

BACKGROUND

- As of October 22, 2020, there has been 343,750 confirmed COVID-19 cases and 7704 deaths in Georgia state.
- On April 3, the governor announced shelter-in-place order in Georgia. On April 30, the shelter-in-place order was lifted.
- It's important to know how shelter-in-place and the subsequent reopening events impacted the transmission of COVID-19 in different regions in Gorgia. Such information could help plan for COVID-19 prevention and control measures.

PROJECT GOALS

- To examine transmission heterogeneity by demographic characteristics (e.g. age, gender), region and time.
- To quantify the serial interval of COVID-19 using traced transmission pairs.
- To estimate the time course of reproduction numbers of COVID-19 for all 159 counties in Georgia and examine effect of shelter-in-place.

METHODS

Data Source

- Data of 118,491 confirmed COVID-19 cases with demographic and clinical information in all 159 counties during February 1-July 13, 2020. Data is provided by the Georgia Department of Public Health (GDPH) and extracted from the SendSS database.
- From the data, there are 4080 tracked pairs of primary case-patients (infectors) and their secondary case-patients (infectees).

Statistical Analysis

- Estimated the serial interval of COVID-19 transmission as a gamma distribution using the maximum likelihood method.
- Imputed data of 48,887 (41.1%) missing symptom onset dates based on observed dates of first specimen collection when available, or observed laboratory report otherwise, by building negative binomial regression models.
- Estimated time-varying reproduction number Rt for each county in Georgia during February 1-July 13, 2020 by using a probability transmission matrix method<sup>1, 2</sup>

KEY FINDINGS

- The average serial interval became shorter over time: from 5.97 days in February–April,186 to 5.03 days in May, and then to 4.40 days in June–July (Figure 1).
- The major transmission shifted from elder generation to younger generation: from ages 40–70 years old in February–April to 20–50 years old in June–July (Figure 2).
- By mid-July, two waves of COVID-19 transmission were apparent, separated by the shelter-in-place period in the state of Georgia (Figure 3 and 5).
- Counties around major cities and along interstate highways had more intense transmission in Georgia (Figure 4).

RESULTS

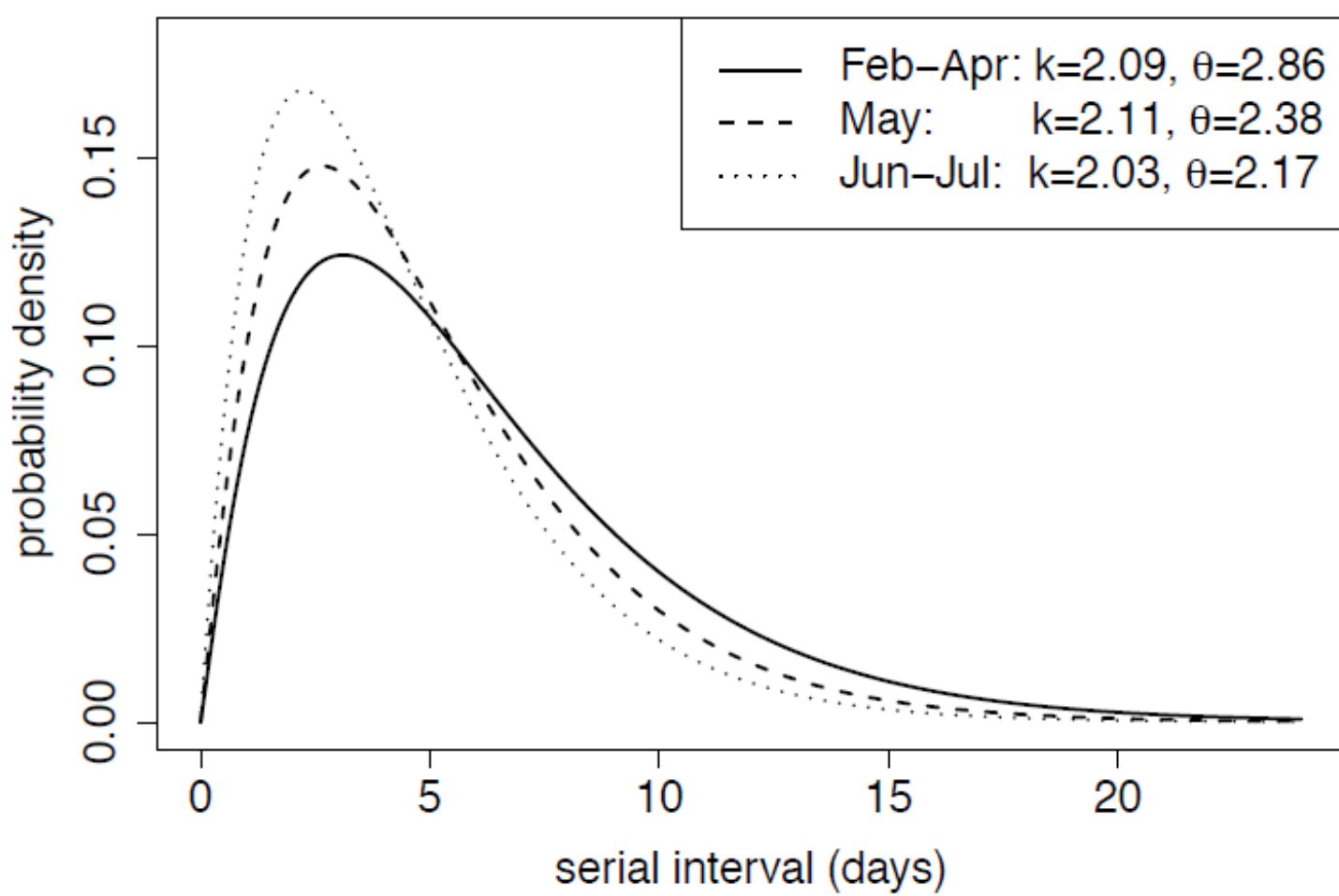


Figure 1. The estimated serial interval distribution for three time periods

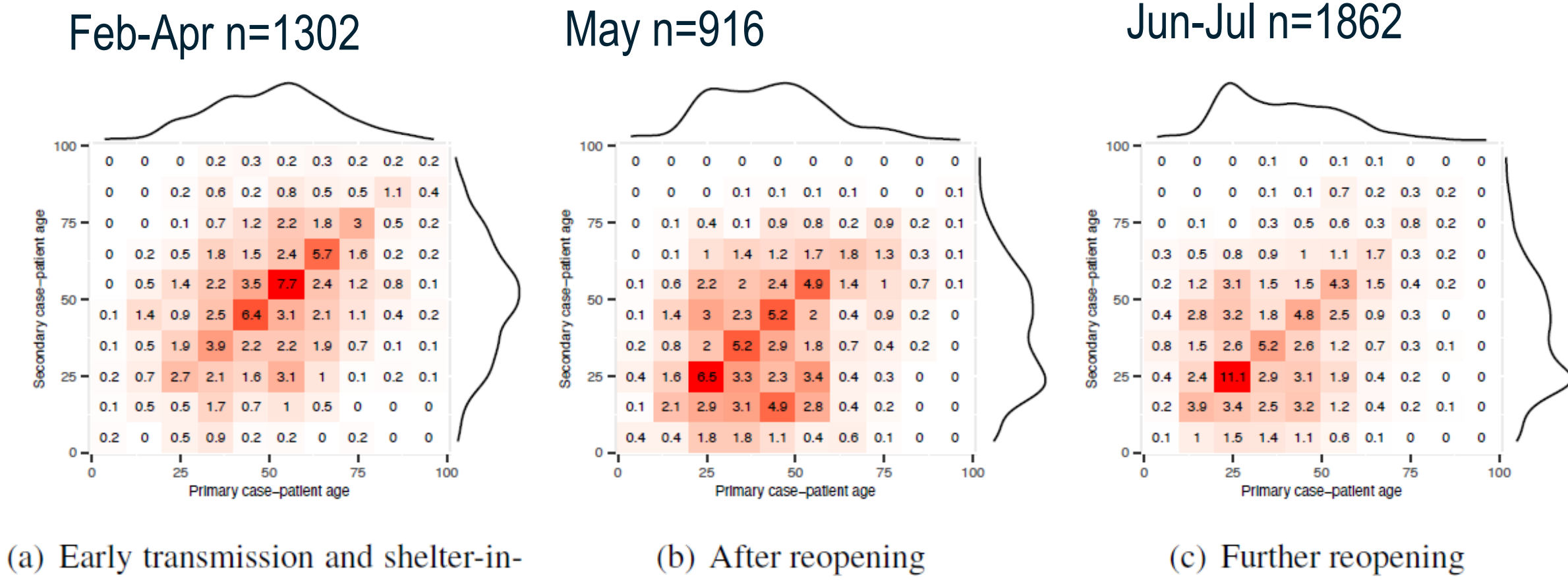


Figure 2. Patterns of COVID-19 disease transmission by age group in three successive time periods

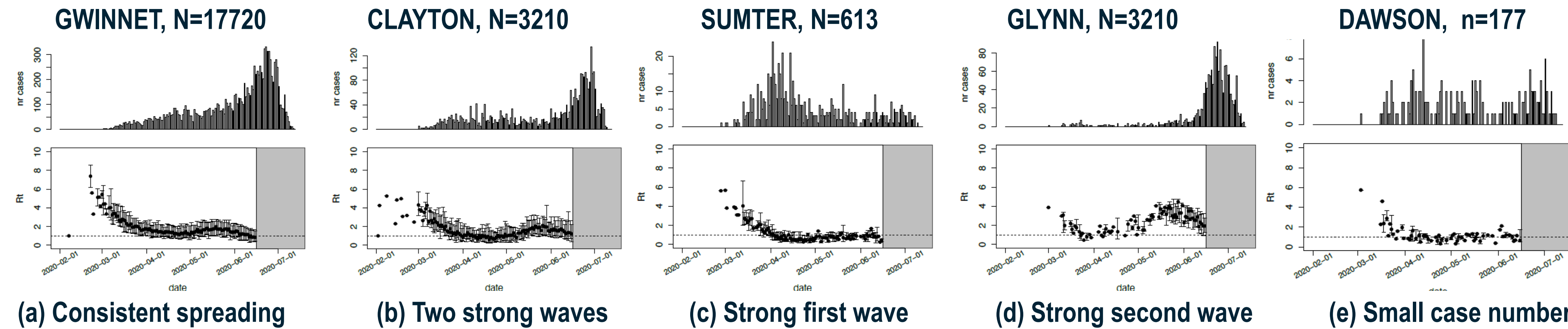


Figure 3. Transmission pattern categories based on epidemic curves and estimated Rt curves

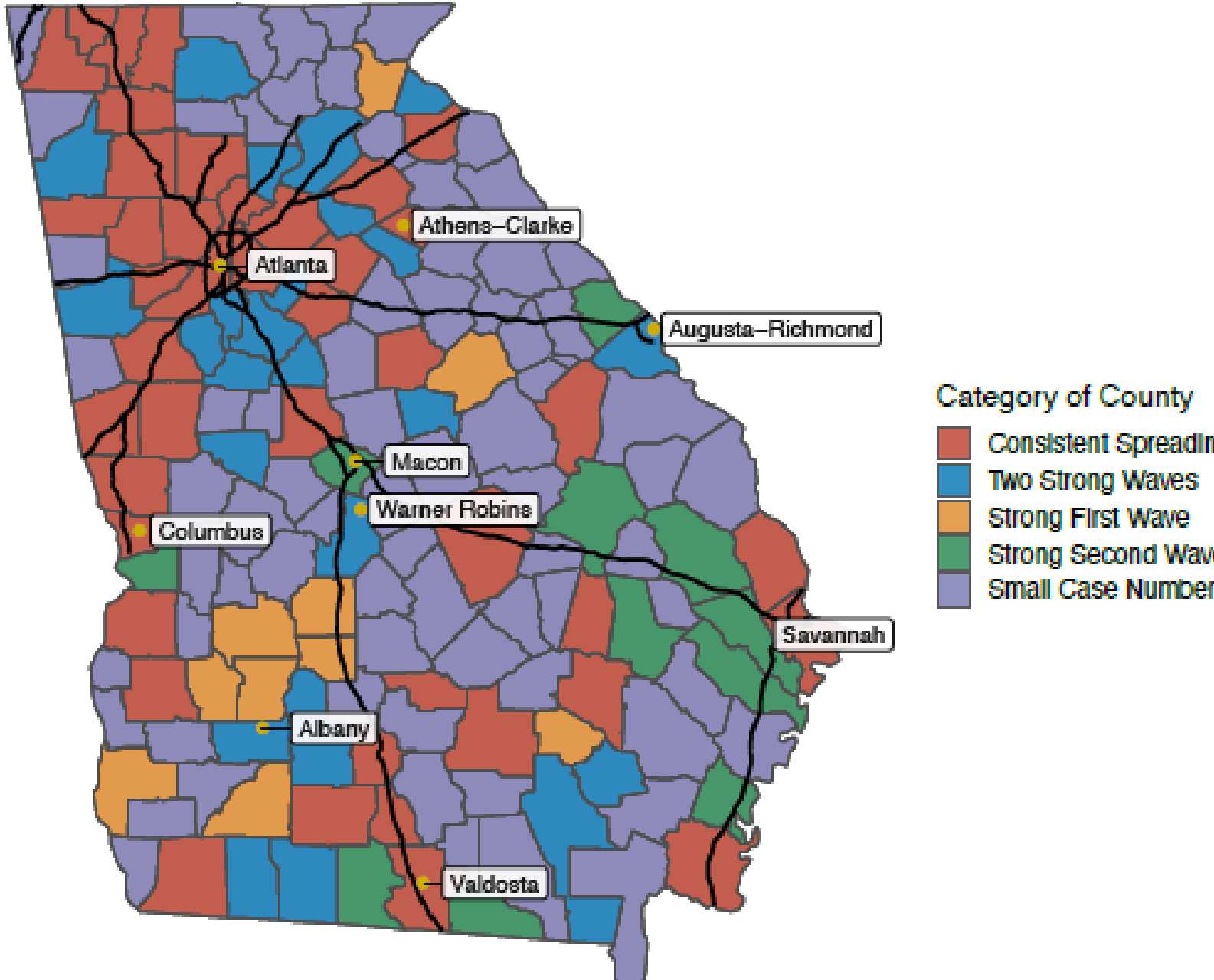


Figure 4. spatial distribution of the five categories of transmission patterns of COVID-19 in Georgia by June 15, 2020

RESULTS (Cont'd)

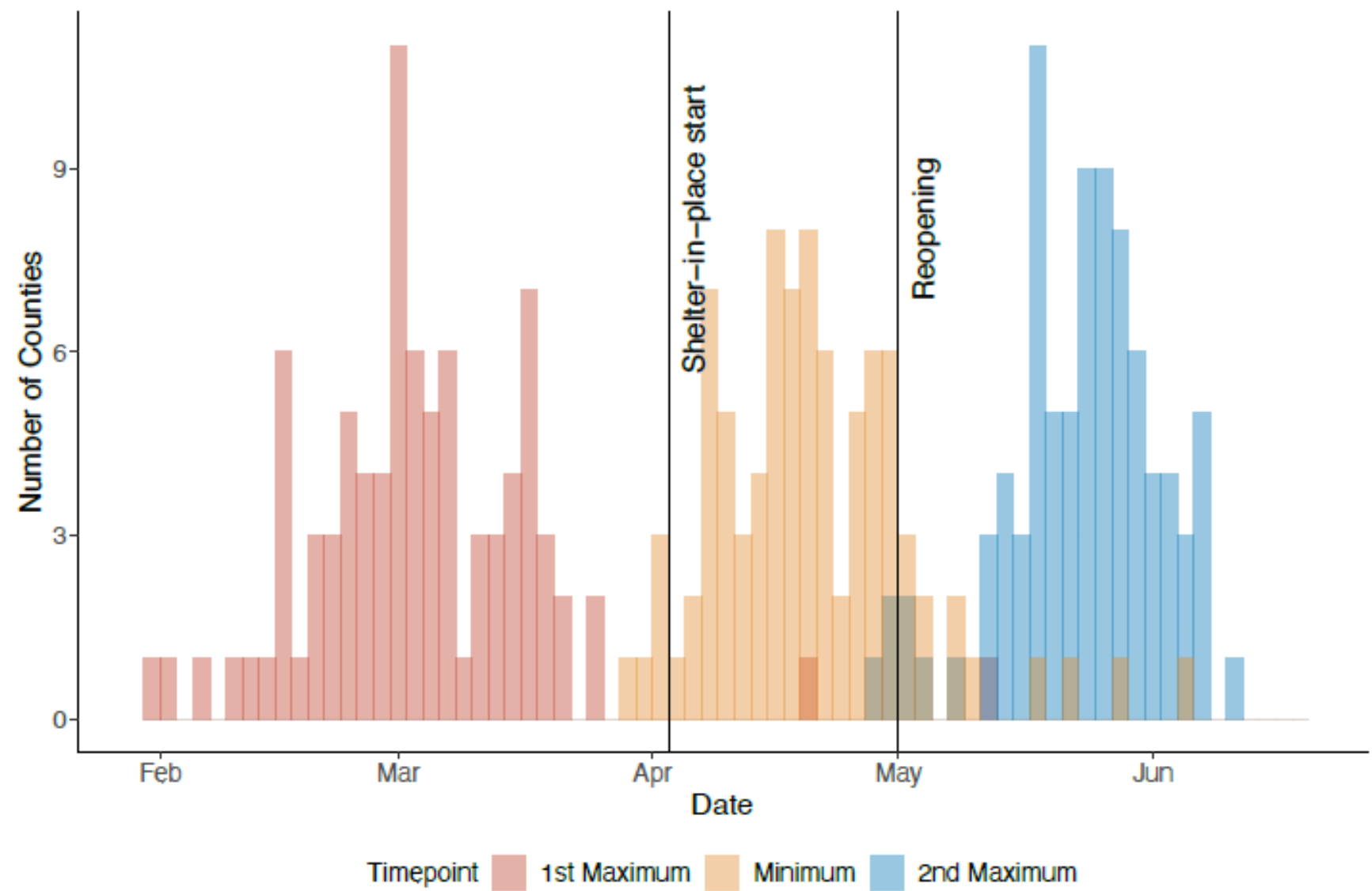


Figure 5. Distributions of estimated dates of first maximum, minimum, and second maximum in Rt for 87 counties with cumulative 200 cases by July 13, 2020, and key events possibly driving COVID-19 transmission.

DISCUSSION

- The shortened serial interval over time may be driven by increasing prevalence of COVID-19 cases.
- The shift of major transmission from older generation to younger generation may be caused by different behavior changes in different age groups. For example, elder people may become more careful to protect themselves from infection, while younger people might have less compliant with quarantine measures.
- The increased transmission along interstate highways suggests commuter links might have been effective transmission links.
- The intense transmission in densely populated urban areas connected by major transportation links indicates that three or four weeks of shelter-in-place orders were not long enough to sufficiently suppress COVID-19 transmission.
- Paper of this research has been preprinted on medRxiv: Yuke Wang, et al. Transmission of COVID-19 in the state of Georgia, United States: Spatiotemporal variation and impact of social distancing: medRxiv 2020.10.22.20217661; doi: <https://doi.org/10.1101/2020.10.22.20217661>

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[2] Wang Y, Teunis P. Strongly heterogeneous transmission of covid-19 in mainland china: Local and regional variation. Frontiers in Medicine 2020;7. doi:10.3389/fmed.2020.00329. URL <http://dx.doi.org/10.3389/fmed.2020.00329>.