

The Impact of Opening K-12 Schools and Colleges on the Spread of COVID-19 in the U.S.

Victor Chernozhukov¹ Hiroyuki Kasahara² Paul Schrimpf²

¹Department of Economics and Center for Statistics and Data Science, MIT

²Vancouver School of Economics, UBC

Issue

What is the impact of opening K-12 schools and colleges/universities on the spread of COVID-19 in the United States?

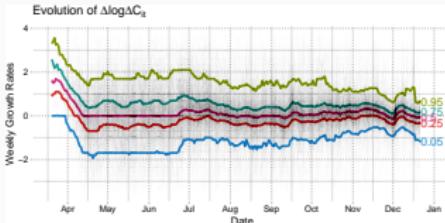
County-level Panel Data

- Data period: from May 1 to December 2.
- 3219 Counties
- Daily cases and deaths: NYT
- County-level policies: mandatory masks, ban gathering more than 50, stay-at-home (?)
- K-12 opening plans: dates of K-12 school openings and the learning modes (in-person, hybrid, and remote) from EducationWeek
- Foot traffic data: visits to colleges/universities, K-12 schools, restaurants, bars, gyms from SafeGraph

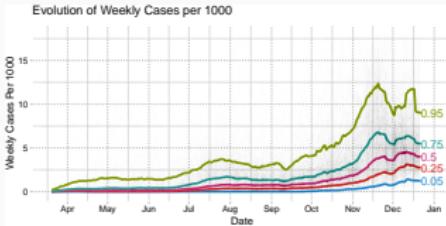
We use 7 days moving averages of all variables

Evolutions of Cases and Visits to K-12 Schools and Colleges

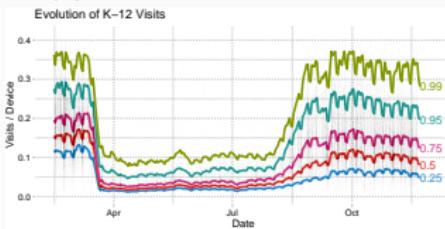
(a) Case Growth



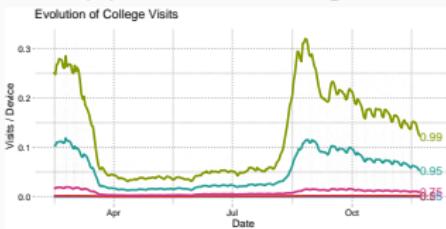
(b) Cases per 1000



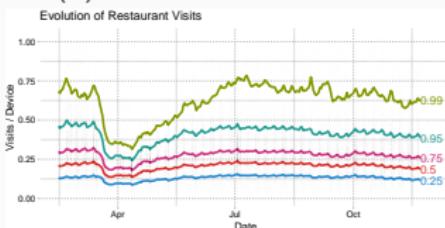
(c) Visits to K-12 Schools



(d) Visits to Colleges



(e) Visits to Restaurants

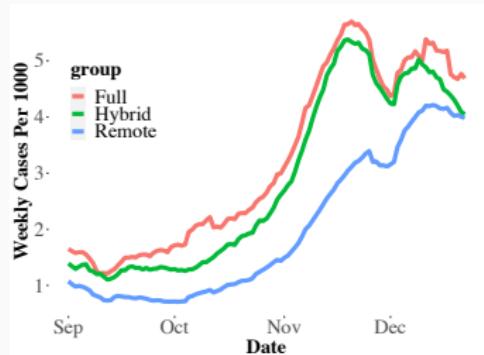


(f) Visits to Bars

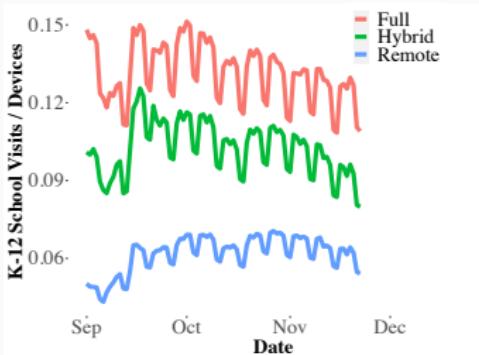


Weekly Cases and Openings of K-12 Schools and Colleges

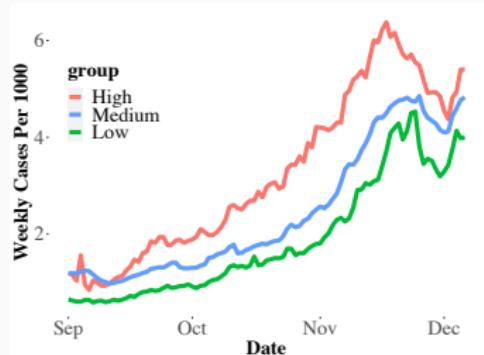
(a) Cases by K-12 opening modes



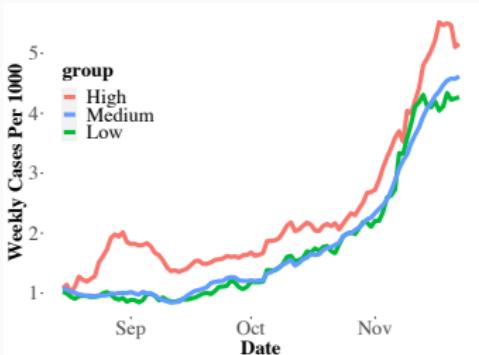
(b) K-12 visits by opening modes



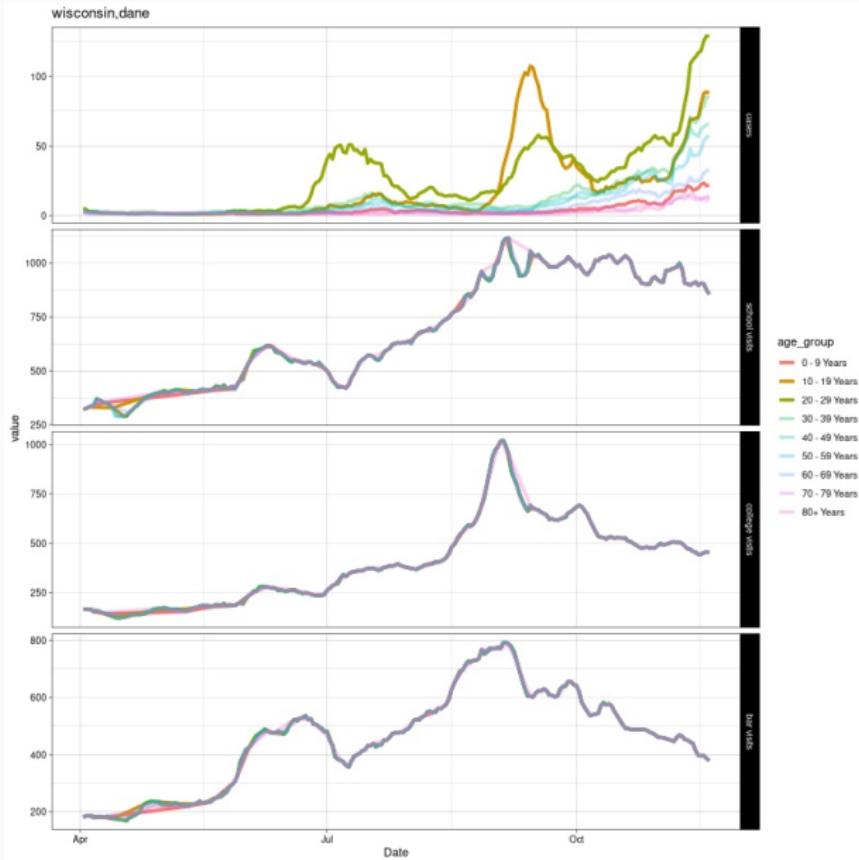
(c) Cases by K-12 school visits



(d) Cases by college visits



Dane County, Wisconsin



County-level Panel Data Regression

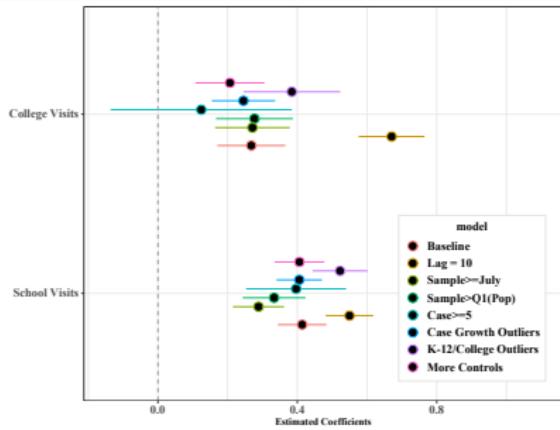
	Dependent variable: Weekly Case Growth Rates			
College Visits, 14 days lag	0.190*** (0.064)	0.462*** (0.151)	0.173*** (0.065)	0.337** (0.159)
K-12 Visits, 14 days lag	0.671*** (0.070)		0.509*** (0.067)	
K-12 Open Full, 14 days lag		0.143*** (0.023)		0.100*** (0.026)
K-12 Open Hybrid, 14 days lag		0.095*** (0.021)		0.050** (0.025)
K-12 Open Remote, 14 days lag		0.032 (0.021)		-0.005 (0.024)
Mask Mandates, 14 days lag	-0.079*** (0.011)	-0.060*** (0.015)	-0.089*** (0.010)	-0.036** (0.015)
Ban Gatherings, 14 days lag	-0.241*** (0.029)	-0.208*** (0.052)	-0.088** (0.042)	-0.130* (0.074)
Stay at Home, 14 days lag	-0.194*** (0.031)	-0.150*** (0.049)	-0.061 (0.042)	-0.065 (0.066)
log(Cases), 14 days lag	-0.109*** (0.004)	-0.122*** (0.009)	-0.104*** (0.005)	-0.107*** (0.010)
log(Cases), 21 days lag	-0.048*** (0.005)	-0.024* (0.012)	-0.054*** (0.005)	-0.034*** (0.012)
log(Cases), 28 days lag	-0.029*** (0.004)	-0.058*** (0.010)	-0.029*** (0.004)	-0.052*** (0.009)
County FE	Yes	Yes	Yes	Yes
State × Month FE	Yes	Yes	No	No
State × Week FE	No	No	Yes	Yes
Observations	586,902	131,890	586,902	131,890

Note:

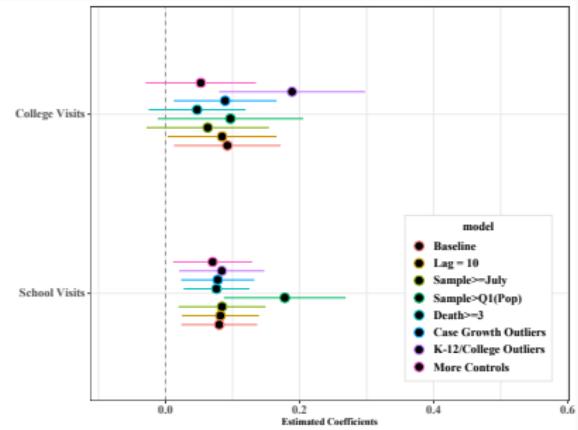
*p<0.1; **p<0.05, ***p<0.01

Sensitivity Analysis

(a) Case Growth Regression



(b) Death Growth Regression



Visits to colleges and K-12 schools and visits to restaurants, bars, gyms, and churches.

	Dependent variable:			
	Restaurant Visits	Bar Visits	Gym Visits	Church Visits
	(1)	(2)	(3)	(4)
College Visits	0.392*** (0.091)	0.026*** (0.007)	0.023** (0.009)	0.036** (0.005)
K-12 School Visits	0.324*** (0.044)	0.044*** (0.016)	0.028*** (0.006)	0.053*** (0.013)
Mandatory mask	0.287 (0.299)	0.112*** (0.041)	0.091*** (0.033)	0.102*** (0.031)
Ban gatherings	-0.773*** (0.143)	-0.122*** (0.017)	-0.326*** (0.029)	-0.018 (0.021)
Stay at home	-1.348*** (0.156)	-0.239*** (0.027)	-0.317*** (0.026)	-0.010 (0.017)
log(Cases)	-0.021 (0.026)	0.001 (0.004)	-0.009** (0.004)	-0.016*** (0.003)
log(Cases), 7 days lag	-0.045** (0.019)	-0.001 (0.004)	-0.015*** (0.003)	-0.017*** (0.003)
log(Cases), 14 days lag	-0.171*** (0.026)	-0.014*** (0.004)	-0.022*** (0.004)	-0.008** (0.003)
County FE	Yes	Yes	Yes	Yes
State × Week FE	Yes	Yes	Yes	Yes
Observations	586,904	586,904	586,904	586,904
R ²	0.883	0.797	0.859	0.846

Note:

*p<0.1; **p<0.05; ***p<0.01

References

Killeen, B. D., Wu, J. Y., Shah, K., Zapaishchykova, A., Nikutta, P., Tamhane, A., Chakraborty, S., Wei, J., Gao, T., Thies, M., and Unberath, M. (2020), “A County-level Dataset for Informing the United States’ Response to COVID-19,” .

Correlation matrix

	Restaurant Visits	Bar Visits	Gym Vists	Church Vists	Mandatory mask	Ban gatherings >50	Stay at home	College Visits	K-12 Visits	Open K-12 full	Open K-12 hybrid	Open K-12 remote
Restaurant Visits	1.00											
Bar Visits	0.21	1.00										
Gym Vists	0.51	0.19	1.00									
Church Vists	0.13	0.04	-0.02	1.00								
Mandatory mask	0.14	0.01	0.18	-0.07	1.00							
Ban gatherings >50	0.17	-0.03	0.07	-0.00	-0.04	1.00						
Stay at home	-0.00	-0.04	-0.03	-0.08	-0.09	0.14	1.00					
College Visits	0.21	0.06	0.18	0.08	0.09	-0.02	-0.04	1.00				
K-12 Visits	-0.02	0.05	-0.02	0.30	0.07	-0.11	-0.18	0.09	1.00			
Open K-12 full	-0.01	-0.06	-0.07	0.25	-0.06	-0.08	-0.13	0.10	0.53	1.00		
Open K-12 hybrid	-0.05	0.04	0.04	0.05	0.13	-0.10	-0.09	0.09	0.29	-0.15	1.00	
Open K-12 remote	0.06	0.07	0.19	-0.05	0.32	0.00	-0.14	0.06	0.05	-0.19	-0.14	1.00