

## **Pediatric Hospitalizations after School Reopening during the SARS-CoV-2 Alpha**

### **(B.1.1.7) Variant Spread: A Multicenter Cross-sectional Study in Israel**

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## **ABSTRACT**

This multicenter, cross-sectional study provides evidence on SARS-CoV-2-associated ED visits and hospitalizations in pediatric wards and intensive care units, after school reopening during the SARS-CoV-2 Alpha (B.1.1.7) variant spread in Israel. Study findings suggest that school reopening was not followed by an increase in SARS-CoV-2-related pediatric morbidity.

**Keywords:** Coronavirus; pandemic; school; opening; child;

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**Abbreviations:** SARS-CoV-2=severe acute respiratory syndrome coronavirus 2,  
ED=Emergency Department, ICU=Intensive Care Unit,  
MIS-C=Multisystem Inflammatory Syndrome in Children, CDC=Centres for Disease Control  
and Prevention.

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## **INTRODUCTION**

One of the measures to control the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was closure of schools and daycares (SDC). Reopening of SDC is a priority because of the potential lifelong impact on children and families [1]; however, it might be associated with increased pediatric morbidity.

On late December 2020 the first cases of the Alpha (B.1.1.7) variant were detected in Israel, where it shortly became the predominant variant. Cases steadily increased, reaching over 3,000 new cases daily and a test positivity rate over 5%, justifying closure of the education system. A lockdown was imposed on January 8, 2021. As of late January, the daily number of new SARS-CoV-2 cases started to steadily decline. Phased reopening of SDC began on February 7, 2021 under preventive measures in schools (Supplementary Figure, a timeline of key events). The objective of this study was to provide evidence on SARS-CoV-2-associated pediatric emergency department (ED) visits and hospitalizations in pediatric wards and Intensive Care Units (ICU), after the reopening of SDC.

## **METHODS**

A cross-sectional, time-series study was conducted in 17 public hospitals. Prospective data collection started on January 24, 2021, two weeks before the reopening of SDC, and continued until May 2, 2021, two weeks after full reopening (Figure 1). Data on the general population were obtained from the Israel Ministry of Health SARS-CoV-2 dataset using a publicly available repository [2]. The institutional review board of each participating center approved the study and waived the need for individual informed consent based on strict safeguarding of participant anonymity by de-identifying patients during database entry.

## **Study Participants**

The study included all patients younger than 18 years of age who visited EDs from home isolation or due to SARS-CoV-2 infection, and all patients who were hospitalized in a pediatric ward or an ICU due to SARS-CoV-2 infection, or diagnosed with Multisystem Inflammatory Syndrome in Children (MIS-C) [3].

The following variables were recorded from the Israel Ministry of Health SARS-CoV-2 dataset: percentage of the total population vaccinated with two doses of the BNT162b2 mRNA vaccine, number of new SARS-CoV-2 cases in the Israeli population, and SARS-CoV-2 test positivity rate. The diagnosis of SARS-CoV-2 was confirmed using nasopharyngeal sample reverse-transcriptase polymerase chain reaction (RT-PCR).

### **Multisystem Inflammatory Syndrome in Children (MIS-C)**

A hyperinflammatory condition in children and adolescents that typically occurs within four weeks after SARS-CoV-2 infection. The case definition for MIS-C was based on the Centres for Disease Control and Prevention (CDC) definition [3].

### **SARS-CoV-2 prevention in schools and daycares**

In Israel, school preventive measures are based on the Centers for Disease Control and Prevention (CDC) recommendations: 1) Studying in small groups and minimizing student mixing in activities and transportation. 2) Studying in outdoor classes when feasible. 3) Teachers and children wearing facemasks in classrooms. 4) Training of children on hand hygiene. 5) Keeping physical distance in classrooms as much as possible. 6) Avoiding school attendance at any sign of illness [4].

## **Data analysis**

Descriptive statistics was performed to summarize the characteristics of the cohorts. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline (Supplementary checklist).

## **RESULTS**

During the 14-week study period, the percentage of the total population vaccinated with two doses of the BNT162b2 mRNA vaccine increased from 40.15% to 55.32%. The weekly number of new SARS-CoV-2 patients in the Israeli population decreased from 26,228 to 86, and the test positivity rate decreased from 4.7% to 0% (Figure 1A).

### **ED Visits**

Overall, 749 children visited the EDs of the 17 participating hospitals during the 14-week study period, 220 patients with known SARS-CoV-2 infection, 397 patients referred from home isolation, and 132 who tested positive for SARS-CoV-2 in the ED. None of the 16-18-year-old patients had received the SARS-CoV-2 vaccine. During these 14 weeks, the weekly number of known SARS-CoV-2 patients who visited the EDs decreased from 68 to 0, the weekly number of children who were referred to the EDs from SARS-CoV-2 isolation decreased from 127 to 1, and the weekly number of patients who tested positive for SARS-CoV-2 in the ED decreased from 30 to 0 (Figure 1B).

### **Hospitalizations in Pediatric Wards and in ICUs, and due to MIS-C**

During the 14-week study period, the weekly number of children in the pediatric wards and ICUs decreased from 52 to 0 and from 12 to 0, respectively. The weekly number of children with MIS-C decreased from 9 to 0 (Figure 1C). Thirty MIS-C patients were admitted to ICU, and 13 required inotropic or vasoactive support. All the patients recovered and none required extracorporeal membrane oxygenation (ECMO) support.

## DISCUSSION

Although SARS-CoV-2 infection generally results in mild disease in children, severe illness that requires hospitalization and even ICU support may occur [5]. During the study period, we observed a decrease in the number of patients who visited the pediatric EDs due to SARS-CoV-2 infection and from home isolation, a decrease in the number of children who were hospitalized in pediatric wards and in ICUs due to SARS-CoV-2 infection, and a decrease in the number of children with MIS-C. These reductions started before the reopening of SDC and continued throughout the 12-week post-reopening period.

Our observational findings clearly suggest that SDC reopening during the spread of the Alpha (B.1.1.7) variant in Israel was not followed by an increase in SARS-CoV-2-related pediatric morbidity. These results represent a reference point for further analyses conducted under the dominance of different SARS-CoV-2 variants, including Omicron (B.1.1.529).

The decrease in SARS-CoV-2-related pediatric ED visits and hospitalizations across time occurred parallel to an increase in the percentage of people vaccinated with two doses of the BNT162b2 mRNA vaccine, a decrease in SARS-CoV-2 test positivity rate, and a reduction in the number of new SARS-CoV-2 cases in the population. These reductions in population-level data that started before the reopening of SDC and continued throughout the study period, reflect successful control of the outbreak. Due to the observational nature of the study, it is not possible to infer causality, but our data suggest that the reductions in test positivity rate and in the number of new SARS-CoV-2 cases play a major role in reducing SARS-CoV-2-related pediatric ED visits and hospital admissions.

Our findings are corroborated by previous reports on the transmission of SARS-CoV-2 among children in schools [7-9]. A prospective multicenter study investigated household transmission of SARS-CoV-2 among children during the summer break and after school



initiation. The findings revealed that children did not greatly contribute to household clusters of infection even when schools were opened [7]. Another study prospectively assessed the risk of SARS-CoV-2 transmission in summer schools, and found that transmission rates to other children and adults were low [8]. A study that assessed the number of SARS-CoV-2 infections that occurred in schools, reported low transmission rates [9].

Our study has several limitations. Firstly, due to the mild illness in most cases, it is possible that some SARS-CoV-2 patients were not diagnosed. As ED protocols did not change throughout the pandemic, we believe that this limitation had no effect on the results.

Secondly, the study included 83% of the SARS-CoV-2-related pediatric ED population of Israel and not all of it [6], although we believe that this large sample was representative of the entire population. Thirdly, since this is a single-country study our conclusions may not be generalizable to other countries.

In conclusion, we found that the reopening of SDC was not followed by an increase in SARS-CoV-2-related pediatric morbidity. Study findings provide observational evidence for a safe reopening of SDC.

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## NOTES

### **Authors' contributions:**

Dr. Nir Friedman designed the study, analyzed and interpreted the data, reviewed the literature, and critically revised the article; Dr. Nitai Levy designed the study, analyzed and interpreted the data, reviewed the literature, and critically revised the article. NL has equal contribution as first author; Dr. Or Kaplan, Dr. Gabi Padeh, Dr. Danna Krupik, Dr. Ron Jacob, Dr. Shirly Gamsu, Dr. Giora Weiser, Dr. Naama Kuchinski Cohen, Dr. Zeev Schnapp, Dr. Noy Cohen, Dr. Oren Feldman, Dr. Danit Porat, Dr. Moran Gal, Dr. Alexandra Gleyzer, Dr. Adi Klein, and Dr. Tali Capua analyzed and interpreted the data, carried out the initial analysis and critically revised the article; Dr. Smadar Shilo, Prof. Itamar Grotto and Prof. Eran Kozer analyzed and interpreted the data, and critically revised the article. Prof Itai Shavit conceived the idea for the study, analyzed and interpreted the data, and drafted the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Dr. Nir Friedman, Dr. Nitai Levy and Prof. Itai Shavit have full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Ethics Committee Approval:** The study was approved by the institutional review boards of each of the 17 participating Centers (Ref # 0086-21-ASF).

### **Declaration of interests:**

Funding: For all 22 authors, no honorarium, grant, or other form of payment was given to produce the manuscript.

Financial Disclosure: None declared for all 22 authors.

Conflict of Interest: For all 22 authors, there are no potential conflicts of interest, real or perceived in the study design, the collection, analysis, and interpretation of data, the writing of the report, and the decision to submit the paper for publication.

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## LEGENDS TO FIGURES

### Figure 1:

#### A

- i. Percentage of the total population vaccinated with two doses of the BNT162B2 mRNA vaccine in the Israeli population
- ii. Weekly number of new SARS-CoV-2 patients in the Israeli population
- iii. SARS-CoV-2 test positivity rate

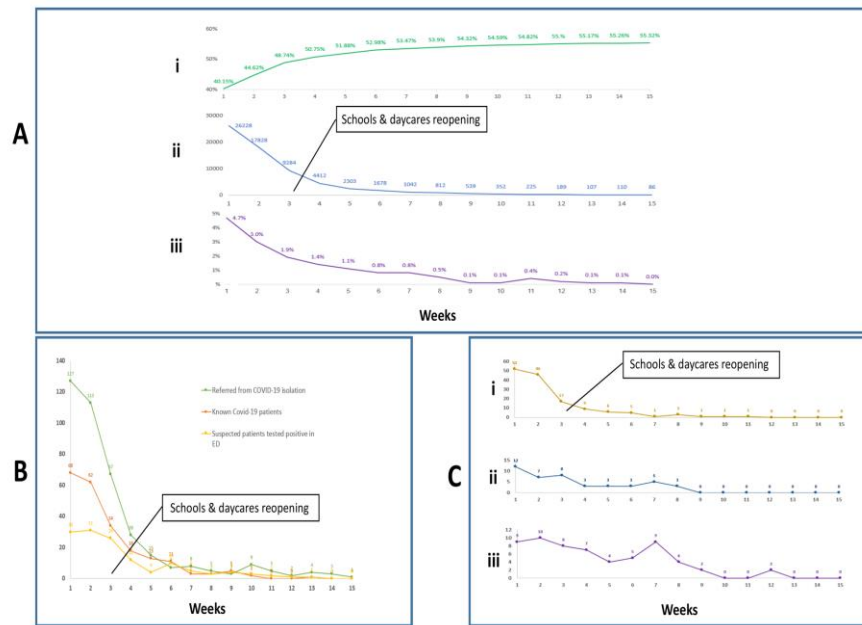
#### B

Weekly number of SARS-CoV-2 patients in Pediatric Emergency Departments (ED): patients referred from home isolation (green), patients with known SARS-CoV-2 infection (brown), and patients who tested positive for SARS-CoV-2 in the ED (yellow)

#### C

- i. Weekly number of SARS-CoV-2 patients hospitalized in pediatric wards
- ii. Weekly number of SARS-CoV-2 patients hospitalized in Intensive Care Units
- iii. Weekly number of hospitalized patients with Multisystem Inflammatory Syndrome in Children (MIS-C)

Figure 1



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