

## CORRESPONDENCE



## Open Schools, Covid-19, and Child and Teacher Morbidity in Sweden

**TO THE EDITOR:** In mid-March 2020, many countries decided to close schools in an attempt to limit the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus causing coronavirus disease 2019 (Covid-19).<sup>1,2</sup> Sweden was one of the few countries that decided to keep preschools (generally caring for children 1 to 6 years of age) and schools (with children 7 to 16 years of age) open. Here, we present data from Sweden on Covid-19 among children 1 to 16 years of age and their teachers. In Sweden, Covid-19 was prevalent in the community during the spring of 2020.<sup>3</sup> Social distancing was encouraged in Sweden, but wearing face masks was not.<sup>3</sup>

Data on severe Covid-19, as defined by intensive care unit (ICU) admission, were prospectively recorded in the nationwide Swedish intensive care registry. We followed all children who were admitted to an ICU between March 1 and June 30, 2020 (school ended around June 10) with laboratory-verified or clinically verified Covid-19, including patients who were admitted for multisystem inflammatory syndrome in children (MIS-C, which is likely to be related to Covid-19)<sup>4</sup> according to the Swedish Pediatric Rheumatology Quality Register. (More information on the registry and a link to the World Health Organization scientific brief on MIS-C are provided in the Supplementary Appendix, available with the full text of this letter at NEJM.org.) The Stockholm Ethics Review Board approved the study. Informed consent was waived by the review board.

The number of deaths from any cause among the 1,951,905 children in Sweden (as of December 31, 2019) who were 1 to 16 years of age was

65 during the pre-Covid-19 period of November 2019 through February 2020 and 69 during 4 months of exposure to Covid-19 (March through June 2020) (see the Supplementary Appendix). From March through June 2020, a total of 15 children with Covid-19 (including those with MIS-C) were admitted to an ICU (0.77 per 100,000 children in this age group) (Table 1), 4 of whom were 1 to 6 years of age (0.54 per 100,000) and 11 of whom were 7 to 16 years of age (0.90 per 100,000). Four of the children had an underlying chronic coexisting condition (cancer in 2, chronic kidney disease in 1, and hematologic disease in 1). No child with Covid-19 died.

Data from the Public Health Agency of Sweden (published report<sup>5</sup> and personal communication) showed that fewer than 10 preschool

### THIS WEEK'S LETTERS

- 669 **Open Schools, Covid-19, and Child and Teacher Morbidity in Sweden**
- 671 **Duration of Culturable SARS-CoV-2 in Hospitalized Patients with Covid-19**
- 673 **Five-Year Outcomes for Refractory B-Cell Lymphomas with CAR T-Cell Therapy**
- 675 **Osimertinib in EGFR-Mutated Lung Cancer**
- 676 **Subcutaneous or Transvenous Defibrillator Therapy**
- 679 **Women Physicians and Promotion in Academic Medicine**
- 681 **The Covid-19 Vaccine-Development Multiverse**

**Table 1. Characteristics of the Children with Covid-19, Including Those with MIS-C, Admitted to Swedish ICUs in March–June 2020.\***

Age	Sex	SARS-CoV-2 Test Result PCR	Antibodies	Days in ICU†	No. of Admissions	BP and Laboratory Measures at Admission‡	Organ Support	Complications
1 yr‡	F	Negative	Positive	5	1	Systolic BP, 70 mm Hg; SaO <sub>2</sub> , 99%; BE, +0.6 mmol/liter; lactate, 1.6 mmol/liter	—	MIS-C, septic shock, renal failure
3 yr	F	Positive	ND	38	3	Systolic BP, 75 to 143 mm Hg; SaO <sub>2</sub> , 96%; lactate, 1.2 mmol/liter	Invasive mechanical ventilation	<i>Clostridium difficile</i> infection
4 yr	F	Positive	Positive	6	1	Systolic BP, 87 mm Hg; SaO <sub>2</sub> , 99%	—	MIS-C, renal failure, coagulation disorder
5 yr	F	Positive	Positive	3	1	Systolic BP, 83 mm Hg; SaO <sub>2</sub> , 98%; BE, -0.7 mmol/liter	—	MIS-C
7 yr¶	M	Negative	ND	<1	1	Systolic BP, 85 mm Hg; SaO <sub>2</sub> , 97%; BE, -0.7 mmol/liter	—	Iron deficiency, coma, fever
7 yr	F	Positive	Positive	35	2	Systolic BP, 115 mm Hg; SaO <sub>2</sub> , 90%; lactate, 0.8; BE, +5 mmol/liter	Invasive mechanical ventilation, renal replacement therapy	—
10 yr‡	F	Negative	Positive	1	1	Systolic BP, 95 mm Hg; SaO <sub>2</sub> , 99%; lactate, 1.1 mmol/liter; BE, -1.5 mmol/liter	—	MIS-C, cardiomyopathy
12 yr	M	Positive	ND	<1	1	Systolic BP, 100 mm Hg; SaO <sub>2</sub> , 98%; BE, -6 mmol/liter	—	—
12 yr	M	Positive	ND	2	1	—	—	Viral pneumonia
13 yr	M	Positive	ND	11	2	Systolic BP, 123 to 137 mm Hg; SaO <sub>2</sub> , 92%; lactate, 0.9 mmol/liter; BE, +3.2 mmol/liter	—	—
13 yr	F	Positive	Positive	7	2	Systolic BP, 80 mm Hg; SaO <sub>2</sub> , 98%; lactate, 3.7 mmol/liter; BE, -9 mmol/liter	Invasive mechanical ventilation	MIS-C, heart failure
14 yr‡	M	Negative	Positive	4	1	Systolic BP, 57 mm Hg; SaO <sub>2</sub> , 98%; lactate, 3.4 mmol/liter; BE, -1.5 mmol/liter	—	MIS-C, myocarditis, sepsis
14 yr	M	Positive	ND	4	2	Systolic BP, 90 to 100 mm Hg; SaO <sub>2</sub> , 83%; lactate, 2.7 mmol/liter; BE, +4 mmol/liter	Invasive mechanical ventilation	—
16 yr	M	Positive	Positive	9	1	—	—	—
16 yr¶	M	Negative	Positive	5	1	—	—	MIS-C, myocarditis with heart failure

\* Four children had underlying conditions: 2 had cancer, 1 had chronic kidney disease, and 1 had hematologic disease and had undergone stem-cell transplantation. Two children had additional conditions: 1 had alcohol intoxication, and 1 had sustained a traumatic injury; coronavirus disease 2019 (Covid-19) was diagnosed in these 2 children only when they underwent screening for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the intensive care unit (ICU) (they did not have Covid-19 symptoms). BE denotes base excess, BP blood pressure, MIS-C multisystem inflammatory syndrome in children, ND not done, PCR polymerase chain reaction, and SaO<sub>2</sub> oxygen saturation.

† For patients with multiple admissions, the total duration is reported.

‡ For patients with multiple admissions, the most aberrant value is reported.

§ The patient was identified through the presence of MIS-C according to the Swedish Pediatric Rheumatology Quality Register. Covid-19 was not diagnosed during ICU care, but the results of subsequent antibody testing were positive.

¶ Covid-19 was diagnosed clinically (i.e., SARS-CoV-2 was not detected during the ICU admission).

teachers and 20 schoolteachers in Sweden received intensive care for Covid-19 up until June 30, 2020 (20 per 103,596 schoolteachers, which is equal to 19 per 100,000). As compared with other occupations (excluding health care workers), this corresponded to sex- and age-adjusted relative risks of 1.10 (95% confidence interval [CI], 0.49 to 2.49) among preschool teachers and 0.43 (95% CI, 0.28 to 0.68) among schoolteachers (see the Supplementary Appendix).

The present study had some limitations. We lacked data on household transmission of Covid-19 from schoolchildren, and the 95% confidence intervals for our results are wide.

Despite Sweden's having kept schools and preschools open, we found a low incidence of severe Covid-19 among schoolchildren and children of preschool age during the SARS-CoV-2 pandemic. Among the 1.95 million children who were 1 to 16 years of age, 15 children had Covid-19, MIS-C, or both conditions and were admitted to an ICU, which is equal to 1 child in 130,000.

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## Duration of Culturable SARS-CoV-2 in Hospitalized Patients with Covid-19

**TO THE EDITOR:** The duration of transmissibility of coronavirus disease 2019 (Covid-19) and the associated level of contagion have been uncertain. We cultured severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in serial respiratory samples obtained from hospitalized patients with Covid-19 to assess the duration of shedding of viable virus.

The data reported here represent all the patients with Covid-19, as confirmed by positive real-time reverse transcriptase–polymerase chain reaction (RT-PCR) testing, who were hospitalized at Chung-Ang University Hospital in Seoul, South Korea, between February and June 2020. The Allplex 2019-nCoV Assay (Seegene) for nasopharyngeal and oropharyngeal samples was used for real-time RT-PCR testing.<sup>1</sup> Patients were isolated until two consecutive negative or inconclusive results on real-time RT-PCR were document-

ed, at least 24 hours apart.<sup>2,3</sup> We endeavored to obtain samples at approximately 2-day intervals, but this was not always possible. Viral RNA was quantitated with the use of the cycle-threshold value for the N gene of SARS-CoV-2.<sup>4</sup> Viral cultures were conducted by means of a plaque assay until at least two consecutive cultures showed no growth.

We compared the time from the onset of illness to viral clearance in culture with the time to clearance in real-time RT-PCR tests.<sup>5</sup> Detailed methods and sensitivities of the culture and real-time RT-PCR assay and the definition and estimation of the time to viral clearance are described in the Supplementary Appendix, available with the full text of this letter at NEJM.org.

A total of 21 patients with Covid-19 were enrolled. Their clinical characteristics are shown in Table S1 in the Supplementary Appendix. The