Understanding the Current Epidemic from Dates of Symptom Onset

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Brief Report Prepared for the Iowa Department of Public Health by the University of Iowa College of Public Health COVID-19 Response Group

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Highlights

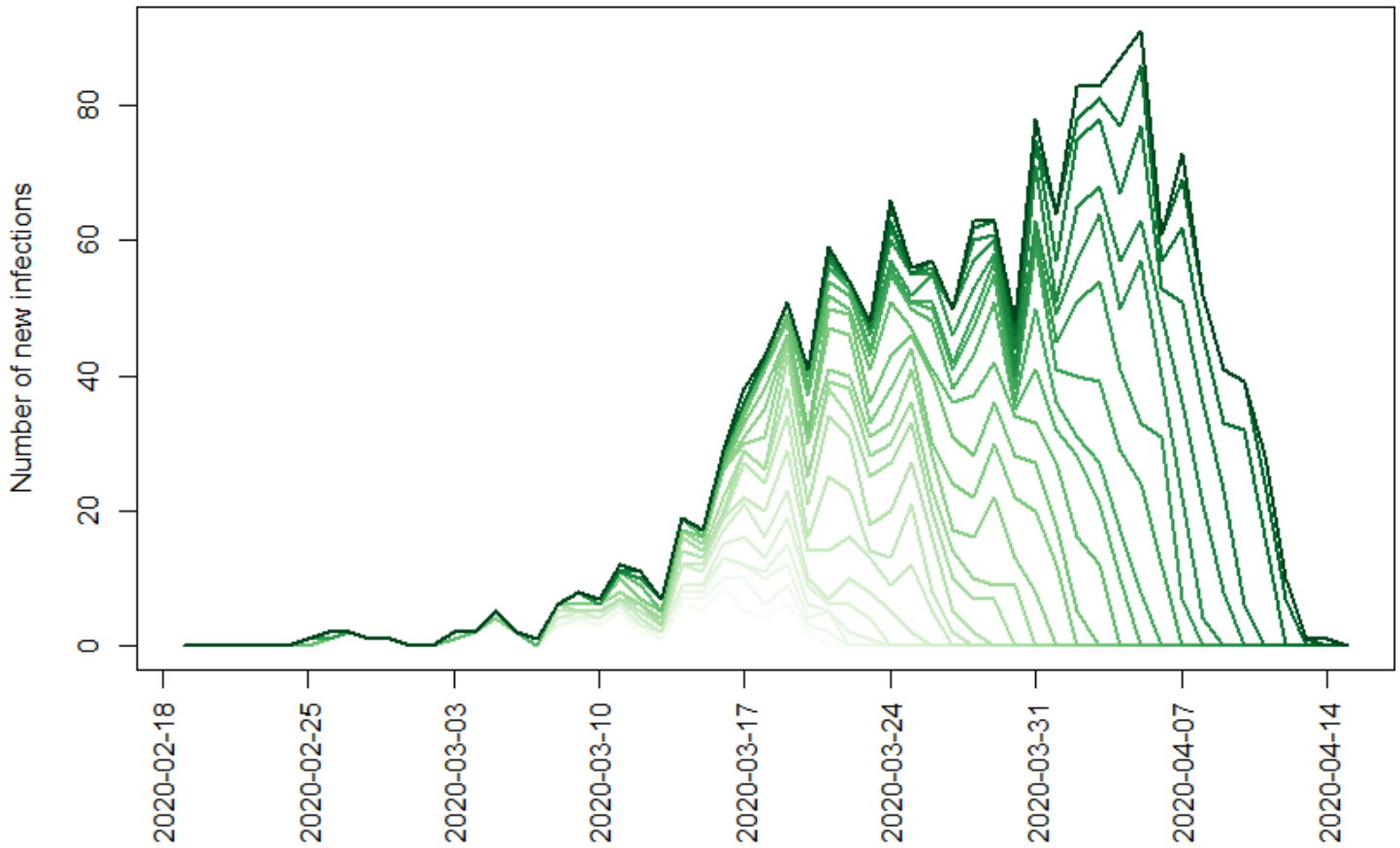
1. Use of symptom onset dates in any estimation of COVID peaks and trajectory is incorrect unless the most recent 7-10 days of data are excluded
2. Current estimates of the epidemic curve using our statistical modeling with Iowa specific data suggest Iowa has not yet reached a peak
3. Opening before the peak is reached is expected to result in a rapid rise of cases throughout the state

Report

To understand the progression of COVID-19 in Iowa, it is critically important to understand the number of individuals whose symptoms begin on each day since the beginning of the outbreak in Iowa. However, due to a systematic pattern of missing reporting of data, we need to be careful in looking at only the daily reported counts. The result of doing so leads to a misrepresentation of the current epidemic trajectory.

For each day starting on March 20, we computed the curve showing the daily number of new infections as determined by symptom onset using the information that was available on that day (Figure 1). The most current curve is shown in the darkest green, and each daily curve going back in time is shown in a lighter shade of green. The pattern of the curve based on showing new cases always appears to be peaking no matter which daily curve we look at. Using this metric, it has looked like Iowa is soon peaking every day for the past 6 weeks, even though this has not been the case. The inherent tendency of these curves to erroneously show that Iowa has passed the peak is due to the time lag between symptom onset and positive test results. This time lag needs to be incorporated into these figures to gain an accurate representation of Iowa's curve.

Figure 1



To account for the time lag between symptom onset and positive test results, we used an imputation procedure to estimate the daily number of new infections as measured by symptom onset. The resulting curve is given in Figures 2 and 3. Figure 2 shows the number of new cases. The observed counts are shown in the red trajectory, but accounting for the lag effect, we estimate the blue curve. Cumulative cases are shown in Figure 3. Note that these figures only reflect the state of the epidemic up to the last day in the data we have received from

Figure 2

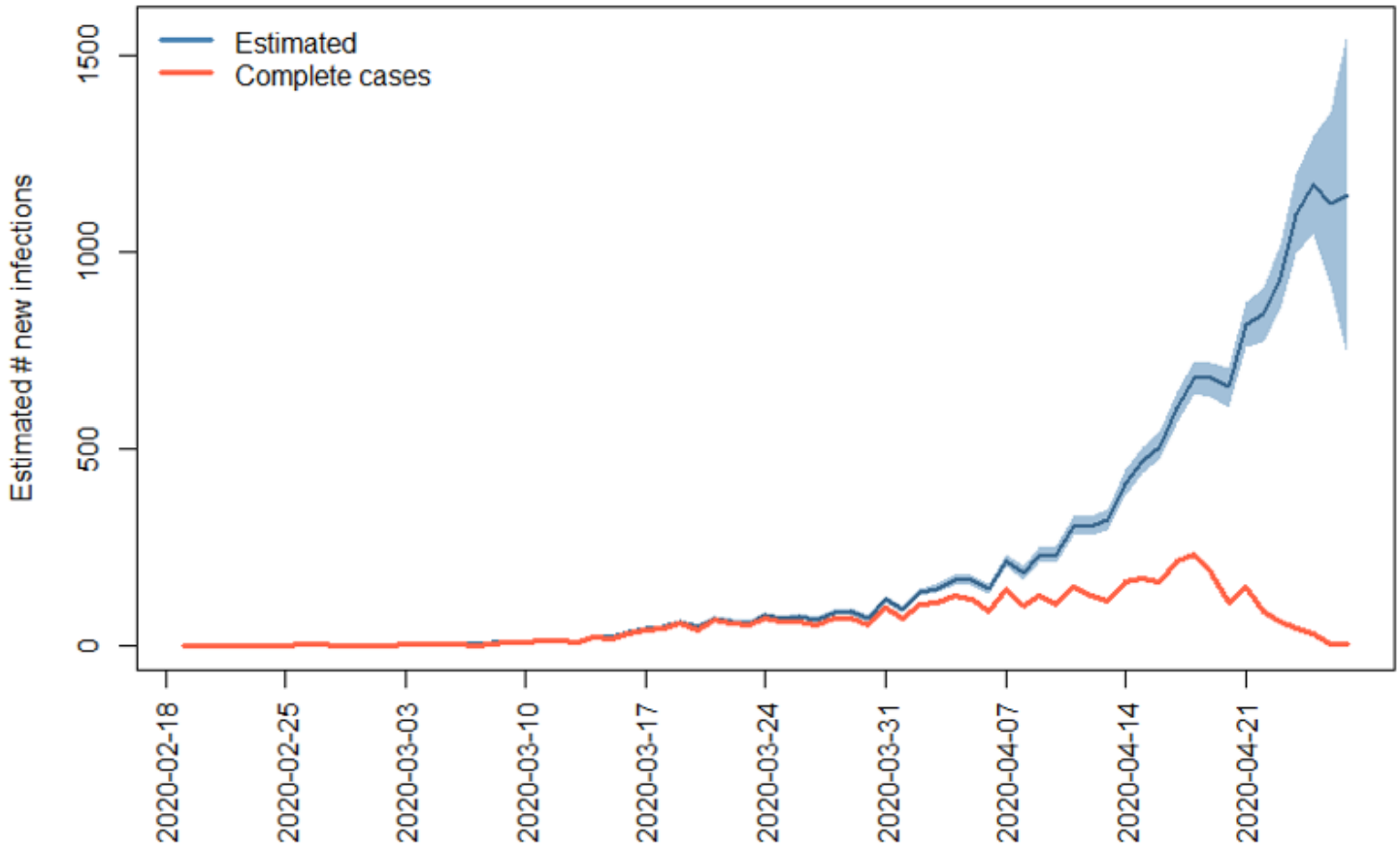
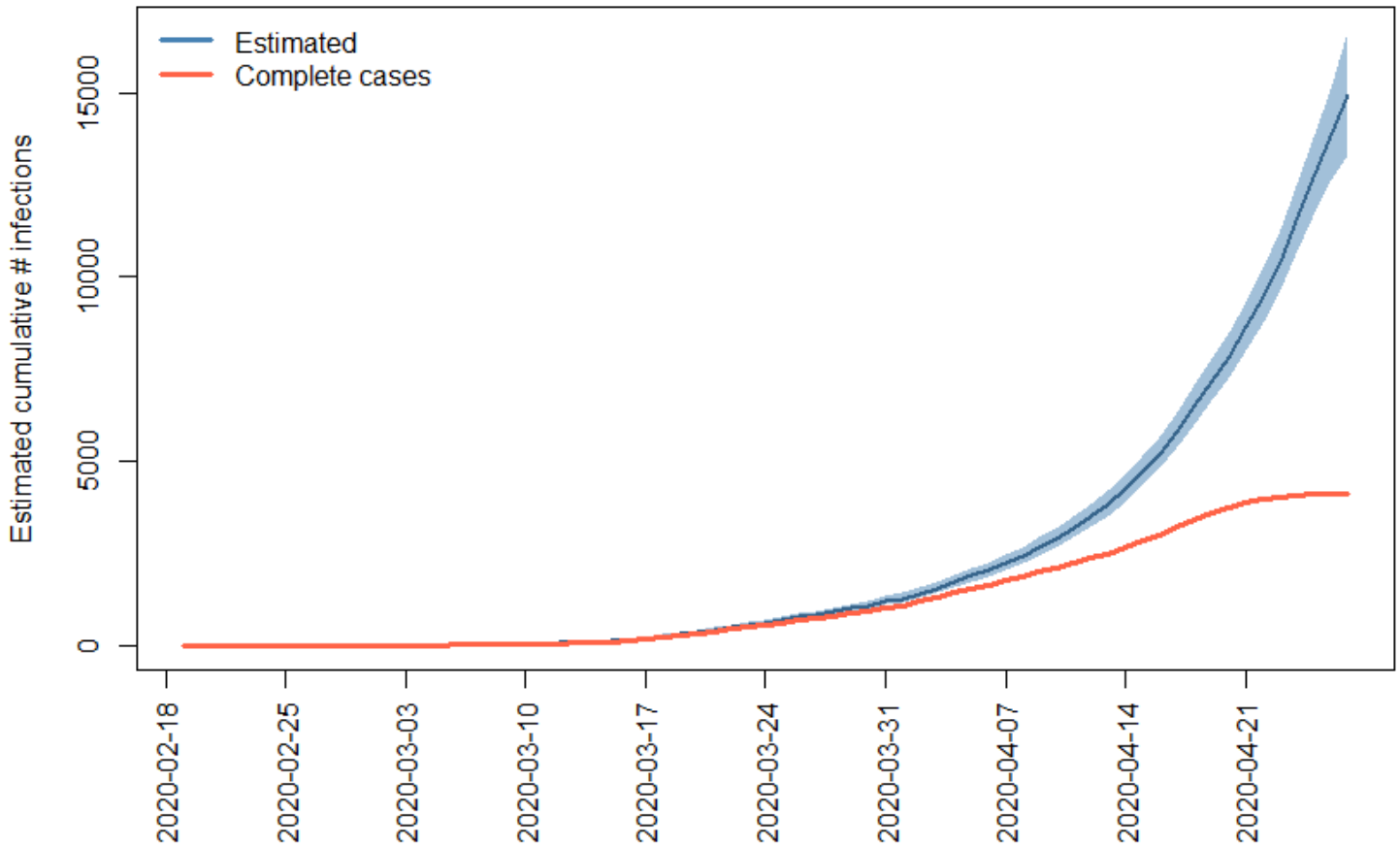

Estimated
Complete cases
Estimated # new infections
0
500
1000
1500
2020-02-18
2020-02-25
2020-03-03
2020-03-10
2020-03-17
2020-03-24
2020-03-31
2020-04-07
2020-04-14
2020-04-21

Figure 3



In summary, considering the dates of symptom onset is critical to understanding the current state of the COVID-19 outbreak in Iowa. However, due to a time lag between symptom onset and receiving a positive test result, there is a systematic missingness in the data that spuriously demonstrates Iowa has progressed past the peak of the epidemic. In actuality, accounting for the time lag paints a different picture, namely we are still on an upward trajectory and have not yet reached the epidemic's peak.