Monitoring Reported Cases of COVID-19 at the Local Level

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Overview

Using weekly case counts disaggregated by demographic categories, we put together the Emerging COVID-19 Trends (EMCOT) Report focusing on statewide and subpopulation trends and incorporating principled statistics to complement other decision-making tools. The report consists of estimates of recent cases and rate of change, with visualizations, and enables comparison between heterogeneous towns.

Background

- Interactive dashboards are useful for case surveillance and visualizing trends but they can make it difficult to identify which trends are meaningful.
- SIR models make accurate predictions, but it would not be feasible to fit SIR models to every town in Rhode Island, due to the high variability in estimating the parameters for smaller towns. They can also be difficult to relate back to the raw data.
- The tracking methodology that we put together lies between tracking dashboards and SIR models in complexity and fulfills a need identified by the Rhode Island Department of Health, to identify which trends warrant a closer look.

Report Overview

- The EMCOT includes statewide trends in tests, cases, percent positive, hospitalizations, and fatalities; case trends for a variety of subpopulations.
- We relied on Bayesian principles to compute credible intervals and probabilities of increase for percent change and case rates.
- The report includes both tables summarizing the estimates and measures of uncertainty and visualizations depicting the measures for geographic regions, race/ethnicity groups, age groups, and high density zip codes, with quadrants indicating risk levels based on the statewide averages.

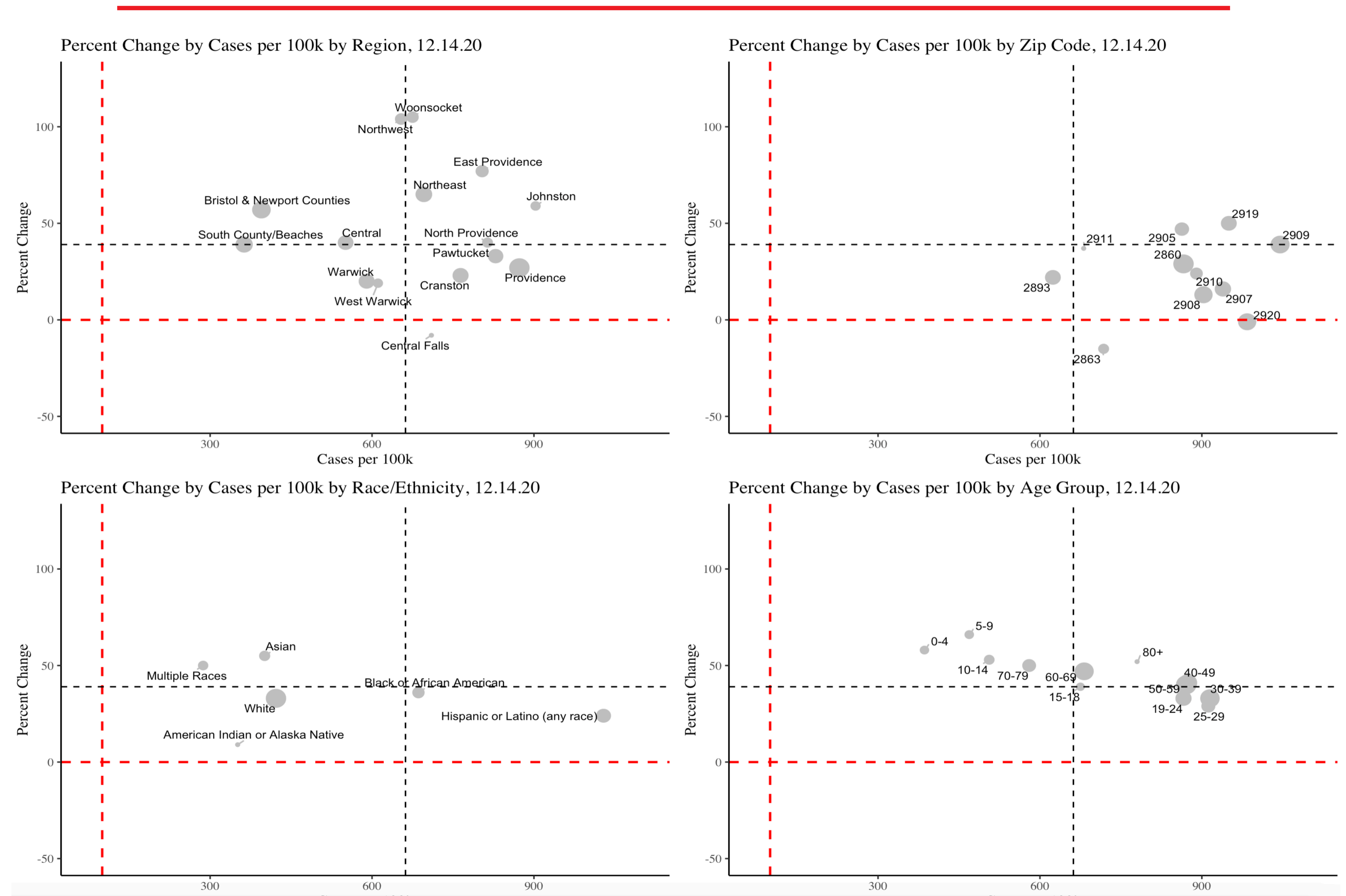
Methods

- We calculated percent change as the comparison between a three week baseline period and a two week new period to stabilize estimates and created fifteen monitoring regions by grouping similar towns.
- The baseline case rate and the new case rate were simulated from gamma distributions and the simulated values were compared to determine the credible intervals and the probability that the observed percent change represented an increase.
- The credible intervals provide necessary context to compare towns of different sizes, conveying the idea that we have more certainty in large populations

Measure	Calculation
Average weekly cases over j baseline weeks	$A_0 = (1/j)\Sigma_{t=n-k-j+1}^{n-k} Y_t$
Average weekly cases over k most recent weeks	$A_1 = (1/k)\Sigma_{t=n-k+1}^{n} Y_t$
Percent Change	$\frac{(A_1 - A_0)}{A_0}$
Percent Change CI	.025 and .975 quantiles of $(\theta_1 - \theta_0)/\theta_0$
Probability of Increase	$P(\theta_1/\theta_0 > 1)$
Probability of > 50% Increase	$P(\theta_1/\theta_0 > 1.5)$
Probability of Doubling	$P(\theta_1/\theta_0 > 2)$
Cases per 100,000	$(Y_n/m)100,000$
Cases per 100,000 CI	.025 and .975 quantiles of $\theta 100,000$

The table provides a summary of the measures displayed in the report. All of these were calculated for each group, unless a population estimate was not available, in which case we could not estimate cases per 100,000

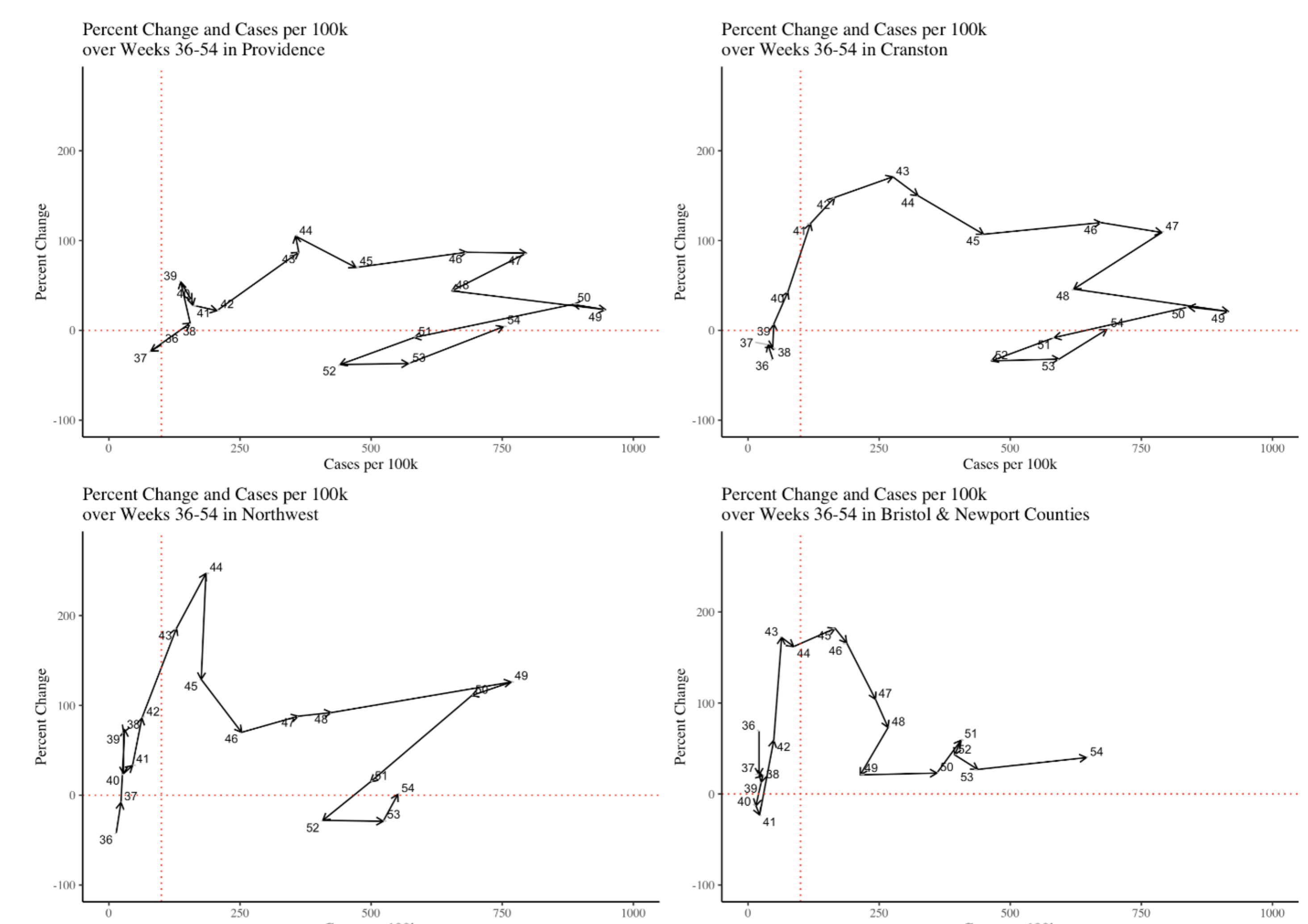
Visualizations



Discussion

Using the quadrants defined by the black dotted lines in the scatterplots, we can describe a risk classification:

- Groups in the upper-right quadrant of each plot are hotspots and getting hotter, i.e. those with high case counts and high increases.
- The lower right quadrant includes the groups that are hotspots and staying hot, i.e. they have high case counts but are not trending up as much as other groups.
- The upper left quadrant identifies the groups that are heating up, groups which would likely be overlooked if only looking at weekly incidence per 100,000.



Conclusion

- Monitoring case counts is imperfect because testing strategies vary over time and by subpopulation (i.e. some groups, such as health care workers, and members of institutes of higher education are tested regularly, while others are tested only when symptomatic). So, we make no attempt at estimating prevalence.
- The EMCOT is currently used only internally but the statistical measures utilized in the report would complement the types of information available to the public.
- Our framework provides more information about spread and potential hotspots than simpler dashboards and easy interpretability compared to SIR models.
- The inclusion of credible intervals alongside crude estimates of case counts and rates of change enables easy comparison between heterogeneous groups