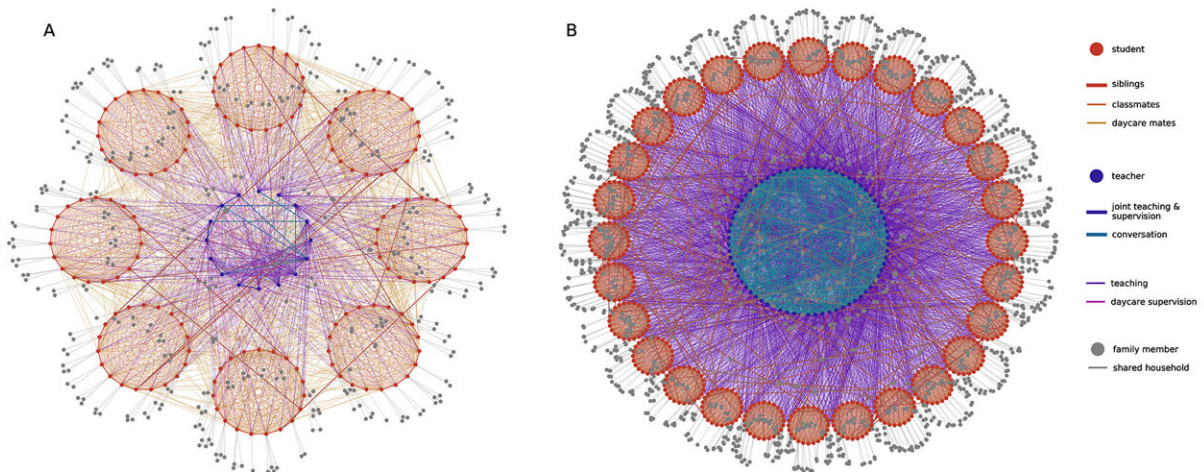


Schools and the pandemic: Simulation model allows for safe operation

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The image on the right shows a primary school with afternoon daycare (8 classes, 19 pupils each, 16 teachers + respective family members). On the right is a typical secondary school (28 classes with 24 children each, 70 teachers + respective family members). Credit: The authors of the study

A year ago, the whole world discussed: is it irresponsible to send children to school during a pandemic, or do measures exist that can prevent corona clusters so efficiently that schools can stay open (or reopen)?

A research team at the Complexity Science Hub Vienna (CSH) wanted

to know for sure. Jana Lasser, then working in Peter Klimek's team at the CSH and MedUni Vienna and now a scientist at Graz University of Technology, developed a [school](#) simulation model that shows how and how likely the virus spreads in different school settings. The model also allows to calculate the effectiveness of (bundles of) measures against virus spread.

For this study published in the current issue of *Nature Communications*, the CSH team added the properties of the delta variant, which was predominant in Austria before Christmas. "However, we can adapt our model any time and simulate a wide variety of other scenarios," said complexity scientist Jana Lasser, the first author of the paper.

The research team developed and calibrated its "school tool" with data on 616 corona clusters that had occurred in Austrian schools in the fall of 2020. The anonymized data were contributed by the Austrian Agency for Health and Food Safety (AGES).

To get a sense of what measures could realistically be implemented in schools, the researchers also conducted several interviews with school principals and teachers.

The multitude of possibilities makes the undertaking complex

First, the scientists defined different types of schools: How many classes does a school have, how big are the classes, how many teachers are there at the school, etc. "In our model, we distinguish [primary schools](#) with or without afternoon daycare, lower secondary schools with or without afternoon daycare, upper secondary schools, or secondary schools with children from 10 to about 18 years," Lasser said.

These virtual schools can take different measures to prevent clusters if possible. The measures included: wearing masks, a frequent intensive ventilation of classrooms, the regular testing of children and teachers, and class size reduction. The scientists also simulated different vaccination rates among teachers and children.

It's all about the mix

One result of the work: the measures must be adapted to different school types. "Secondary schools tend to be larger, with more children in the classes and changing teachers, so there are significantly more opportunities for infection spread. The web-based visualization we also developed shows nicely how an infection runs through a school," Lasser explains. This higher likelihood of contagion in larger schools means they need to implement more measures than elementary schools.

Based on the delta variant, and given that 80 percent of the teachers are vaccinated, the model shows that elementary and lower [secondary schools](#) can keep the reproduction rate R below 1 (i.e., one [sick person](#) infects less than one other person on average) with classroom ventilation, wearing masks, and class size reduction even when children are not vaccinated. In all other types of schools, the same measures can help to keep R

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