

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).^{1,2} 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 2020.³ Social distancing was encouraged in Sweden, but wearing face masks was not.³

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 multi-system inflammatory syndrome in children (MIS-C, which is likely to be related to Covid-19)⁴ 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 report⁵ and personal communication) showed that fewer than 10 preschool 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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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 ₂ , 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 ₂ , 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 ₂ , 99%	—	MIS-C, renal failure, coagulation disorder
5 yr	F	Positive	Positive	3	1	Systolic BP, 83 mm Hg; SaO ₂ , 98%; BE, −0.7 mmol/liter	—	MIS-C
7 yr¶	M	Negative	ND	<1	1	Systolic BP, 85 mm Hg; SaO ₂ , 97%; BE, −0.7 mmol/liter	—	Iron deficiency, coma, fever
7 yr	F	Positive	Positive	35	2	Systolic BP, 115 mm Hg; SaO ₂ , 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 ₂ , 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 ₂ , 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 ₂ , 92%; lactate, 0.9 mmol/liter; BE, +3.2 mmol/liter	—	—
13 yr	F	Positive	Positive	7	2	Systolic BP, 80 mm Hg; SaO ₂ , 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 ₂ , 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 ₂ , 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 SaO₂ 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).

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Disclosure forms provided by the authors are available with the full text of this letter at NEJM.org.

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1. Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020;382:727-33.
2. Viner RM, Russell SJ, Croker H, et al. School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. *Lancet Child Adolesc Health* 2020;4:397-404.

3. Ludvigsson JF. The first eight months of Sweden's COVID-19 strategy and the key actions and actors that were involved. *Acta Paediatr* 2020;109:2459-71.

4. Whittaker E, Bamford A, Kenny J, et al. Clinical characteristics of 58 children with a pediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2. *JAMA* 2020;324:259-69.

5. Public Health Agency of Sweden. Förekomst av covid-19 i olika yrkesgrupper inom skolan. 2020 (<https://www.folkhalsomyndigheten.se/publicerat-material/publikationsarkiv/f/forekomst-av-covid-19-i-olika-yrkesgrupper-inom-skolan/>).

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