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Mandatory Social Distancing Associated With Increased Doubling Time: An Example Using Hyperlocal Data



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INTRODUCTION

Mandatory social distancing has been shown in both observational and modeling studies to decrease the spread of infectious diseases such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹ It has been widely implemented in the U.S. during the SARS-CoV-2 pandemic, but this implementation occurred at different times and with different levels of adherence. The state of Georgia has 159 relatively small counties, making it possible to assess the impact of different distancing policies in neighboring counties. The authors present an example using these hyperlocal data in the state of Georgia.

In Georgia, Clarke County was among the first counties to adopt a mandatory policy of sheltering-in-place (SIP) with 2 primary objectives: (1) prohibition of assemblages, events, and gatherings of more than 10 people and (2) requiring individuals to remain at home 24 hours a day, with very limited exceptions for essential travel. The policy was adopted on March 19, 2020, and implemented on March 20, 2020. These measures were not adopted by any surrounding counties except for 1 neighboring county (Oconee) that implemented a similar policy on March 24, 2020. A statewide SIP policy was not implemented until April 3, 2020.² This variation in SIP policies at this hyperlocal level created a natural experiment before the statewide policy change, allowing examination of the relationship between SIP policy implementation and case doubling rates for Clarke (treatment county) versus surrounding counties (control group).

METHODS

Statewide data regarding new cases by county have been reported since March 14, 2020. The authors used these data to estimate the doubling rate for Clarke County (population: 127,330) and the surrounding 6 counties (Jackson, Barrow, Oconee, Oglethorpe, Madison, and Walton; total population of the 6 counties: 328,710).

Because of relatively small and fluctuating numbers of cases, the authors calculated 5-day moving averages of the percentage increase in cases in Clarke County versus surrounding counties. The following formula was used to calculate doubling time, where T_d is doubling time and r is the 5-day moving average in the percentage increase in cases (range, 0–100)³:

$$T_d = t \frac{\ln(2)}{\ln(1 + \frac{r}{100})}$$

RESULTS

Data for new cases by date are shown in [Table 1](#), and the doubling times for Clarke County, surrounding counties, and the state of Georgia are presented in [Figure 1](#). A more rapid and larger increase in doubling time was observed in Clarke County after the implementation of mandatory distancing than in the surrounding counties. Authors used the `xtreg` procedure in Stata, version 16.1, to fit a fixed-effect linear regression model using doubling time as the dependent variable and distancing policy as the independent variable. The distancing policy variable was estimated in 2 ways: (1) using only local data and (2) adding statewide data. The local model showed a mean increase in doubling time of 11.3 days in Clarke County compared with surrounding counties. Incorporating state data still found an increased doubling time by a mean of 8.0 days. The authors performed a sensitivity analysis by creating a model using the percentage daily increase in cases as the dependent variable and found the results to be consistent with the other models, that is, a 30% decrease in the percentage

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Table 1. New Cases for Clarke County, Surrounding Counties, and the State of Georgia

Date	Doubling time (days)		
	Clarke county	Counties surrounding Clarke	State of Georgia
3/19/20	1.9	—	2.3
3/20/20 ^a	2.0	—	2.1
3/21/20	2.8	2.1	2.2
3/22/20	2.6	2.6	2.3
3/23/20	3.1	1.9	2.4
3/24/20	4.3	1.6	2.5
3/25/20	5.0	1.9	3.6
3/26/20	3.5	1.7	3.4
3/27/20	2.9	1.7	2.9
3/28/20	3.7	2.2	3.2
3/29/20	4.6	2.7	3.9
3/30/20	4.4	3.5	4.2
3/31/20	4.6	2.7	3.7
4/1/20	7.2	3.0	4.0
4/2/20	7.7	3.0	4.2
4/3/20 ^b	6.9	3.1	4.3
4/4/20	8.9	2.9	4.3
4/5/20	16.1	6.2	6.2
4/6/20	11.4	7.4	7.6
4/7/20	9.7	5.4	6.9
4/8/20	9.8	5.7	6.5
4/9/20	11.4	6.0	6.4
4/10/20	12.7	5.7	6.3
4/11/20	19.6	6.1	6.7
4/12/20	45.7	9.9	10.0
4/13/20	71.6	10.1	11.7
4/14/20	21.2	8.9	11.6
4/15/20	17.9	11.0	13.0
4/16/20	15.7	8.9	13.6
4/17/20	14.0	7.7	10.7
4/18/20	15.5	8.1	11.8
4/19/20	26.9	10.0	13.7
4/20/20	29.9	11.6	14.7
4/21/20	31.0	13.9	14.5
4/22/20	38.3	20.1	18.5
4/23/20	29.9	16.0	18.5
4/24/20	32.8	14.9	18.2
4/25/20	33.4	14.2	19.2
4/26/20	45.5	16.0	21.2
4/27/20	38.2	18.0	25.4

^aDate that shelter-in-place was mandated in Clarke County.

^bDate that shelter-in-place was mandated for the state of Georgia.

increases in Clarke compared with that in the surrounding counties.

DISCUSSION

One would expect a lag of at least 5 days between the implementation of mandatory distancing and an impact

on disease spread, given the incubation period of the infection. A longer lag period may also be created by delays in test results being reported, which was occurring. Assuming a 5-day median time of incubation³ and a 5-day lag in test results is consistent with the visual separation in the doubling time curves occurring approximately 10 days after mandatory SIP became

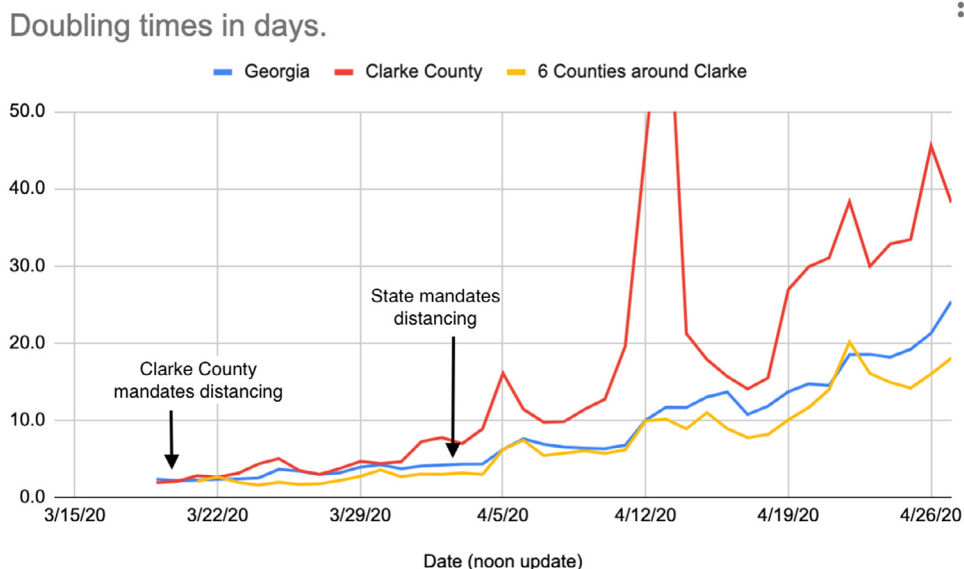


Figure 1. Doubling times for Clarke County, 6 surrounding counties, and the state of Georgia.

implemented in Clarke County. The lag after state SIP implementation is likely to be shorter owing to a more rapid return of results as the pandemic progresses.

Limitations

Limitations include the fact that county of residence may have been attributed incorrectly. However, this would bias results against Clarke County because it has the only hospitals in the 7-county region, meaning that some patients who reside outside of Clarke may be attributed mistakenly to Clarke County. Adherence to distancing in Clarke County may have been better than the adherence in surrounding counties regardless of local mandates. However, demographic and socioeconomic characteristics of the region, such as the unemployment rate, uninsured rate, and median income, are similar across the 7-county region (with the exception of Oconee county, which has higher concentrations of wealth, education, and access to care).^{4–6}

CONCLUSIONS

The authors observed a favorable impact on doubling time that corresponded to the earlier implementation of

mandatory distancing in Clarke County than the later implementation in the surrounding counties and the state of Georgia.

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