Eun Young Kim ,¹ Boyeong Ryu ,¹ Eun Kyoung Kim ,¹ Young-Joon Park ,¹ Young June Choe ,² Hye Kyung Park ,¹ Eun Kyeong Jeong ¹

¹Korea Disease Control and Prevention Agency, Cheongju, the Republic of Korea

²Department of Social and Preventive Medicine, Hallym University College of Medicine, Chuncheon, the Republic of Korea



Received: Oct 28, 2020

Revised: Oct 31, 2020

Accepted: Nov 1, 2020

Correspondence to

Eun Kyeong Jeong

Korea Disease Control and Prevention Agency, Osong Health Technology Administration Complex, 187 Osongsaengmyeong 2-ro, Heungdeok-gu, Cheongju 28159, the Republic of Korea.

E-mail: jeongek@korea.kr

Copyright © 2020 The Korean Society of Pediatric Infectious Diseases

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORCID iDs

Eun Young Kim

<https://orcid.org/0000-0002-0163-1117>

Boyeong Ryu

<https://orcid.org/0000-0001-9336-8098>

Eun Kyoung Kim

<https://orcid.org/0000-0003-3613-3270>

Young-Joon Park

<https://orcid.org/0000-0001-9697-4173>

Young June Choe

<https://orcid.org/0000-0003-2733-0715>

Hye Kyung Park

<https://orcid.org/0000-0002-3263-8776>

Eun Kyeong Jeong

<https://orcid.org/0000-0002-4386-201X>

ABSTRACT

Purpose: To describe pediatric coronavirus disease 2019 (COVID-19) cases after the reopening of schools in the Republic of Korea and their transmission routes.

Methods: All case report forms and epidemiologic investigation forms for children aged 3–18 years reported as COVID-19 cases to the National Notifiable Disease Surveillance System from May 1 to July 12, 2020, were reviewed.

Results: After the schools were reopened in May 2020, a total of 127 pediatric COVID-19 cases were confirmed until July 12. Of these, 59 children (46%) were exposed to severe acute respiratory syndrome coronavirus 2 through family and relatives, followed by 18 children (14%) through cram schools or private lessons, 8 children (6%) through multi-use facilities, and 3 children (2%) through school.

Conclusions: The present data do not suggest an increased risk of COVID-19 transmission in the context of stringent school-based infection prevention measures introduced across the country.

Keywords: Coronavirus; SARS-CoV-2; COVID-19; Child; Schools

INTRODUCTION

In response to the coronavirus disease 2019 (COVID-19) pandemic, a record number of children are not attending school because of closures mandated in many places.¹⁾ As one of the first-hit countries, the Republic of Korea postponed the start of a new school year in March. In the context of lifting social distancing, all elementary, middle, and high schools have partially reopened since May 2020, in 4 steps in different grades of students to minimize crowding.²⁾ All public education and childcare systems were mandated to follow infection control policies and guidance, along with physical distancing, hygiene measures, and self-isolation of sick students.³⁾ Here, we present pediatric COVID-19 cases at kindergartens and schools (from elementary to high school) after schools in the Republic of Korea were reopened and describe their transmission routes.

MATERIALS AND METHODS

All children aged 3–18 years attending kindergartens and schools (from elementary to high school) who were reported positive for COVID-19 to the National Notifiable Disease

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Author Contributions

Conceptualization: Kim EY, Ryu B, Kim EK, Choe YJ, Jeong EK; Data curation: Kim EY, Choe YJ; Formal analysis: Kim EY; Investigation: Ryu B, Kim EK, Park YJ; Methodology: Ryu B, Kim EK, Park HK; Project administration: Park HK, Jeong EK; Resources: Park YJ; Supervision: Park HK; Validation: Jeong EK; Writing - original draft: Ryu B, Kim EK, Choe YJ.

Surveillance System from May 1 to July 12, 2020, were included in the analysis. During the surveillance period, from one-third to two-thirds of the students were on-site at the school, depending on the region, school, and time period. The average number of COVID-19 reports regardless of age from May 1 to July 12 was 36.3 cases per day (range: 2–79), with a modest increase in July. Children and adolescents aged 0–19 years accounted for 7.2% of the 13,417 confirmed cases until July 12, 2020, without definite changes in percentages before and after school opening.⁴⁾ Epidemiological investigation forms were reviewed for the child's attendance in public education or childcare systems. Exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was assessed upon overlapping exposures with the index patient's transmissible period (14 days following onset of symptoms). Exposures were classified according to the persons or spaces that were the sources of the infection: family and relatives, cram schools/private lessons, multi-use facilities, and schools (public education/childcare system).

This study was conducted as a legally mandated public health investigation under the authority of the Korean Infectious Diseases Control and Prevention Act (No. 12444 and No. 13392).

RESULTS

From May 1 to July 12, 2020, a total of 127 pediatric COVID-19 cases at kindergartens and schools (from elementary to high school) were confirmed in the Republic of Korea (**Table 1**). Eighty-four (66%) were boys, 46 (36%) were ages 7–12, and 36 (28%) attended elementary schools. Fifty-nine children (46%) had been exposed to SARS-CoV-2 through family and relatives, followed by 18 children (14%) through cram schools or private lessons, 8 children (6%) through multi-use facilities (coin-operated Karaoke, Internet café, church), and 3 children (2%) through schools.

Table 1. Transmission of COVID-19 to children after reopening of schools, the Republic of Korea, May 1–July 12, 2020

Characteristics	No. (%)
Age distribution (yr)	
3–6	24 (18.9)
7–12	46 (36.2)
13–15	32 (25.2)
16–18	25 (19.7)
Sex	
Female	43 (33.9)
Male	84 (66.1)
Attendance in public education/childcare system	
Preschool and kindergarten	12 (9.4)
Elementary school (1st–6th graders)	36 (28.3)
Middle school (7th–9th graders)	22 (17.3)
High school (10th–12th graders)	25 (19.7)
Exposure to SARS-CoV-2	
Family and relatives	59 (46.5)
Cram schools, private lessons	18 (14.2)
Multi-use facilities	8 (6.3)
Public education/childcare system	3 (2.4)
Total	127 (100.0)

Abbreviations: COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

DISCUSSION

Schools may play an important role in the transmission of respiratory viruses; therefore, understanding the transmission process within schools can improve our ability to plan effective interventions in responding to the COVID-19 pandemic.⁵⁾ Our finding is in line with reports from Ireland,⁶⁾ Australia,⁷⁾ and New Zealand,⁸⁾ which all suggested that schools are not a high-risk setting for the transmission of COVID-19 between students.

To reduce the risk of in-school transmission in Korea, infection prevention guidelines were developed to apply in all public schools.³⁾ The guidelines convey the following main principles: physical distancing, hygiene measures, and self-isolation of sick students. Moreover, they address specific rules including self-check using a smartphone-based app, entry screening at the gate, wearing masks, separating passage to minimize the mixing of students, and controlling the number of students present at schools by separating the school time for different classes.

The evidence for the benefit of school closures in response to COVID-19 is limited, while this approach is costly at both the individual and societal levels.^{9,10)} The present data do not suggest an increased risk of COVID-19 transmission in the context of stringent school-based infection prevention measures introduced across the country. The transmission of COVID-19 in children is likely to relate to households, cram schools, or private lessons, and multi-use facilities with limited access to infection control practices. To protect children's rights and meet their basic needs, public health intervention should broaden the focus of COVID-19 containment from school closures to attaining its social values and sustaining children's education.

ACKNOWLEDGEMENT

We thank the relevant ministries (including the Ministry of Interior and Safety, Si/Do, and Si/Gun/Gu), medical staff in health centers, and medical facilities for their efforts in responding to the COVID-19 outbreak.

The opinions expressed by authors contributing to this journal do not necessarily reflect the opinions of the Korea Disease Control and Prevention Agency or the institutions with which the authors are affiliated.

REFERENCES

1. Masonbrink AR, Hurley E. Advocating for children during the COVID-19 school closures. *Pediatrics* 2020;146:e20201440.
[PUBMED](#) | [CROSSREF](#)
2. Yoon Y, Kim KR, Park H, Kim S, Kim YJ. Stepwise school opening and an impact on the epidemiology of COVID-19 in the children. *J Korean Med Sci* 2020;35:e414.
[PUBMED](#) | [CROSSREF](#)
3. Ministry of Education, Central Disaster Management Headquarters, Central Disease Control Headquarters, Ministry of Food and Drug Safety. Coronavirus disease 2019 infection prevention management guideline in schools, version 2. May 7, 2020 [Internet]. Sejong: Ministry of Education; 2020 [cited 2020 Aug 17]. Available from: <http://schoolhealth.kr>.
4. Korea Centers for Disease Control and Prevention. The updates of COVID-19 in Republic of Korea, as of 12 July, 2020. Cheongju: Korea Centers for Disease Control and Prevention; 2020.

5. Heymann AD, Hoch I, Valinsky L, Kokia E, Steinberg DM. School closure may be effective in reducing transmission of respiratory viruses in the community. *Epidemiol Infect* 2009;137:1369-76.
[PUBMED](#) | [CROSSREF](#)
6. Heavey L, Casey G, Kelly C, Kelly D, McDarby G. No evidence of secondary transmission of COVID-19 from children attending school in Ireland, 2020. *Euro Surveill* 2020;25:2000903.
[PUBMED](#) | [CROSSREF](#)
7. Macartney K, Quinn HE, Pillsbury AJ, Koirala A, Deng L, Winkler N, et al. Transmission of SARS-CoV-2 in Australian educational settings: a prospective cohort study. *Lancet Child Adolesc Health* 2020;4:807-16.
[PUBMED](#) | [CROSSREF](#)
8. Ministry of Health (NZ). COVID-19: Source of cases [Internet]. Wellington: Ministry of Health; 2020 [cited 2020 Aug 17]. Available from: <https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics/covid-19-source-cases>.
9. Van Lancker W, Parolin Z. COVID-19, school closures, and child poverty: a social crisis in the making. *Lancet Public Health* 2020;5:e243-4.
[PUBMED](#) | [CROSSREF](#)
10. Araújo LA, Veloso CF, Souza MC, Azevedo JMC, Tarro G. The potential impact of the COVID-19 pandemic on child growth and development: a systematic review. *J Pediatr (Rio J)*. 2020. Online ahead of print.
[PUBMED](#) | [CROSSREF](#)

요약

목적: 국내 초중고 학교 등교재개 이후 소아에서의 코로나바이러스감염증-2019 (코로나19) 사례의 감염경로를 파악하고자 하였다.

방법: 2020년 5월 1일부터 7월 12일까지 국가감염병감시체계에 신고된 3-18세 소아 청소년 코로나19 확진자의 사례조사서 및 역학조사서를 분석하였다.

결과: 2020년 5월 국내 초중고 학교 등교 재개 이후 7월 12일까지 총 127명의 소아 청소년 코로나19 확진자가 신고되었다. 그 중 59명(46%)은 가족 및 친지로부터 전파된 사례였으며 18명(14%)은 학원 및 개인교습 중 전파되었다. 8명(6%)은 다중이용 시설에서 전파되었으며 3명(2%)은 학교에서 전파된 사례였다.

결론: 코로나19 감염예방을 위한 관리체계가 사전에 마련되고 준비된 경우 학교 내 코로나19 전파는 드물게 나타났다.