Direct and Indirect Effects of Vaccines Evidence from COVID-19 in Schools

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Vaccines influence the course of pandemics both directly, by protecting the vaccinated, and indirectly, by reducing transmission to the unvaccinated, a key externality. Estimating direct effects is challenging because of selective vaccine take-up; estimating indirect effects also poses difficulty as it requires exogenous variation in peer vaccination status. We overcome these challenges using unique microdata from Indiana together with a natural experiment. To identify direct effects, we use federal age-based vaccine eligibility rules by which seventh graders were eligible in Fall 2021 but sixth graders and younger were not. To identify indirect effects, we compare sixth graders in middle schools (whose older schoolmates are vaccine eligible) to sixth graders in elementary schools (whose schoolmates are ineligible). This variation in difference-in-differences designs leads to large estimates of direct effects: vaccination reduces COVID-19 incidence by 80 percent. But our estimates of indirect effects are small and statistically insignificant: despite a 20 percentage point increase in vaccination rates across all grades, we find essentially no difference in COVID-19 incidence between sixth graders in middle schools and sixth graders in elementary schools. A complementary identification strategy also finds small indirect effects from vaccinated grade-mates. This evidence from real-world settings matches clinical evidence forCOVID-19 vaccines’ benefits for the vaccinated, and provides new evidence that clinical trials were unable to examine, on indirect effects. Prior work on the influenza and pertussis vaccines has found substantial externalities, thus our findings suggest that prior evidence on one disease and its vaccine need not generalize to others.

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