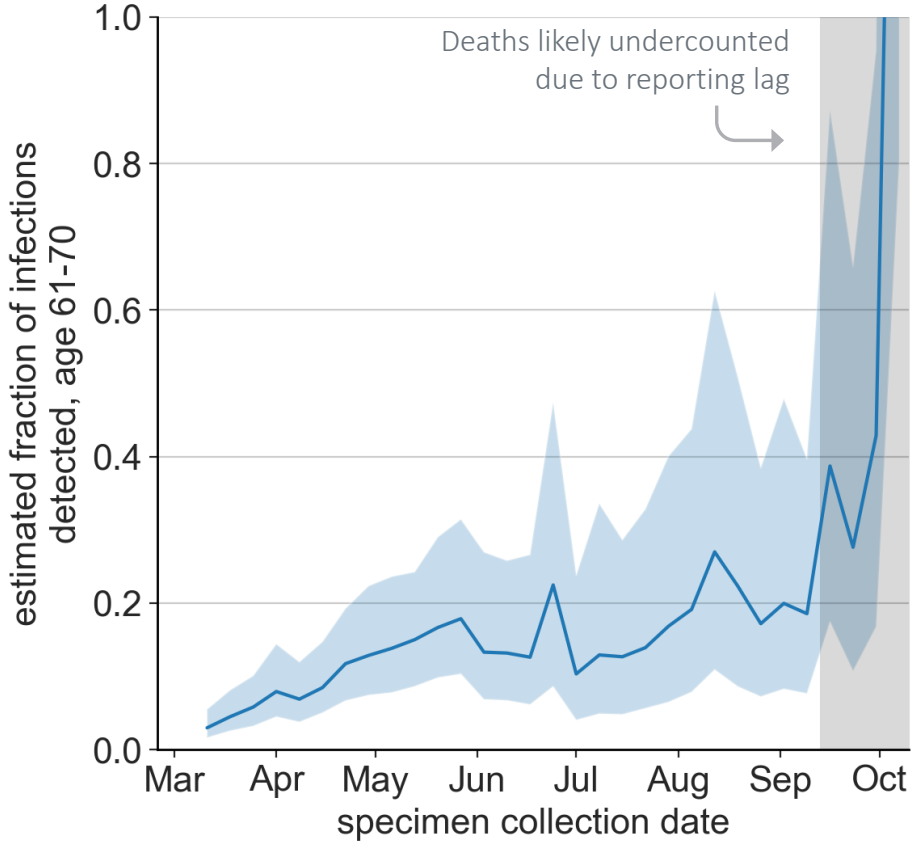
What areas in Chicago are most in need of expanded COVID-19 diagnostic testing?

Reese Richardson, Manuela Runge and Jaline Gerardin

October 19, 2020

Institute for Global Health
Northwestern

By our best estimate (see Appendix), no more than 40% of SARS-CoV-2 infections are being detected across the state of Illinois

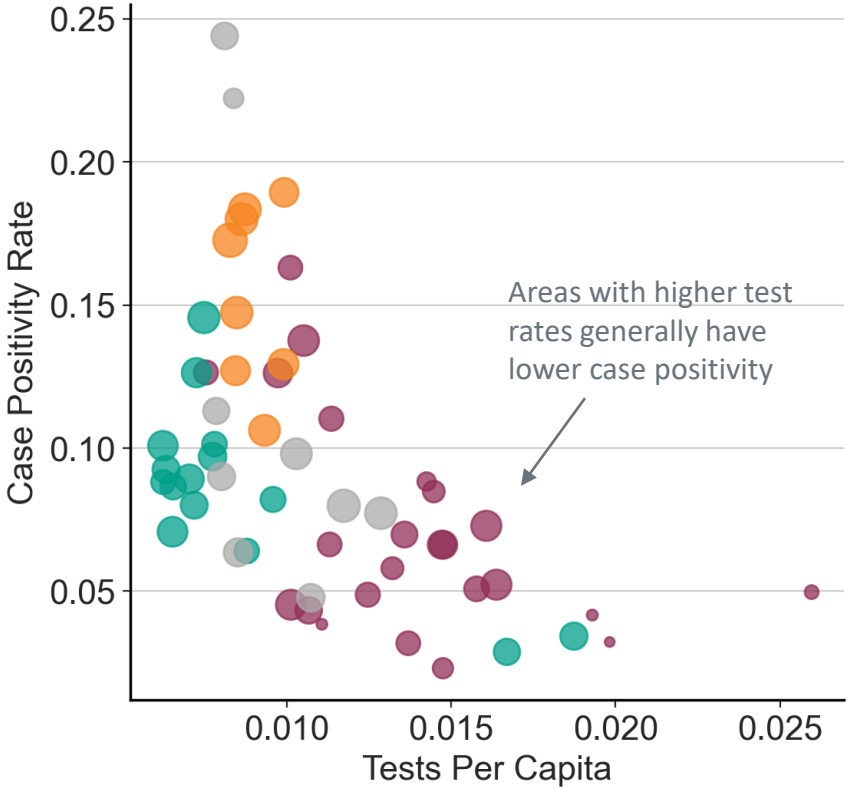


- When testing is insufficient, **surveillance quality suffers**, and infectious individuals are **less likely to adequately self-isolate**
- Testing should be expanded in general to contain viral spread, but **some locales are more in need of expanded access to diagnostic testing than others**
- How should we decide where testing expansion efforts should be prioritized*?*

Northwestern

Can we design an unbiased “testing expansion priority index” that can help identify which communities most urgently require expanded testing?

Comparing case positivity rate (# new cases / # tests) to testing rate among Chicago's ZIP codes reveals an inverse relationship between disease burden and testing intensity



Majority Race of ZIP Code
- White
- Hispanic/Latino
- Black
- no majority race

Population of ZIP Code
- 5k
- 25k
- 50k
- 100k

Data source: CDPH, accessed 10/15, testing data from 9/27-10/10

Generally, we should prioritize increasing access to testing in communities that have:

- a high disease burden

and/or

- a low testing rate per capita

We can create one index that combines both factors by taking

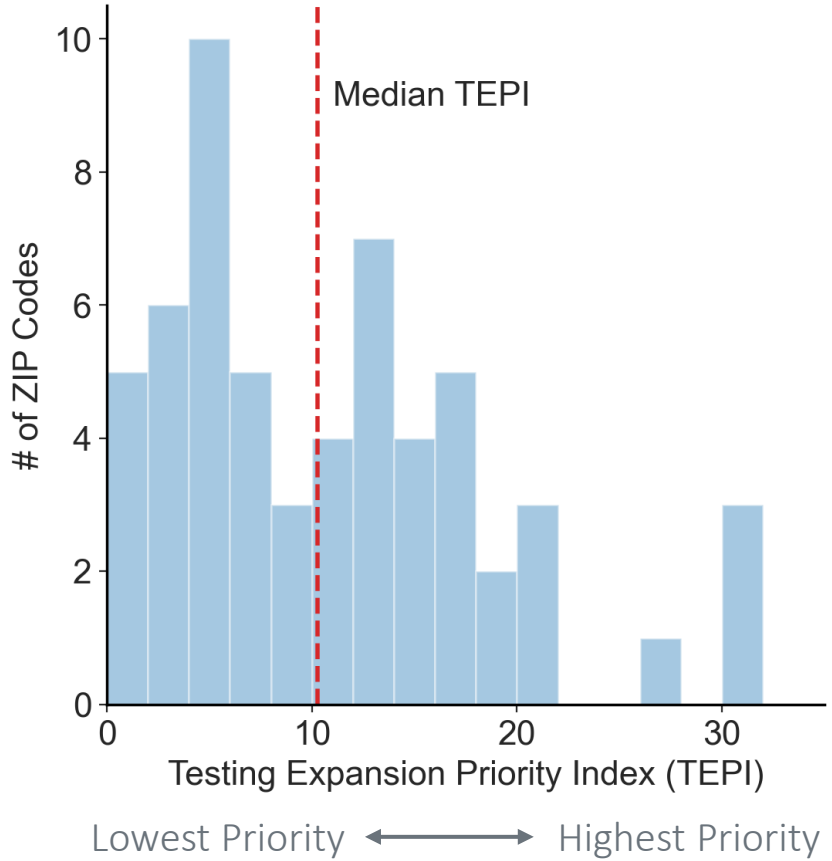
$$\frac{\text{case positivity rate}}{\text{tests per capita}} = \frac{\frac{\#\text{ new cases}}{\#\text{ tests}}}{\frac{\#\text{ tests}}{\#\text{ residents}}}$$

This index, which we'll call the **Testing Expansion Priority Index (TEPI),** could be used to organize ZIP codes by greatest need for expanded testing

$$\text{TEPI} = \frac{\text{case positivity rate}}{\text{tests per capita}} = \frac{\frac{\#\text{ new cases}}{\#\text{ tests}}}{\frac{\#\text{ tests}}{\#\text{ residents}}}$$

Higher index = greater need = prioritize first

TEPI assigns priority to each ZIP code on a continuous scale



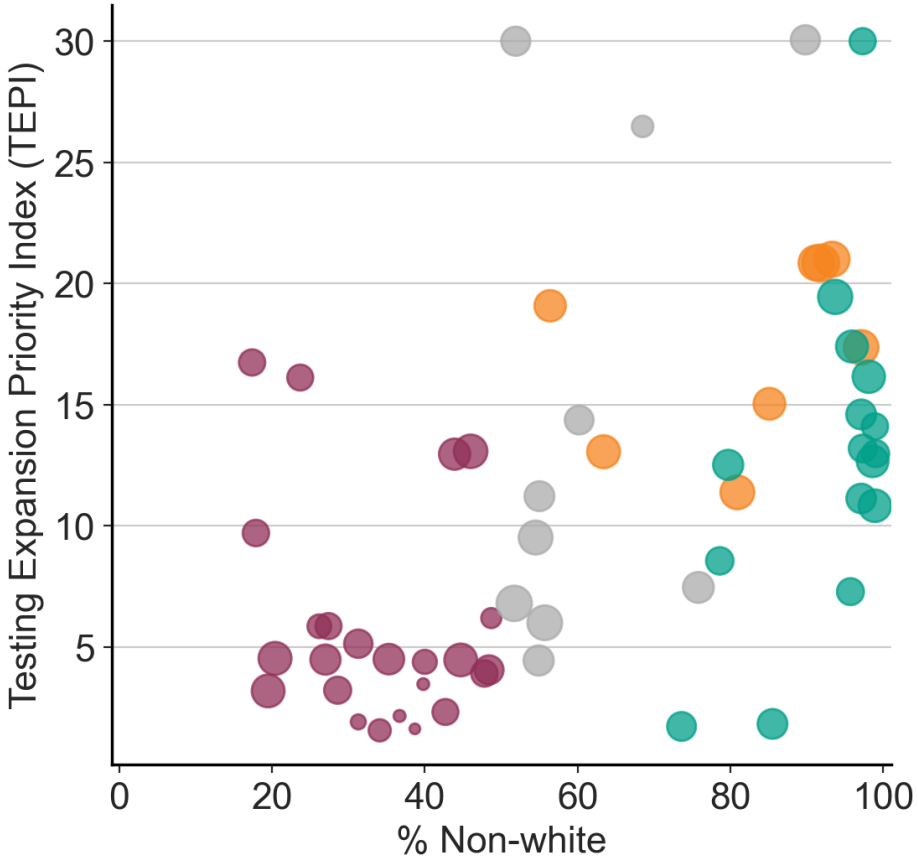
- TEPI values across Chicago ZIP codes take an asymmetric distribution with a long tail of high-priority areas
- TEPI can be calculated over any period of time, allowing for the visualization of recent trends (e.g. last two weeks) or long-term trends (e.g. last two months)

Data source: CDPH, accessed 10/15, testing data from 9/27-10/10

TEPI demonstrate that majority-Hispanic/Latino and majority-Black communities generally have higher need for expanded testing than majority-white communities

Highest Priority

Lowest Priority

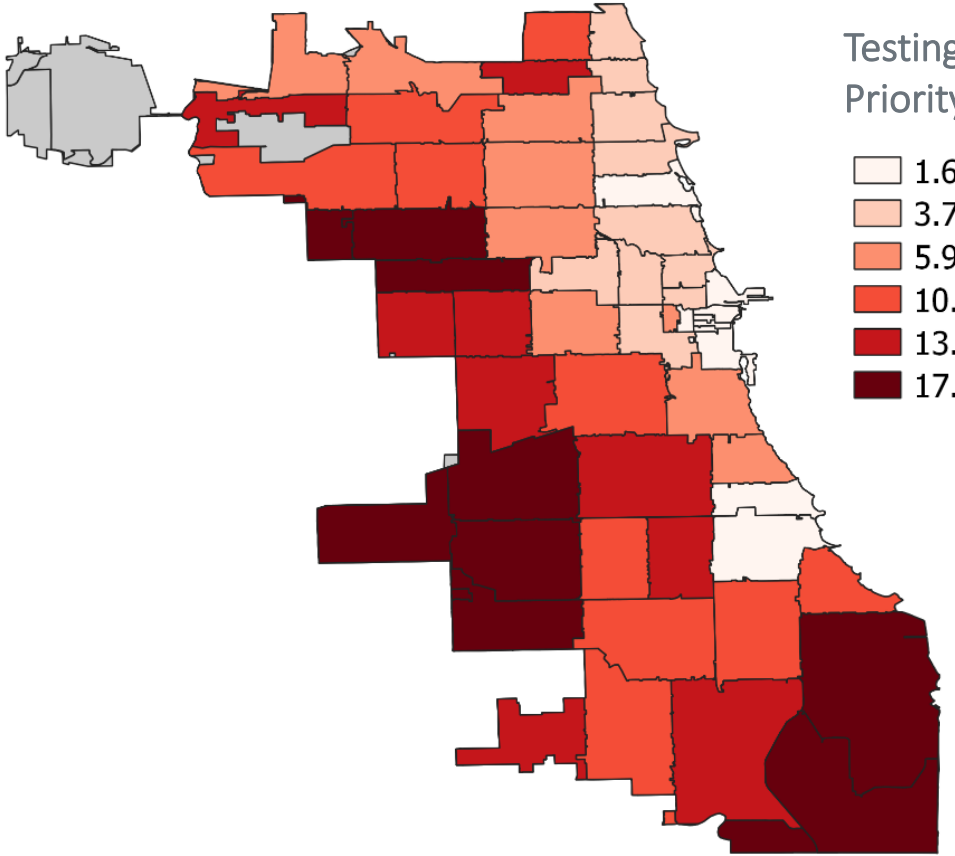


Majority Race of ZIP Code
- White
- Hispanic/Latino
- Black
- no majority race

Population of ZIP Code
- 5k
- 25k
- 50k
- 100k

Data source: CDPH, accessed 10/15, testing data from 9/27-10/10

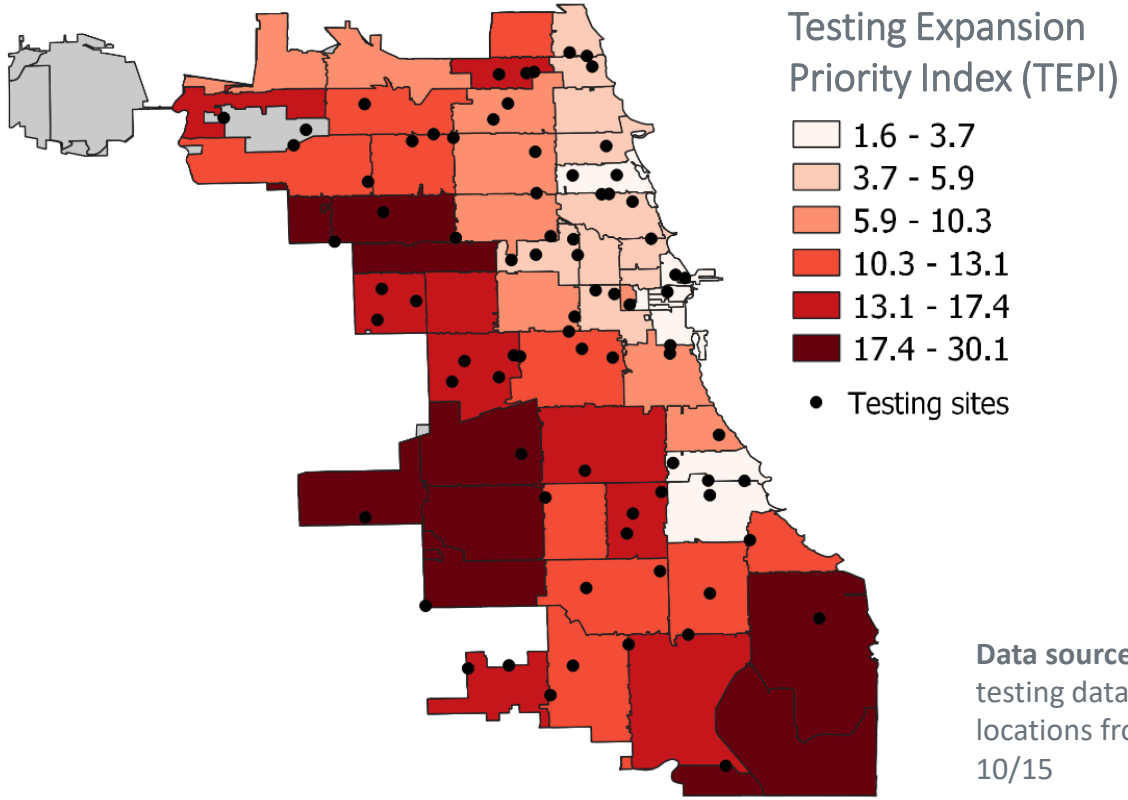
TEPI can also identify neighboring ZIP codes that would be most served by expanded access to testing



Data source: CDPH, accessed 10/15, testing data from 9/27-10/10

Northwestern

In general, ZIP codes with a higher density of testing sites are better served…



Data source: CDPH, accessed 10/15, testing data from 9/27-10/10, test site locations from IDPH website, accessed 10/15

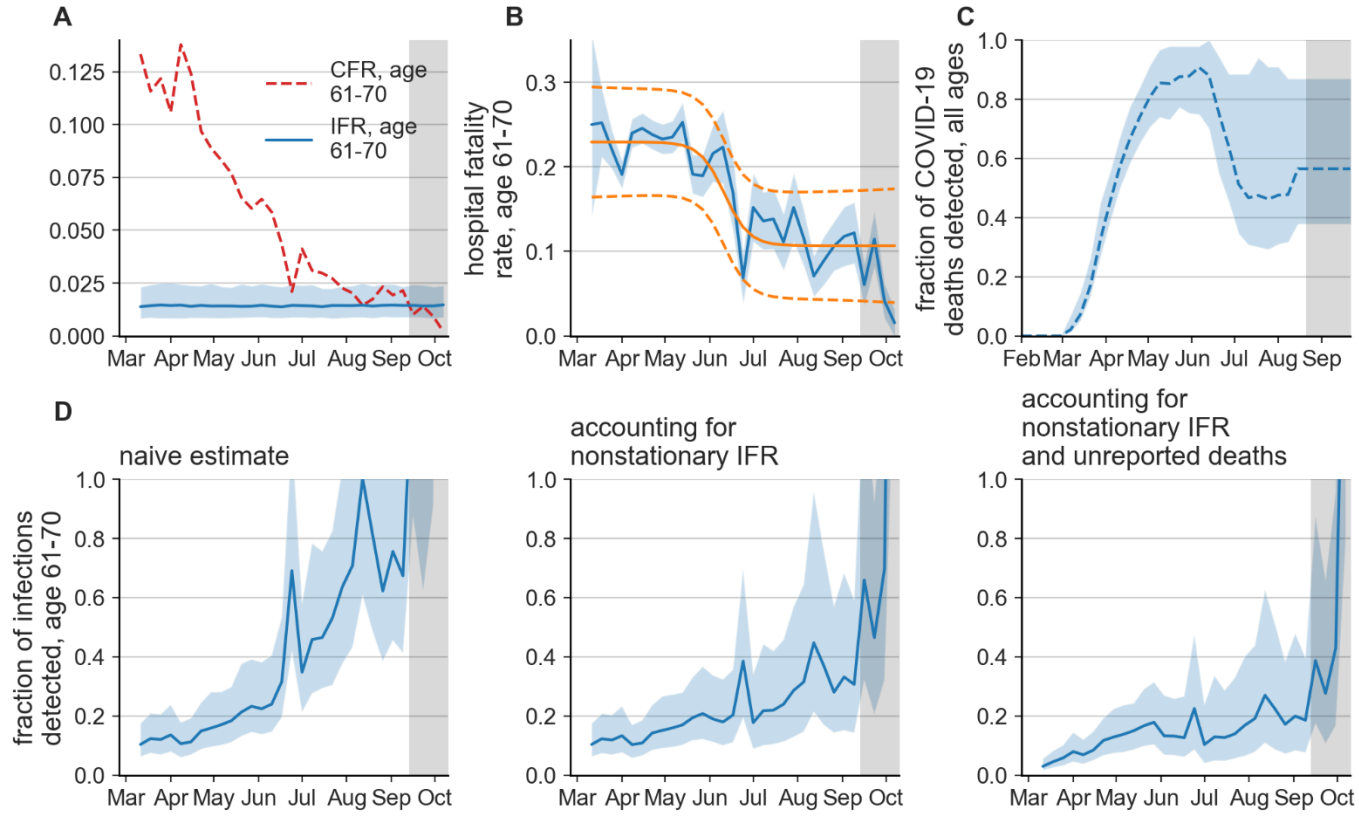
…but greater number of testing sites does not necessarily imply lower priority for testing expansion

Preliminary Conclusions

- Only a **small fraction of incident infections are currently being detected**
- Testing **must** be expanded, but regions with **the highest disease burden and lowest testing rates are highest priority**
- A simple testing expansion priority index (TEPI) could be used to determine **which ZIP codes are most in need of increased testing**
- As measured by TEPI, high-priority regions are currently **majority Hispanic/Latino and Black communities on the South and West Side**
- Access to testing data by age/race within each ZIP code would allow us to **compute TEPI within age/race** subpopulations, **enhancing targeting capabilities**

Appendix

Detection rate estimation



(A) Naive CFR among 61-70 year-olds by week of specimen collection alongside expected IFR among this age distribution. **(B)** HFR among admitted 61-70 year-olds by week of specimen collection (solid blue) with standard error of proportions (shaded blue), fitted sigmoid curve (solid orange) and 95% prediction interval (dashed orange). **(C)** Proportion of all deaths reported by date of death, based upon comparison of COVID-19 mortality and excess all-cause mortality. **(D)** Progression of estimates of fraction of infections detected among 61-70 year-olds and 95% bootstrapped confidence intervals, first assuming that all deaths are reported and IFR is stationary, then assuming all deaths are reported and IFR is non-stationary due to improving clinical outcomes, and finally assuming that some deaths are unreported and IFR is non-stationary. Calculations in the gray regions use deaths that are very likely undercounted due to lags in reporting.

TEPI by ZIP code for testing data from 9/27 to 10/10 (last two available weeks)

ZIP	TEPI	ZIP	TEPI	ZIP	TEPI
60601	1.57	60621	14.11	60643	12.52
60602	2.16	60622	4.50	60644	14.60
60603	3.47	60623	17.37	60645	11.23
60604	1.63	60624	13.20	60646	5.87
60605	2.32	60625	9.52	60647	6.00
60606	1.91	60626	4.45	60649	11.13
60607	3.91	60628	16.15	60651	17.40
60608	11.39	60629	20.85	60652	30.06
60609	15.04	60630	12.96	60653	7.29
60610	5.14	60631	9.71	60654	5.86
60611	3.22	60632	20.85	60655	16.74
60612	8.56	60633	26.48	60656	16.12
60613	4.48	60634	13.08	60657	3.19
60614	4.53	60636	12.98	60659	14.37
60615	1.73	60637	1.83	60660	4.06
60616	7.46	60638	19.08	60661	6.20
60617	19.45	60639	21.00	60707*	30.06*
60618	6.80	60640	4.47	60827*	30.06*
60619	12.67	60641	13.06		
60620	10.83	60642	4.39		

*CDPH testing data pulled on 10/15 report zero tests for each of these ZIP codes within the two weeks surveyed but a nonzero number of new cases. This yields an infinite TEPI, so TEPI was adjusted down to 30.06 (the next highest TEPI) for these ZIP codes