Research Letter

SARS-CoV-2 Immunity Gap Among Schoolchildren and Teachers in the Summer of 2022

To prepare for autumn/winter 2022 in Germany, knowledge of the "immunity gap"—meaning the lack of a measurable antibody response in the population—is highly relevant. Until calendar week 21/2022, more than 26 million SARS-CoV-2 infections were reported via the official notification numbers of the Robert Koch-Institute (RKI). Because of relevant underreporting and a high vaccination rate, this figure can be assumed to reflect immunity to an unsatisfactory extent. This is especially true for school students and teachers, knowledge of the current seroprevalence levels before the start of the new school year in this population is therefore of particular interest.

Methods

Since May 2020 the SchoolCoviDD19 Study (1, 2) has serially collected data on the SARS-CoV-2 seroprevalence in students and teachers at secondary schools in eastern Saxony. The schools were selected by the state department for schools and education (LaSuB) of the Federal State of Saxony. The selected schools were supplied with information materials to be distributed to students and teachers at their own discretion. The participation rate ranged from 10% to 50% per school. After participants had been provided with information and given consent, SARS-CoV-2 antibody concentrations were measured by LIAISON SARS-CoV-2 S1/S2 IgG assay against the spike protein, which is detectable after natural infection as well as after vaccination. Participants' vaccination status was documented by questionnaire. We present data from November 2021—at the peak of the Delta wave—and May 2022—at the end of the Omicron wave.

TABLE 1

Demographic data

	November 2021	May 2022
Students	**1142**	**601**
Age; median (IQR)	16 (14–17)	16 (14–17)
Female (%)	663 (58.1)	359 (59.7)
Household size; median (IQR)	4 (4–5)	4 (4–5)
Vaccination rate* (%)	739 (64.7)	441 (73.4)
Teachers	**393**	**264**
Age; median (IQR)	49 (37–57)	47 (38–58)
Female (%)	278 (70.7)	199 (75.4)
Household size; median (IQR)	2 (2–4)	2 (2–4)
Vaccination rate* (%)	343 (87.3)	230 (87.1)

* At least one dose of the vaccine
IQR, interquartile range

Results

In November 2021, 1535 participants—1142 students (74.4%) and 393 teachers (25.6%)—took part in the study. 739 students (64.7%) and 343 teachers (87.3%) had received at least one dose of a COVID-19 vaccine at this time (*Table 1*). The seroprevalence among unvaccinated students was 32%, not relevantly different to that among teachers (22%). Of the vaccinated participants, 98.2% tested positive on serology. Altogether 1203 (78.4%) of all participants had measurable antibodies against SARS-CoV-2, with the proportion significantly higher among teachers (89.3%) than among students (74.6%).

In May 2022, 865 participants—601 students (69.5%) and 264 teachers (30.5%)—took part. 922 (95%) had previously participated in the SchoolCoviDD19 Study. The vaccination rate among students rose slightly, to 73.4%, whereas that among teachers remained stable, at 87.1%. The seroprevalence among unvaccinated participants rose to a relevant degree over five months and was 70% (112/160) among students 67.6% (23/34) among teachers, without relevant differences *(Table 2)*. Among participants who received at least one vaccine dose, 99.7% had confirmed antibodies to the spike protein. In total in May 2022, 92.9% of participants tested positive on SARS-CoV-2 serology, without relevant differences between teachers (95.1%) and students (92%).

Discussion

In the early summer of 2022, in the third year of the SARS-CoV-2 pandemic, the immunity gap in eastern Saxony—a federal state with a vaccination rate that is low in the national comparison—in students and teachers amounted to a very low percentage. The differences that had been confirmed in the autumn of 2021 between the adults and young people equalized in the course of the omicron wave, immunization increased in accordance with the relevant STIKO [Standing Vaccination Committee] guidelines at the time, and the vast majority of those remaining unvaccinated had become immunized naturally over this time period. We can assume that this process will continue over the coming summer months and will reduce the existing immunization gap further. The infection numbers/rates that will presumably rise in the autumn will therefore hit a population that is immunized to a high degree. Making an uncontrolled spread and resulting
collapse of the healthcare system very unlikely , as long as variants with a increased potential for immune escape do not emerge.

The available data also show that in spite of the focus of many pandemic mitigation measures on students—such as creening tests, mandatory mask wearing during lessons, restrictions to exercise and

TABLE 2

Seroprevalence

	Total	Students	Teachers
Seropositivity (anti-spike IgG) November 2021			
Vaccinated* participants	1063 /1082(98.2 %)	723/739 (97.8 %)	340/343 (99.1 %)
Unvaccinated participants	140/453 (30.9 %)	129/403 (32.0 %)	11/50 (22.0 %)
All	1203/1535 (78.4 %)	852/1142 (74.6)	351/393 (89.3 %)
Seropositivity (anti-spike IgG) May 2022			
Vaccinated* participants	669/671 (99.7)	441/441 (100 %)	228/230 (99.1 %)
Unvaccinated participants	135/194 (69.6 %)	112/160 (70.0 %)	23/34 (67.6 %)
All	804/865 (92.9)	553/601 (92.0 %)	251/264 (95.1 %)

* At least one vaccine dose

leisure activities—did not affect the primarily natural immunization of this population. The measures have, on the other hand, a multitude of undesirable negative effects on this age group (3,k 4), whose long-term sequelae can currently only be estimated. In the subsequent course of the pandemic this should be considered when balancing measures, especially given the very low risk for a severe disease course in this age group.

Jakob Peter Armann, Judith Blankenburg, Paula Czyborra, Maren Doenhardt, Theresa Horst, Josephine Schneider, Christin Gano, Reinhard Berner
Department for Pediatric and Adolescent Medicine, University Hospital and Medical Faculty Carl Gustav, Dresden University of Technology, Dresden, Jakob.Armann@ukdd.de

Conflict of interest statement
The authors declare that no conflict of interest exists.

Manuscript received on 7 June 2022, revised version accepted on 16 August 2022.

Translated from the original German by Birte Twisselmann, PhD.

References

1. Kirsten C, Kahre E, Blankenburg J, Schumm L, Haag L, Galow L, et al.: Seroprevalence of SARS-CoV-2 in German secondary schools from October 2020 to July 2021: a longitudinal study. Infection 2022; 23: 1–8.
2. Kirsten C, Unrath M, Lück C, Dalpke AH, Berner R, Armann J: SARS-CoV-2 seroprevalence in students and teachers: a longitudinal study from May to October 2020 in German secondary schools. BMJ Open 2021;11: e049876.
3. Blankenburg J, Wekenborg MK, Reichert J, Kirsten C, Kahre E, Haag L, et al.: Comparison of mental health outcomes in seropositive and seronegative adolescents during the COVID19 pandemic. Sci Rep 2022; 12: 2246.
4. Ravens-Sieberer U, Kaman A, Devine J, et al.: The mental health and health-related behavior of children and parents during the COVID-19 pandemic. Dtsch Arztebl Int 2022; 119: 436–7.
5. Sorg A-L, Hufnagel M, Doenhardt M, et al.: Risk for severe outcomes of COVID-19 and PIMS-TS in children with SARS-CoV-2 infection in Germany. Eur J Pediatr 2022; 13: 1–9.

Cite this as:
Armann JP, Blankenburg J, Czyborra P, Doenhardt M, Horst T, Schneider J, Gano C, Berner R: SARS-CoV-2 immunity gap among schoolchildren and teachers in the summer of 2022. Dtsch Arztebl Int 2022; 119: 800–1. DOI: 10.3238/arztebl.m2022.0307