

## Original Article



# Decrease in Incidence of Febrile Seizure following Social Distancing Measures: A National Cohort Study in South Korea

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### Conflict of Interest

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

## ABSTRACT

**Purpose:** Nonpharmaceutical measures, such as social distancing, have resulted in unintended consequences, including a decrease in the incidence of childhood diseases. This study aimed to estimate the impact of social distancing on the incidence of febrile seizure (FS) in Korea using nationally representative data.

**Methods:** We used claims data from the Health Insurance Review and Assessment Service, a single-payer database capturing >95% of the Korean population. The database included any inpatient encounter with a FS diagnosis from January 2010 to September 2020 for those aged 0-5 years old. We aggregated the monthly number of cases to estimate the incidence per 100,000 patient-years in 2020 (January 1 to September 30) for the same periods in 2010–2019.

**Results:** The incidence of FS in 2020 ranged from 113 per 100,000 (95% confidence interval [CI], 108–118 per 100,000) in January to 27 per 100,000 (95% CI, 25–30 per 100,000) in September, whereas the average FS incidence in 2010–2019 ranged from 116 per 100,000 (95% CI, 112–121 per 100,000) in January to 101 per 100,000 (95% CI, 97–106 per 100,000) in September.

**Conclusions:** The incidence of FS decreased by –38% in 2020, suggesting that social distancing contributed towards decreasing the incidence of FS.

**Keywords:** Fever; Seizure; Convulsion; Pandemics

## INTRODUCTION

Febrile seizure (FS) is a seizure in the setting of fever that frequently occurs in children aged under 5 years. Usually, fever caused by viral infections, particularly influenza virus, adenovirus, parainfluenza virus, and rotavirus, are known to have a positive association with FS.<sup>1)</sup>

Since the spread of the coronavirus disease 2019 (COVID-19) pandemic, many countries have instituted social distancing measures to mitigate its transmission. Such nonpharmaceutical measures have resulted in unintended consequences, such as a decrease in the incidence of childhood diseases that are often triggered by infections, including Kawasaki disease and intussusception.<sup>2,3)</sup>

**Author Contributions**

Conceptualization: Park KH, Choe YJ, Shim Y, Eun BL, Byeon JH; Data curation: Park KH, Choe YJ; Formal analysis: Park KH; Methodology: Choe YJ; Supervision: Choe YJ, Shim Y, Eun BL, Byeon JH; Visualization: Park KH; Writing - original draft: Park KH; Writing - review & editing: Park KH, Choe YJ, Shim Y, Eun BL, Byeon JH.

In South Korea, following the social distancing measures implemented since February 2020, there has been a decrease in the number of infectious diseases among children.<sup>4)</sup> In this context, we sought to estimate the impact of social distancing on the incidence of FS in Korea, using nationally representative data.

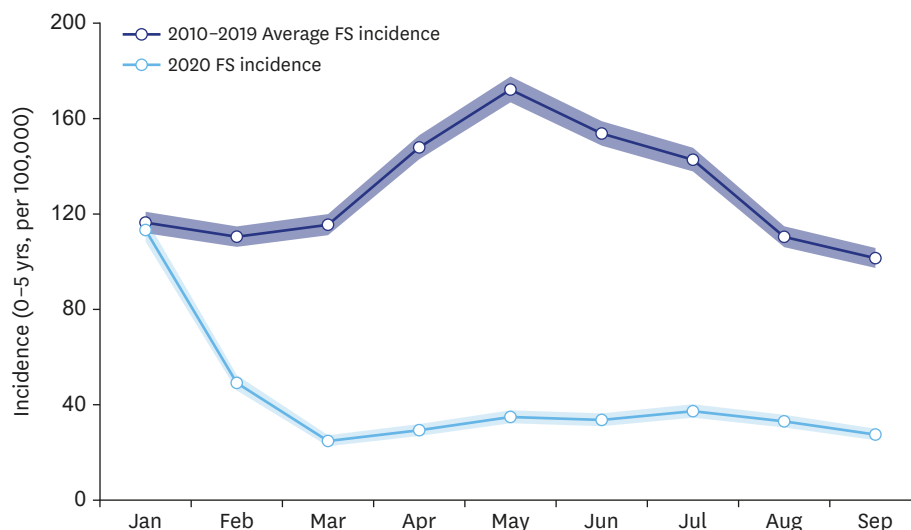
**MATERIALS AND METHODS**

We used claims data from the Health Insurance Review and Assessment Service (HIRA), a single-payer database capturing >95% of the Korean population. The database included any inpatient encounter with an FS diagnosis from January 2010 to September 2020 for those aged 0–5 years old. The International Statistical Classification of Diseases, Tenth Revision, code R56 was used. We aggregated the monthly number of cases to estimate the incidence per 100,000 patient-years in 2020 (January 1 to September 30) for the same periods in 2010–2019. Descriptive statistics with point estimates of incidence and their 95% confidence intervals are presented (**Fig. 1**).

Poisson regression was used to estimate the net reduction in FS incidence in 2020 compared with 2010–2019 using R (R Core Team, 2020). This study was deemed exempt from Institutional Review Board oversight (IRB No. K2021-0817-001), and reviewed by the Korea University Anam Hospital.

**RESULT**

During the study period, there were a total of 210,985 diagnoses of FS comprising 125,847 boys (59.6%) and 85,138 girls (40.4%) (**Table 1**). The monthly number of FS incidence in children aged 0–5 years from January to September 2020 was compared to the corresponding months of 2010–2019 (**Fig. 1**). The incidence of FS in 2020 ranged from 113 per 100,000 (95% confidence interval [CI], 108–118 per 100,000) in January to 27 per 100,000 (95% CI, 25–30 per 100,000) in September, whereas the average FS incidence in 2010–2019 ranged from 116



**Fig. 1.** Incidence of febrile seizure in children aged 0–5 years old, from January 2010 to September 2020. Abbreviations: FS, febrile seizure.

**Table 1.** Baseline of the study population, patients diagnosed with febrile seizure, September 2011 to August 2020

Variables	No.
Total diagnoses	210,985
Boys	125,847
Girls	85,138
Total visits (days)	584,866
Total No. of claims	306,180

per 100,000 (95% CI, 112–121 per 100,000) in January to 101 per 100,000 (95% CI, 97–106 per 100,000) in September. The estimated net reduction in FS incidence in 2020 compared to 2010–2019 was –38% (95% CI, –34% to –42%). When analyzed by month, the period with the highest incidence of febrile seizures was recorded between April and July, which is a result corresponding to the 2009–2016 HIRA data study. On the other hand, there is no monthly difference after the decrease from February 2020.<sup>5)</sup>

## DISCUSSION

The incidence of FS decreased by –38% in 2020. According to the HIRA database, influenza virus, enterovirus, rotavirus, respiratory syncytial virus (RSV), and adenovirus were the most common viral causative agents of FS, seasonally, enterovirus in summer and influenza virus in winter are the most frequent viruses.<sup>4)</sup>

The national surveillance during the same period suggested a significant reduction of enveloped viruses, including influenza virus and RSVs, whereas the incidence of non-enveloped viruses, including rhinovirus, remained relatively stable. Factors that determine the spread of pathogens include virus, host intrinsic factors, and environmental factors, and it is known that non-enveloped viruses are more resistant to external environmental factors such as temperature and humidity.<sup>6)</sup> This may suggest the differential attributable risk of viruses triggering FS in children.

Our finding is in line with reports from other regions, including a study from Hong Kong that showed a significant decrease of 0.379 (95% CI, 0.245–0.588) in seizure-related attendance in 2020 compared to 2015–2019.<sup>7)</sup> On the other hand, findings from Italy, which was heavily affected by regional transmission, showed higher FS admission rate in 2020 implying a potential causal association with severe acute respiratory syndrome coronavirus 2.<sup>8)</sup>

The main driver in the transmission of respiratory diseases was children, but there was a study that the proportion of transmission through children decreased as schools and kindergartens were closed in the COVID-19 pandemic.<sup>9)</sup> Therefore, the effect of strengthening personal hygiene such as wearing a mask or social distancing between adults may have had an effect on the reduction of febrile illness and furthermore on the decrease of the prevalence of FS. The difference in the incidence rate of FS through environmental change can be seen as a net function of non-pharmacological intervention.

Given the inherent limitation of claims data, our study did not reflect the patient's underlying conditions, such as previous seizure events, hypoglycemia, and electrolyte imbalance. Therefore, these findings should be interpreted cautiously. Despite this, our study confirmed a significant net decrease in FS cases using nationally representative data.

A previously unexperienced person-to-person isolation has been initiated due to the COVID-19 pandemic. In March 2020, the Republic of Korea was declared the second-most affected country in the world by World Health Organization. However, in August 2020, almost only the case showed a flat infection curve for more than 50 days, and successful disease control was achieved with the 50th in terms of the total number of confirmed cases.<sup>10)</sup>

There were benefits such as a reduction in FS as well as COVID-19. On the other hand, as non-pharmaceutical interventions (NPIs) were prolonged, the incidence of mental disorders such as depression, anxiety, and loneliness increased.<sup>11)</sup> Children were deprived of time to experience school life and peer relationships at a time when relationship formation was important. As a result, although we have successfully overcome the COVID pandemic through NPIs, we need to be careful when deciding on social isolation considering the dark side, and the psychological aspect also needs to be considered.

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## 요약

**목적:** 사회적 거리두기와 같은 비약물적 조치는 아동기 질병 발병률 감소를 포함하여 의도하지 않은 결과를 초래하였다. 이에 대하여 한국의 국가 데이터를 사용하여 열성 경련 발병률과 사회적 거리두기의 영향을 연구하였다.

**방법:** 이 연구는 한국의 건강보험심사평가원의 청구 데이터를 사용하여 2010년 1월부터 2020년 9월까지 0-5세 사이의 아동에서 열성 경련 진단을 받은 모든 입원 환자가 포함되었으며, 2010-2019년 1월 1일부터 9월 30일까지, 2020년 같은 기간동안 인구 100,000명 당 발병률을 추정하기 위해 월별 사례 수를 집계하였다.

**결과:** 2010-2019년 열성경련의 발병률은 1월 100,000명 당 116명에서 9월 101명 이었으나, 2020년 2월 사회적 거리두기 이후 열성 경련의 발병률은 1월 100,000명당 113명에서 9월 27명으로 감소하였다.

**결론:** 2010-2019년에 비해 2020년 열성경련의 발병률 순 감소는 -38% 였으며, 사회적 거리두기가 열성 경련의 발병률 감소에 기여했음을 시사하는 결과를 확인하였다.