Where COVID-19 Testing Lags Community Need in Illinois

Isaac Ahuvia, Alex Bartik, Marianne Bertrand, Joshua Gottlieb, Kelly Hallberg, Matt Notowidigdo, Harold Pollack, & Winnie van Dijk
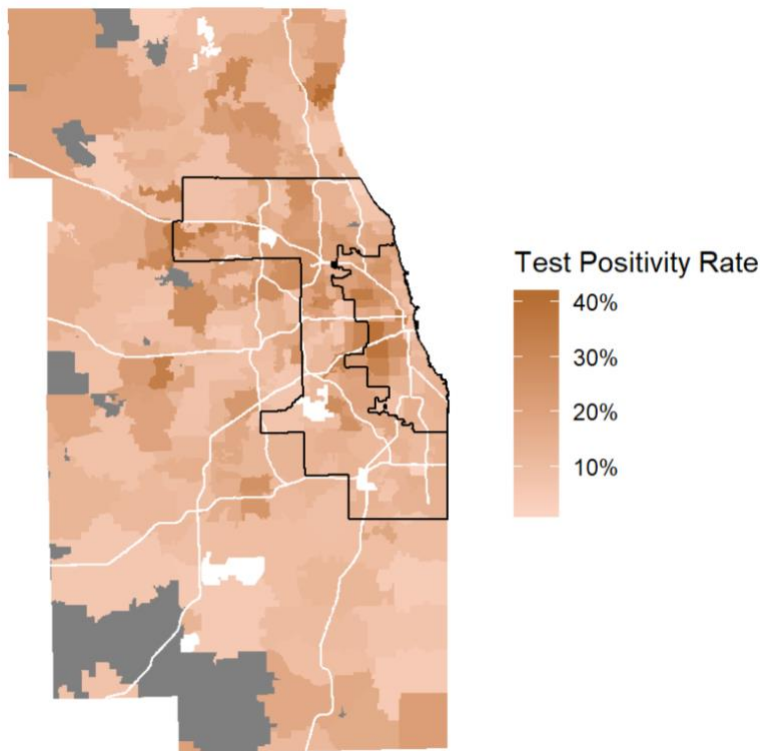
EXECUTIVE SUMMARY

The COVID-19 pandemic is imposing uneven economic and health burdens on different communities in Illinois. Until a vaccine or effective therapy is available, intensive testing and monitoring of the disease will be necessary to prevent community spread and facilitate economic reopening. Unfortunately, existing inequities are likely to inhibit these efforts by creating barriers to accessing healthcare. An analysis by researchers at the University of Chicago Poverty Lab suggests that communities with high shares of **residents without health insurance** and **residents who are undocumented** face additional barriers to testing and care.[1] Other community-level characteristics including racial composition, household size, density of essential workers and population density, do not appear to be significant predictors of test positivity rates. Expanding testing sites alone will likely be insufficient to address these disparities, and policymakers should pursue a holistic approach in partnership with affected communities. Finally, it is important to note that this analysis does not speak to the differential mortality risk associated with COVID-19 in different communities. This is a critical issue that is beyond the scope of the current report.

BACKGROUND

The number of confirmed cases of COVID-19 continues to rise day-to-day in Illinois. This is due in part to the increased number of tests conducted throughout the state, as well as changing guidance from public health officials about who should get tested.[2] Currently, the State is monitoring test positivity rates for each region outlined in Governor Pritzker's recovery plan, *Restore Illinois*.[3] According to the plan, one requirement for proceeding to the next recovery phase is that zones must maintain a test positivity rate of 20 percent or less for 14 consecutive days. That is, for all tests administered in any given day, no more than 20 percent can return positive.

Figure 1. Test Positivity Rates in the Northeast Region by ZIP Code

Source: Illinois Department of Public Health. Retrieved May 17, 2020.

The current test positivity rate for Illinois is trending downwards as testing capacity expands (see **Appendix B**). However, **Figure 1** shows that there are certain ZIP codes,[4] particularly in Chicago, North Chicago, Highwood, and Elgin, where test positivity rates far exceed the 20 percent threshold. Moreover, test positivity rates are declining more rapidly in some communities than others (see **Appendix D**).

As the State continues to expand testing capacity, it is important to prioritize areas with the highest test positivity rates, as experts suggest that such rates may be indicative of a large share of undetected individuals.[5] At the same time, the geographic pattern

described above may be influenced by barriers in access to testing or individual-level risks associated with employment or housing conditions. By examining what community-level characteristics are most strongly correlated with test positivity rates, policymakers and health care providers can take a more holistic approach to sustaining reductions in test positivity rates.

To better understand these patterns across Illinois, researchers from the University of Chicago Poverty Lab examined a variety of neighborhood characteristics (primarily reported by the American Community Survey[6]) and their associations with test positivity rates.[7] A select few neighborhood characteristics showed the strongest associations with test positivity. From this point, researchers conducted a series of robustness checks (**Appendices G – N**) to assess which associations explained the most about a neighborhood's test positivity rate after controlling for other factors.

KEY FINDINGS

At the time of this analysis, only two of the community-level characteristics that we included in our analyses are consistently associated with higher positivity rates: the proportion of a community's residents who lack **health insurance** and the proportion of a community's residents who are **undocumented**. While public discussion and media coverage of COVID-19 has examined other factors including racial composition, average household size, density of essential workers and population density, the relationship between test positivity rates and these factors appears modest at this time.[8] Detailed findings from a state-wide analysis can be found in the Appendix along with those for the Northeast Region.[9]

Proportion of People without Health Insurance. Illinois ZIP codes in which a larger portion of individuals without health insurance live tend to have higher test positivity rates than communities with a smaller share of people who do not have insurance (R=0.58). As can be seen in the figure below, results are driven primarily by community rates of lack of insurance in the Northeast Region of the State (R=0.70). Testing rates are correlated with this metric (R=0.54), but not enough to bring the test positivity rate in line with the rest of the region (**Figure 2**). _Within the Northeast Region, a neighborhood in the top 10th percentile for residents without health insurance has an average test positivity rate that is 78 percent higher than average, but a testing rate that is only 52 percent higher than the regional average._
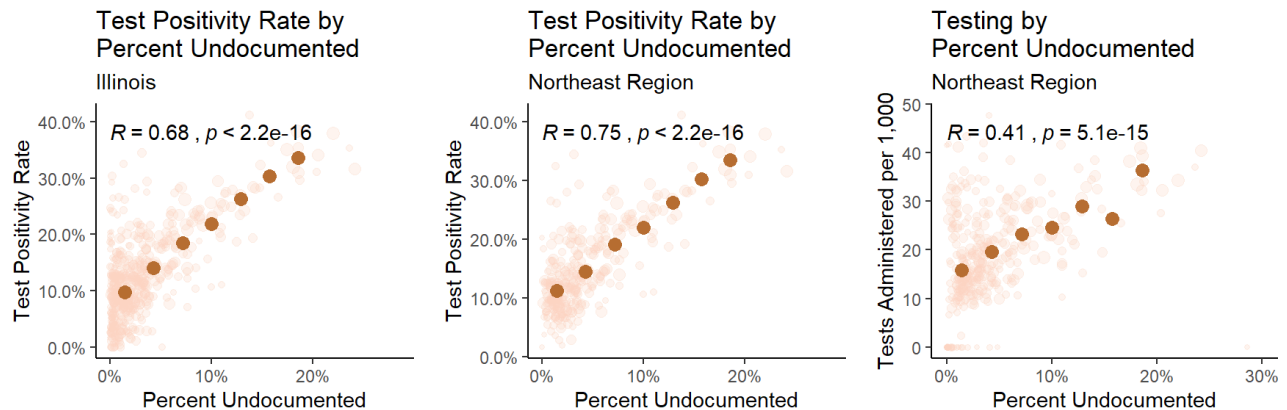
Figure 2. Percent of Residents Lacking Health Insurance
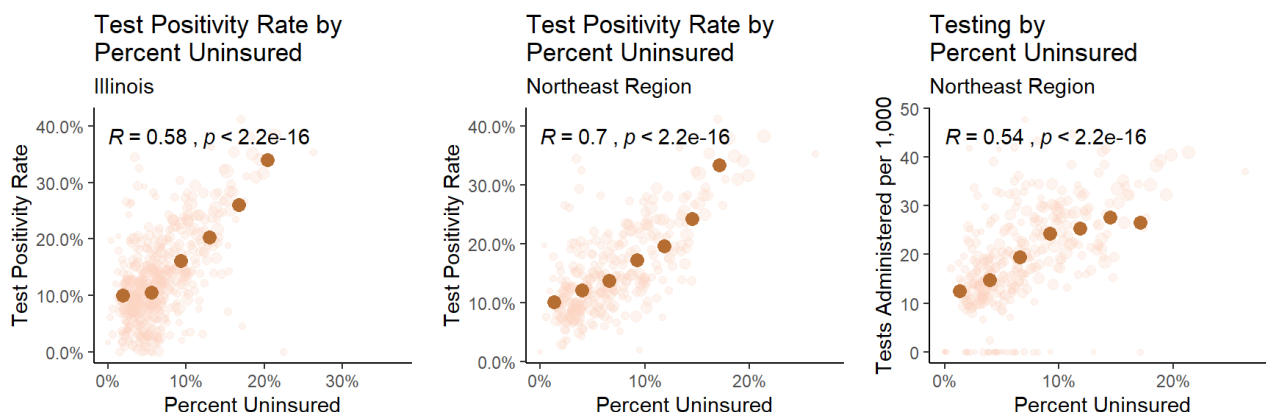
Sources: Illinois Department of Public Health; American Community Survey. Retrieved May 17, 2020.

Proportion of Residents Who Are Undocumented.[10] Likewise, Illinois ZIP codes where more individuals who are undocumented live have higher test positivity rates (R=0.68). These results seem fairly consistent across the State but are driven primarily by rates of undocumented individuals in the Northeast Region (R=0.75). Our analyses also revealed that, while there is a moderate relationship between testing and the proportion of residents who are undocumented in a community (R=0.41), more

testing is required in these regions (**Figure 3**). *Within the Northeast Region, a neighborhood in the top 10th percentile for residents who are undocumented has an average test positivity rate that is 84 percent higher than the average ZIP code in the Region, but a testing rate that is only 49 percent higher than the regional average.* This indicates that better targeting methods could be implemented in the expansion of testing efforts throughout the Region.

Figure 3. Percent of Residents Who Are Undocumented

Test Positivity Rate by Percent Undocumented
Illinois
$R = 0.68$, $p < 2.2e-16$

Test Positivity Rate by Percent Undocumented
Northeast Region
$R = 0.75$, $p < 2.2e-16$

Testing by Percent Undocumented
Northeast Region
$R = 0.41$, $p = 5.1e-15$

Sources: Illinois Department of Public Health; American Community Survey; Department of Homeland Security. Retrieved May 17, 2020.

DISCUSSION & RECOMMENDATIONS

Over the last several weeks, policymakers in Illinois have succeeded in dramatically expanding testing and sustaining reductions in test positivity rates across much of the state. Nevertheless, our analyses indicate that communities that are home to larger shares of residents who do not have health insurance or who are undocumented continue to have higher test positivity rates for COVID-19. As policymakers work to expand access to testing, it is important to prioritize these communities with the highest positivity rates, as WHO guidance indicates that a test positivity rate above 10 percent may imply that many infected individuals may benefit from being identified. Our analysis indicates that proximity to testing alone does not explain high test positivity rates in these communities (see **Appendix S**). Reducing these rates may therefore require additional efforts beyond the expansion of testing sites to address barriers and risks that are disproportionately borne by these groups.

In light of these findings, State and local policymakers may consider the following strategies to address potentially high rates of community transmission in these communities:

- Share and discuss the findings of this research with representatives of affected communities to gather information about potential barriers to testing, and to identify culturally competent approaches to more effective outreach, testing, and care.

- Ensure that daily briefings as well as information about testing availability and cost are available in multiple languages and accessible through multiple channels (social media, television, radio, print media).

- Partner with faith leaders and community-based organizations to launch social media campaigns that connect affected communities to state and local government websites providing information on the above.

- Expand testing sites within communities where people who are uninsured or undocumented live, with a focus on testing sites that do not require an appointment, as this can create barriers for Spanish-speaking residents.

- Eliminate requirements that an individual provide a doctor's note to be tested, as this creates barriers for residents who are uninsured.
- Address potential concerns among residents who are undocumented about confidentiality of test results and other public health data used to address the COVID-19 pandemic.
- Ensure that residents of every affected community are aware of State programs that address the cost of testing and treatment for COVID-19, and provide a resource hotline for residents to access additional information regarding any bills that may result from seeking treatment.
- Provide guidance to residents in highly impacted areas about self-quarantine protocols and information about isolation centers to individuals who test positive for COVID-19.
- Address childcare needs for single caregivers who test positive for COVID-19.
- Share information on paid sick leave with residents of affected communities and vigorously enforce such requirements with employers[11] so that no individual foregoes testing in order to maintain their wages.
- Address income losses associated with self-quarantine among undocumented individuals.[12]
- Roll out strategic contact tracing efforts earlier in communities with a high proportion of undocumented and uninsured residents given presumed barriers to testing and underestimation of confirmed cases.
- Incorporate specific strategies for serving residents who are uninsured and/or undocumented in local contract tracing programs, including hiring individuals with relevant lived experience and appropriate language skills.
- Braid private, state and local funding into programs to overcome federal restrictions on serving residents who are undocumented.

Finally, while the above analysis highlights the need to examine barriers to testing for Illinois residents who lack health insurance or documentation status, the risk of mortality from COVID-19 is uneven across different groups as well, and the strategies for addressing mortality risk will likely be different than those described above. In particular, congregate care facilities present unique challenges for protecting medically vulnerable populations, and mortality rates for African Americans are much higher than the average for Illinois residents. Policymakers and healthcare providers should continue pursuing targeted strategies for addressing mortality risk for these individuals.

ACKNOWLEDGMENTS

ABOUT THE UNIVERSITY OF CHICAGO POVERTY LAB

Founded in 2015, The University of Chicago Poverty Lab conducts rigorous experimental studies that lead to greater economic opportunity for communities that have been harmed by disinvestment and segregation. The lab partners with policymakers, community-based organizations and others to identify their most urgent and pressing challenges, co-generate evidence about what works, and translate findings into policy changes that reduce urban poverty and improve people's lives. One of five Urban Labs based at the Harris School of Public Policy, the Poverty Lab is led by Pritzker Director Marianne Bertrand, Chris P. Dialynas Distinguished Service Professor of Economics at the Booth School of Business. https://povertylab.uchicago.edu

[1] All analyses have been conducted using IDPH ZIP code information from May 1, 2020 through May 17, 2020.

[2] Currently, IDPH guidelines recommend testing for people experiencing COVID-19-related symptoms, those who may have come into contact with someone confirmed to have the illness, and those with compromised immune systems or a serious chronic medical condition. Testing has also expanded to include individuals who work in a healthcare or correctional facility, serve as first responders or law enforcement, or those who support critical infrastructure (essential workers).

[3] IDPH Restore Illinois. https://dph.illinois.gov/restore

[4] We use ZCTAs (Zip Code Tabulation Areas) to approximate ZIP codes in this analysis. ZCTAs are published by the U.S. Census Bureau and allow for summary statistics to be calculated at the ZIP code level.

[5] Huang, P. "If Most of Your Coronavirus Tests Come Back Positive, You're Not Testing Enough." NPR. 30 March 2020.

[6] 2018 5-year estimates

[7] We use an Empirical Bayes (EB) procedure to shrink the test positivity rate estimates towards the overall sample mean, since some of the variation in the test positivity rates across ZIP codes will reflect sampling variation (rather than "true" variation in test positivity rates). Using the EB procedures corrects for this measurement error and potential bias.

[8] The correlates examined in our analysis include racial composition, average household size, percent undocumented, proportion uninsured, median income, essential worker composition, proportion in congregate care facilities, median age, population density and proximity to a hospital. Multivariate regression plots can be found in Appendices G - N. Multivariate regression plots are only shown for Regional correlations greater than 0.3. We also explored the relationship between distinct essential occupations and test positivity rates and found that none were robust at this time.

[9] Throughout this report, we define the Northeast Region as the portion of the State that includes Cook, Lake, DuPage, Will, Kankakee, Grundy, Kendall, Kane, and McHenry counties. This specification is derived from the State's recovery plan, *Restore Illinois.*

[10] While the American Community Survey (ACS) collects data on citizenship, it does not collect data on an immigrant's legal status. For this analysis, we estimated the population who are undocumented for each ZIP code in a two-step process using DHS estimates of immigrants who are undocumented by country of birth (Baker, 2017) and ACS estimates of population by country of birth. Using these estimates, we calculated the nation-wide share of immigrants from a given country who are undocumented per DHS. Then, by applying this share to the number of immigrants from each country in a ZIP code, we estimated the number who are undocumented.

Baker, B. (2017). Estimates of the unauthorized immigrant population residing in the United States: January 2014. DHS.

[11] All employers with fewer than 500 employees are required to pay all full- and part-time employees two weeks of paid sick leave funded by the federal government, and to provide 66 percent regular pay for employees caring for sick individuals.

[12] Kaur, H. "California is now offering support to undocumented immigrants, in the first relief fund of its kind." CNN. 18 May 2020.

Appendix

APPENDIX A: TESTING AND CONFIRMED CASES IN ILLINOIS FROM MARCH 10, 2020
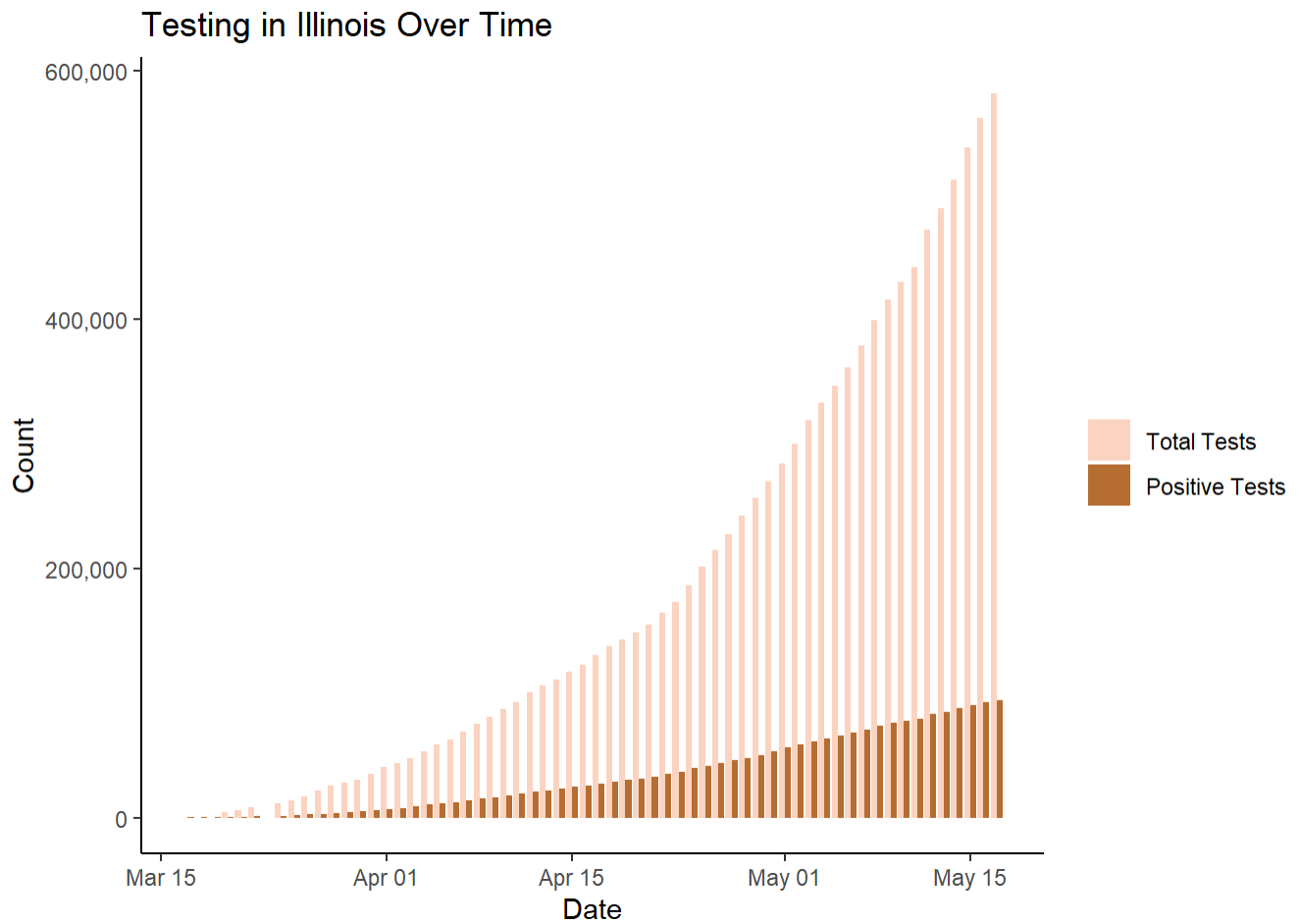
Testing in Illinois Over Time

Source: Illinois Department of Public Health. Retrieved May 17, 2020.

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Test Positivity Rate in Illinois Over Time
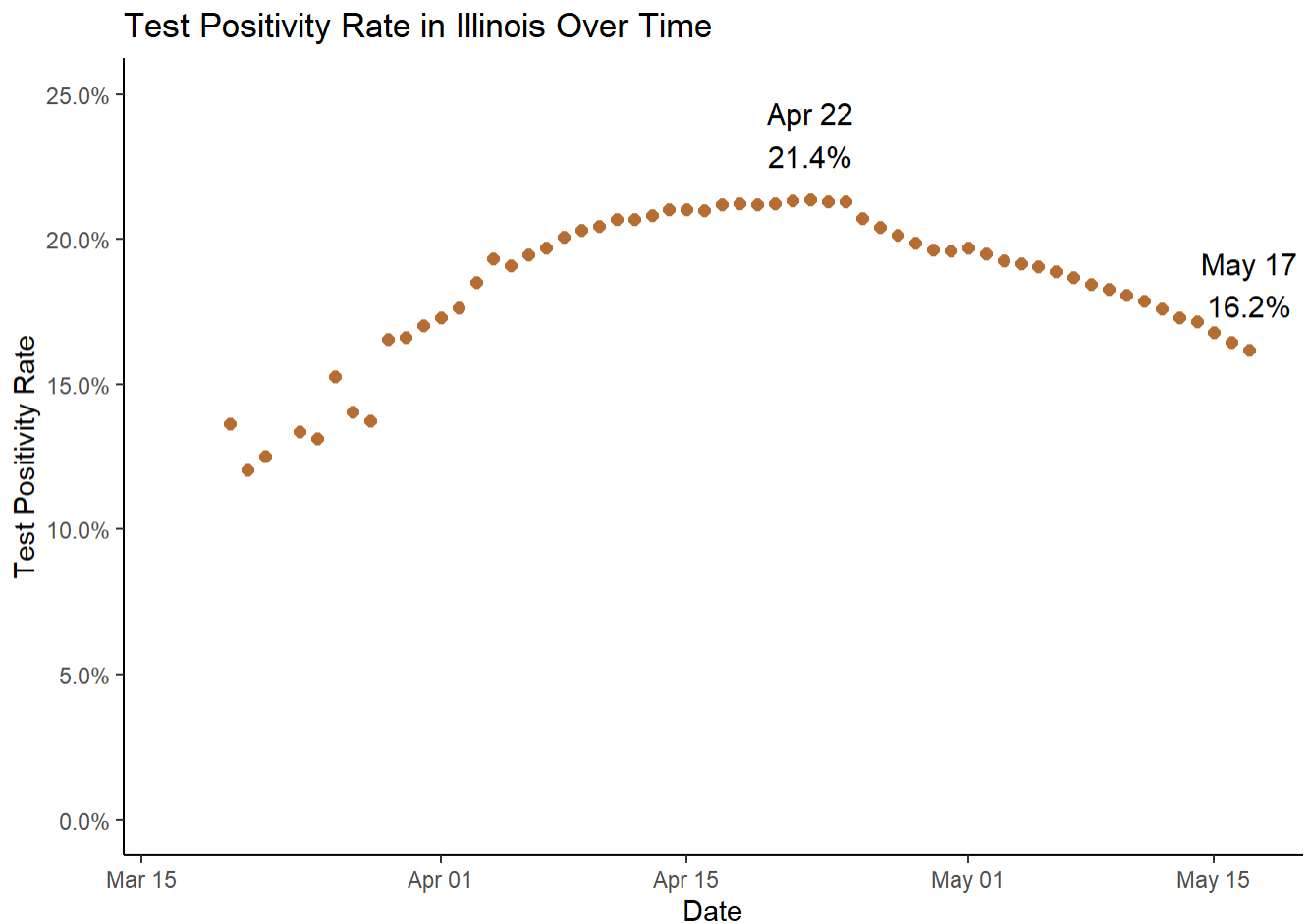
Source: Illinois Department of Public Health. Retrieved March 17, 2020.

APPENDIX C: TEST POSITIVITY RATES BY NORTHEAST REGION ZIP CODES
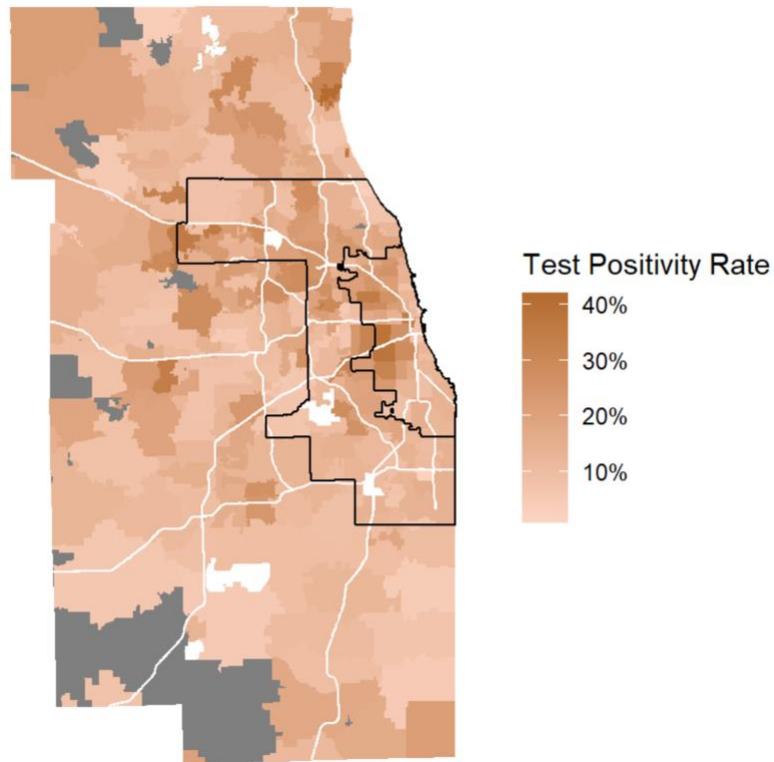
Source: Illinois Department of Public Health. Retrieved May 17, 2020.

The Northeast Region includes Cook, Lake, DuPage, Will, Kankakee, Grundy, Kendall, Kane, and McHenry counties.

APPENDIX D: CHANGE IN POSITIVITY RATES BY ZIP CODE FOR THE NORTHEAST REGION
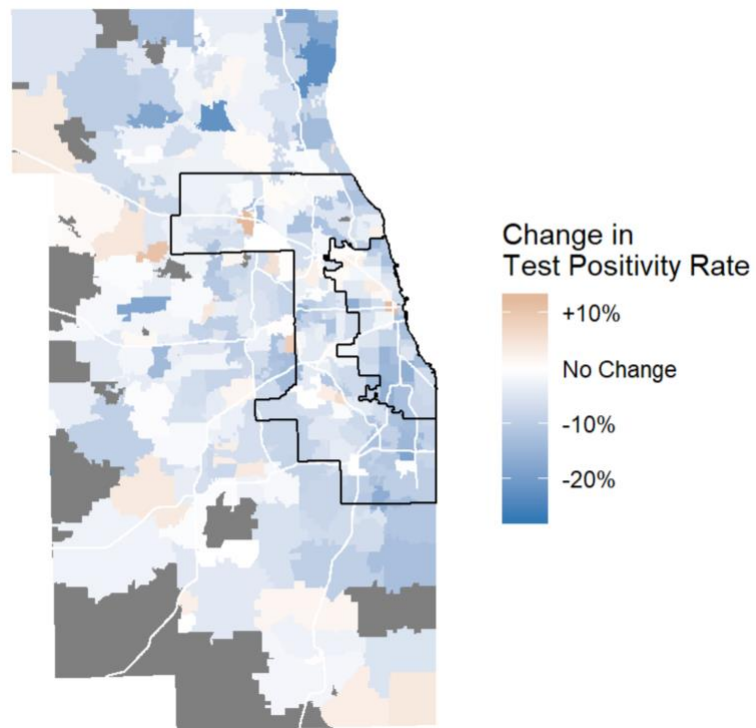
Source: Illinois Department of Public Health. Retrieved on May 17, 2020.

The Northeast Region includes Cook, Lake, DuPage, Will, Kankakee, Grundy, Kendall, Kane, and McHenry counties. The chart displays the change in test positivity rates by zip code from May 1 – May 17, 2020.

APPENDIX E: TEST POSITIVITY RATE BY IL ZIP CODE, TOP 50 ZIP CODES IN THE NORTHEAST REGION

	ZIP Code	City	Number of Tests	Test Positivity Rates
1	60064	North Chicago	540	41%
2	60623	Chicago	3,521	38%
3	60632	Chicago	3,116	38%
4	60040	Highwood	140	36%
5	60120	Elgin	1,641	35%
6	60165	Stone Park	182	35%
7	60639	Chicago	3,457	35%
8	60607	Chicago	434	34%
9	60505	Aurora	2,496	34%
10	60088	North Chicago	30	32%
11	60110	Carpentersville	766	32%
12	60629	Chicago	3,748	32%
13	60804	Cicero	3,369	32%
14	60501	Bedford Park	328	31%
15	60085	Waukegan	2,787	31%
16	60160	Melrose Park	865	30%
17	60073	Round Lake	1,366	29%
18	60177	South Elgin	434	29%
19	60173	Schaumburg	130	28%
20	60609	Chicago	2,161	28%
21	60651	Chicago	2,034	28%
22	60106	Bensenville	581	28%
23	60185	West Chicago	1,175	28%
24	60465	Palos Hills	328	28%
25	60090	Wheeling	810	28%
26	60101	Addison	935	28%
27	60191	Wood Dale	294	27%
28	60131	Franklin Park	483	27%
29	60608	Chicago	2,422	27%
30	60070	Prospect Heights	245	27%
31	60463	Palos Heights	315	27%
32	60432	Joliet	515	27%
33	60647	Chicago	1,779	26%
34	60521	Hinsdale	336	26%

35	60625	Chicago	1,837	26%
36	60060	Mundelein	640	25%
37	60641	Chicago	1,888	25%
38	60018	Chicago	667	25%
39	60433	Joliet	402	24%
40	60714	Niles	1,144	24%
41	60402	Berwyn	2,087	24%
42	60139	Glendale Heights	838	24%
43	60440	Bolingbrook	1,352	24%
44	60659	Chicago	855	24%
45	60176	Schiller Park	227	24%
46	60630	Chicago	1,099	23%
47	60133	Hanover Park	1,072	23%
48	60056	Mount Prospect	833	23%
49	60123	Elgin	1,351	23%
50	60169	Hoffman Estates	605	23%

Source: Illinois Department of Public Health. Retrieved on May 17, 2020.

Sources: Illinois Department of Public Health; American Community Survey. Retrieved May 17, 2020.

The Northeast Region includes Cook, Lake, DuPage, Will, Kankakee, Grundy, Kendall, Kane, and McHenry counties.

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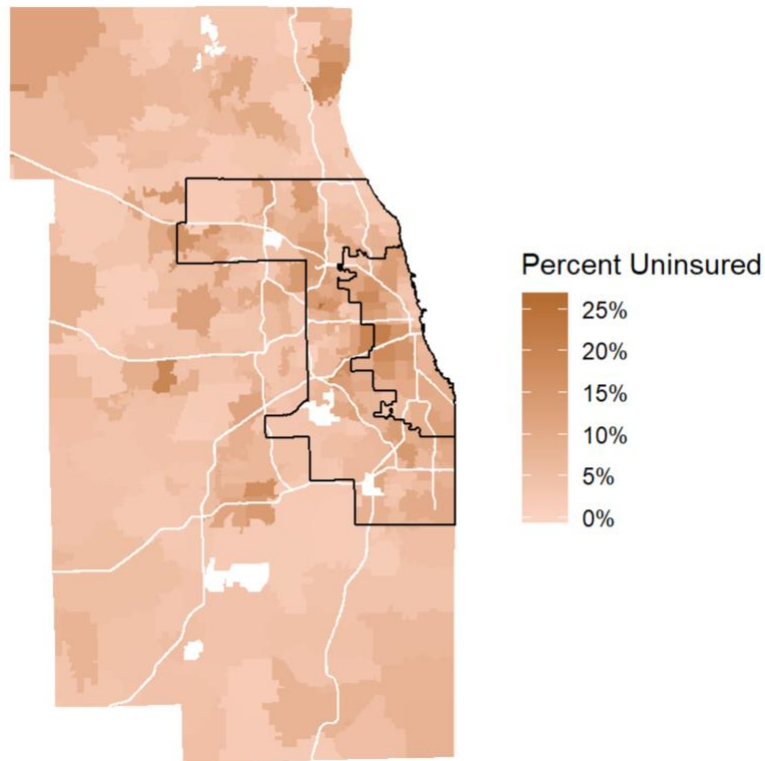
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APPENDIX G: COMMUNITY AREA PROPORTION OF RESIDENTS WITHOUT HEALTH INSURANCE

Appendix G.1. Relationship Between Test Positivity Rates and the Proportion of Residents Without Health Insurance (Illinois & Northeast Region)
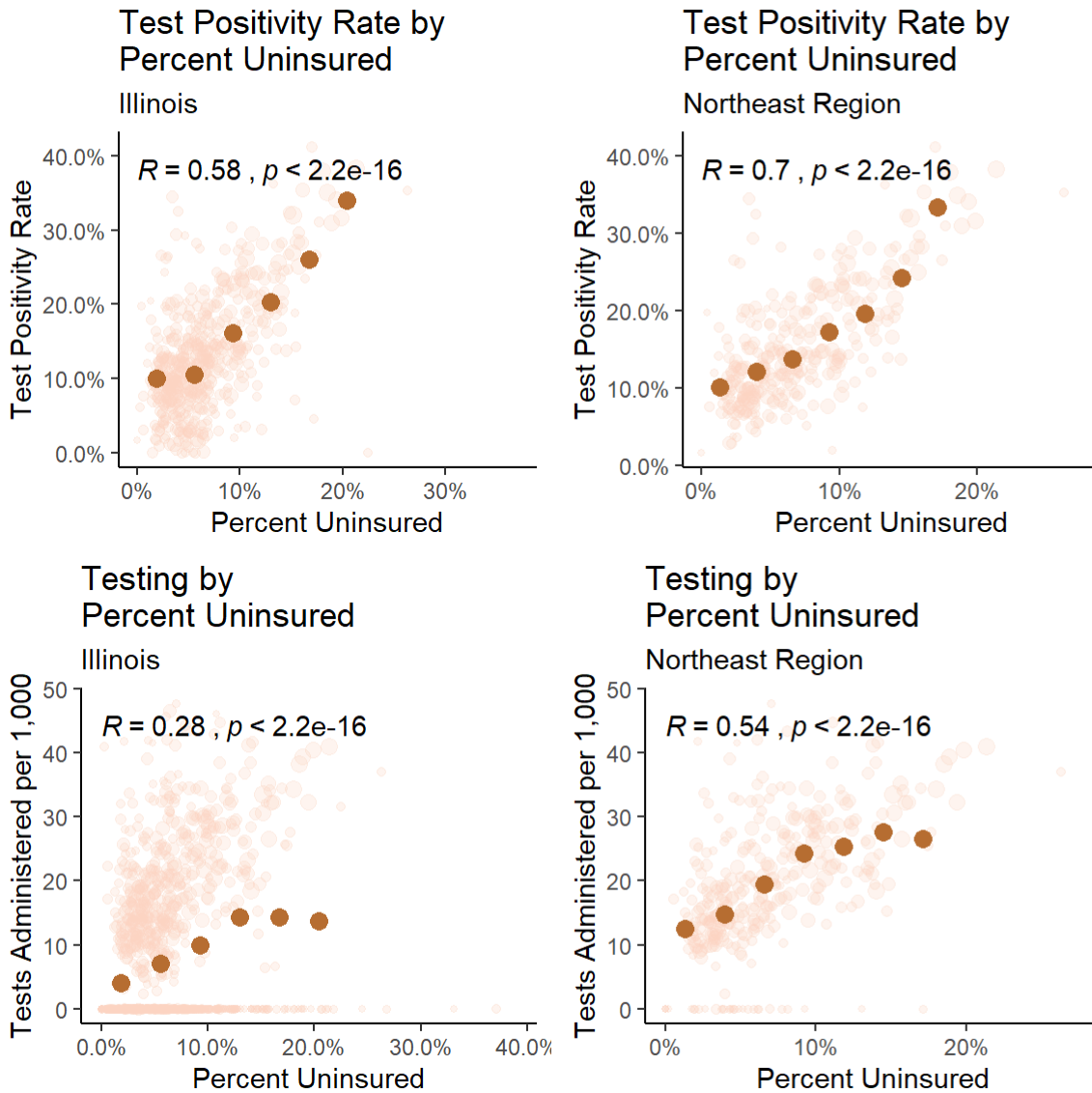
Test Positivity Rate by Percent Uninsured — Illinois — $R = 0.58$, $p < 2.2e\text{-}16$

Test Positivity Rate by Percent Uninsured — Northeast Region — $R = 0.7$, $p < 2.2e\text{-}16$

Testing by Percent Uninsured — Illinois — $R = 0.28$, $p < 2.2e\text{-}16$

Testing by Percent Uninsured — Northeast Region — $R = 0.54$, $p < 2.2e\text{-}16$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between the percentage of a community area's residents who lack health insurance and the area's test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix G.2. Multivariate Regression Analysis for Percent Uninsured (Northeast Region)

Test Positivity Rate by Pct Uninsured
Northeast Region

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between percent uninsured and test positivity rate is **relatively robust**. This relationship cannot be explained by a ZIP's average household size, median household income, or percent essential workers, though it can partially be explained by a ZIP's Hispanic population and undocumented population.

APPENDIX H: COMMUNITY COMPOSITION OF RESIDENTS WHO ARE UNDOCUMENTED
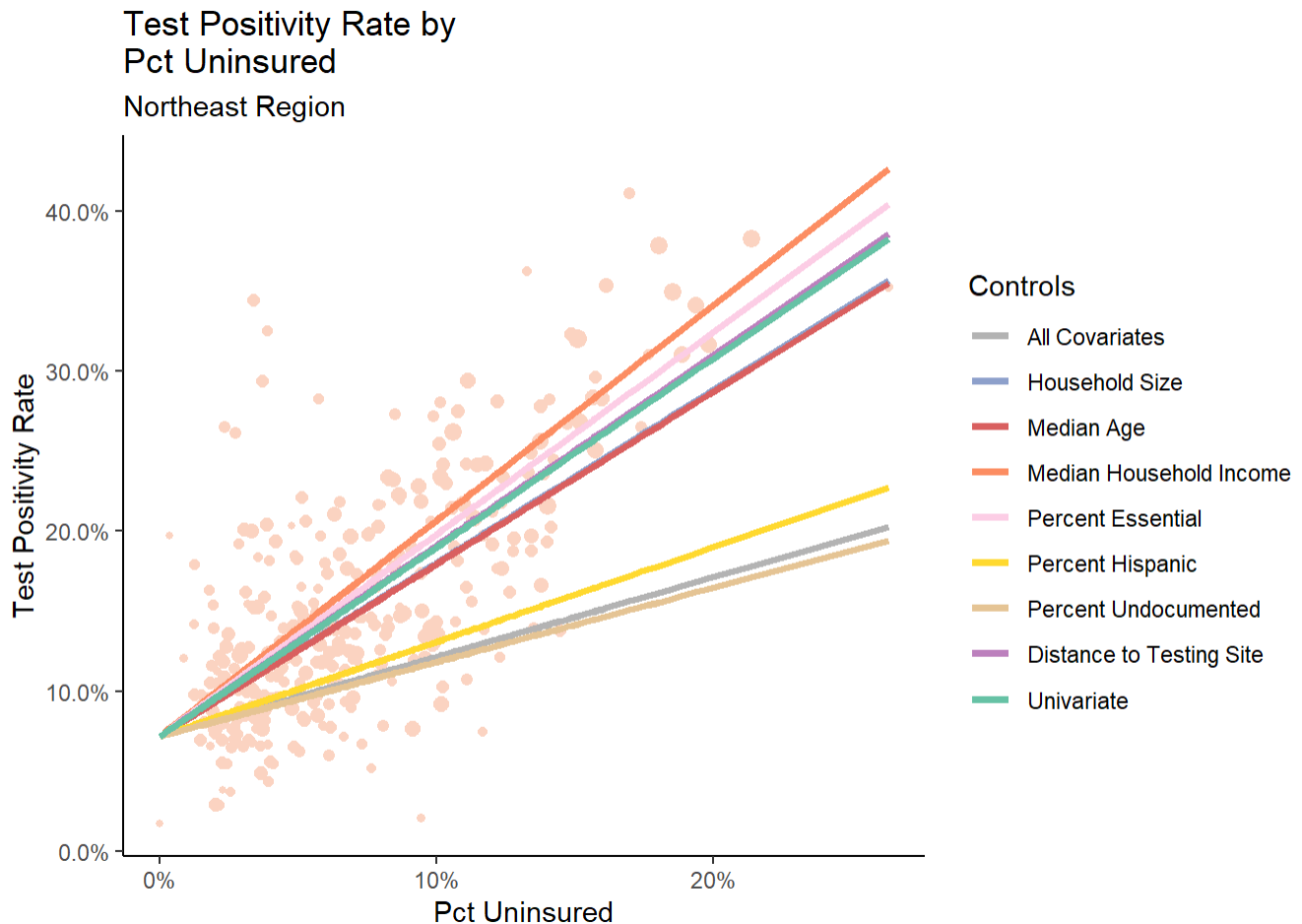
Appendix H.1. Relationship Between Test Positivity Rates and Proportion of Residents who are Undocumented (Illinois & Northeast Region)

Positive Test Rate by Percent Undocumented
Illinois

$R = 0.67$, $p < 2.2e\text{-}16$

Positive Test Rate by Percent Undocumented
Northeast Recovery Zone

$R = 0.75$, $p < 2.2e\text{-}16$

Testing by Percent Undocumented
Illinois

$R = 0.56$, $p < 2.2e\text{-}16$

Testing by Percent Undocumented
Northeast Recovery Zone

$R = 0.41$, $p = 5.1e\text{-}15$

Sources: Illinois Department of Public Health, American Community Survey; Department of Homeland Security. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between the percentage of a community area's residents who are undocumented and the area's test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix H.2. Multivariate Regression Analysis for Percent Undocumented (Northeast Region)
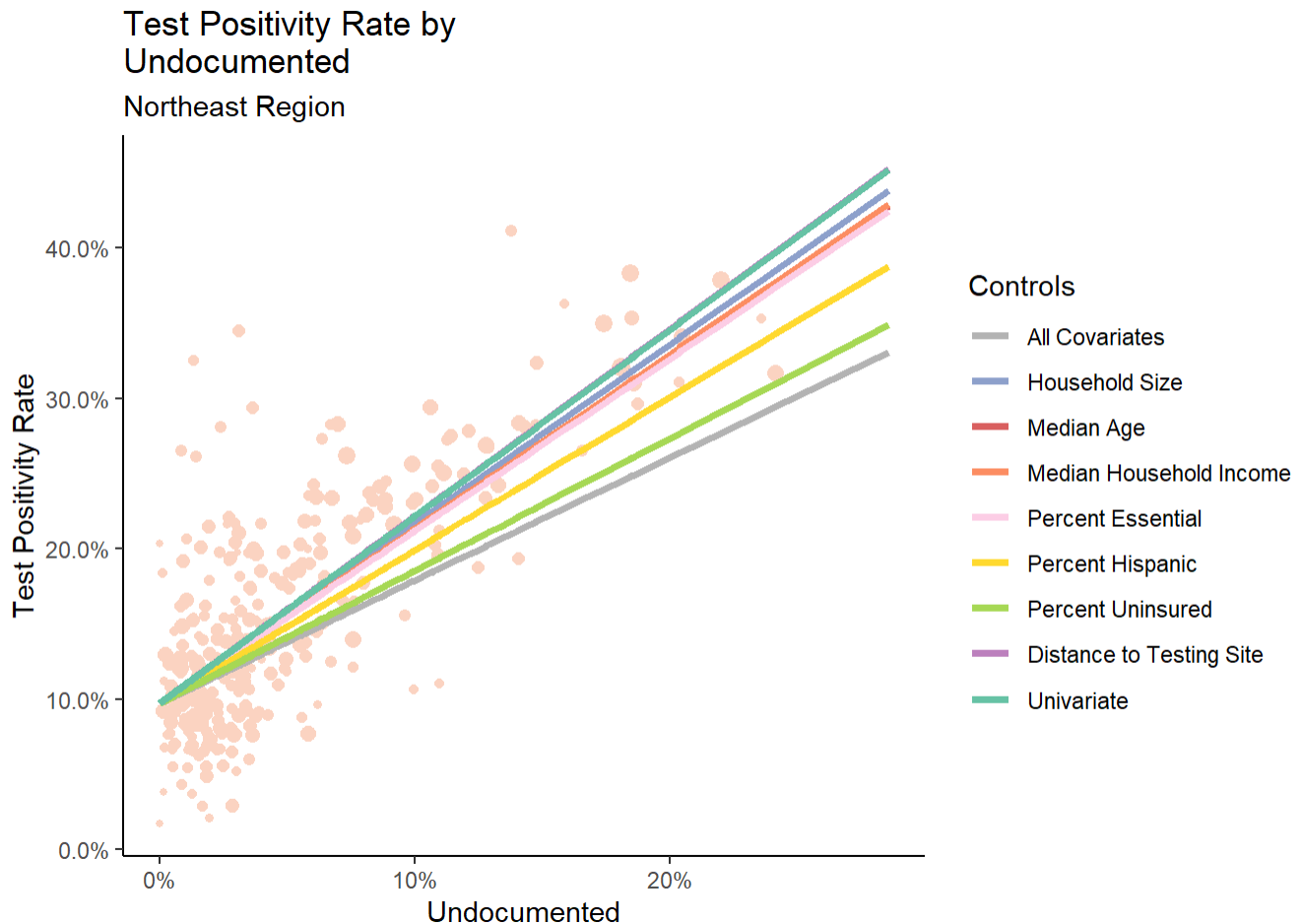
Test Positivity Rate by Undocumented

Northeast Region

Controls

— All Covariates
— Household Size
— Median Age
— Median Household Income
— Percent Essential
— Percent Hispanic
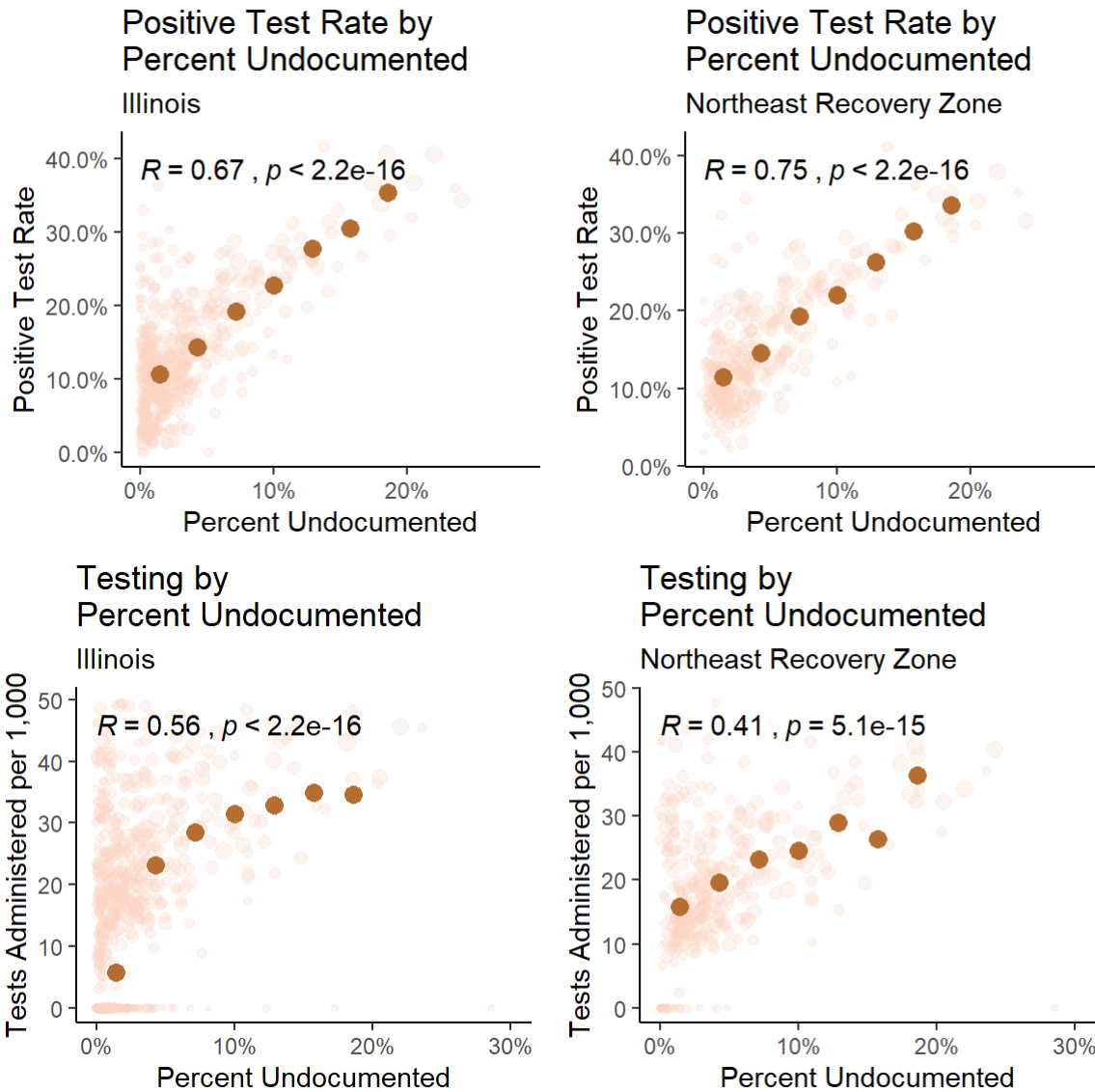— Percent Uninsured
— Distance to Testing Site
— Univariate

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between undocumented population and test positivity rate is **very robust**. This relationship cannot be explained by a ZIP's average household size, median household income, percent essential workers, percent Hispanic, or percent uninsured.

APPENDIX I: COMMUNITY COMPOSITION OF HISPANIC RESIDENTS

Appendix I.1. Relationship Between Test Positivity Rates and Percent Hispanic (Illinois & Northeast Region)

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between the percentage of a community area's residents who identify as Hispanic and the area's test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix I.2. Multivariate Regression Analysis for Percent Hispanic (Northeast Region)

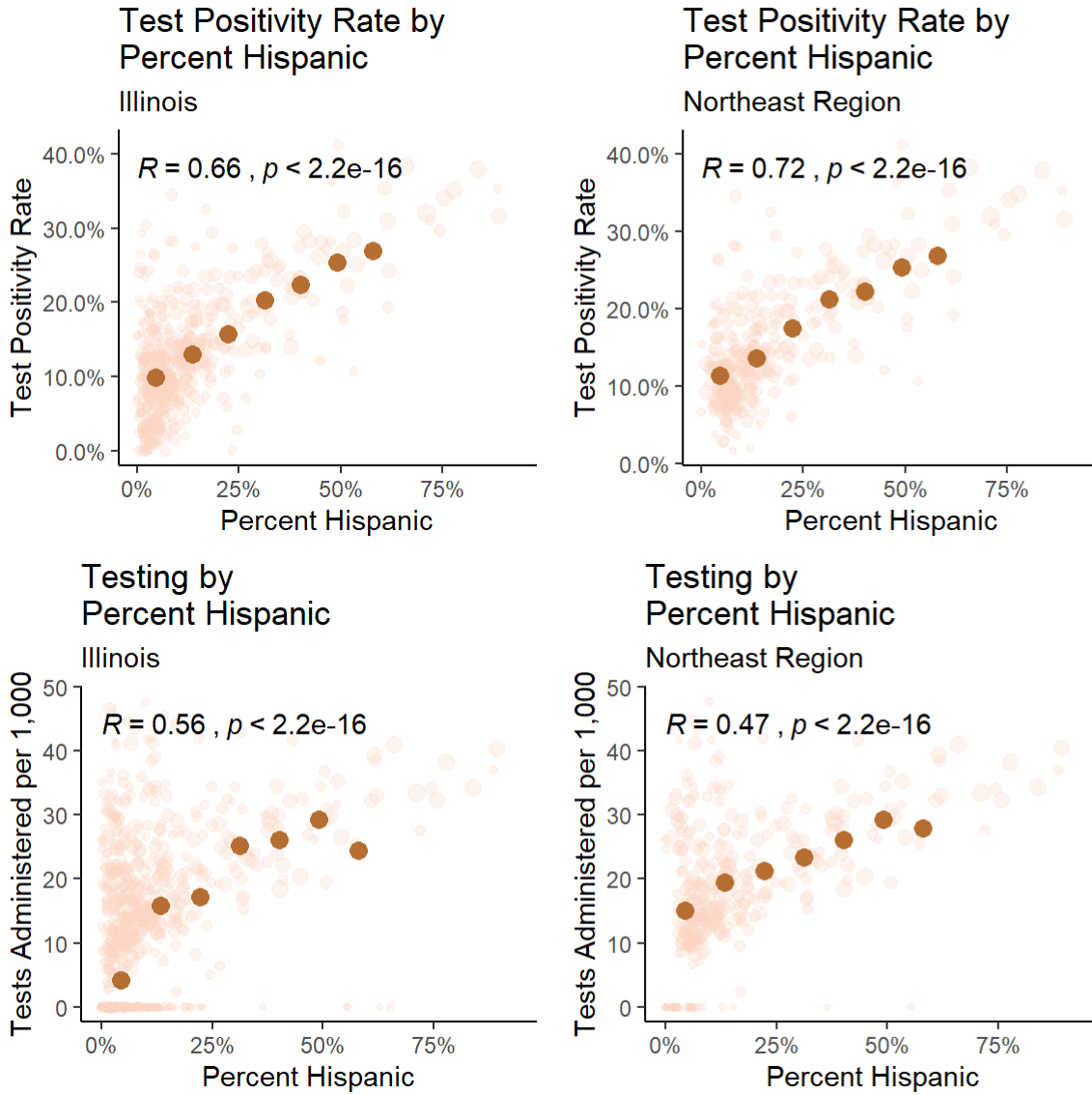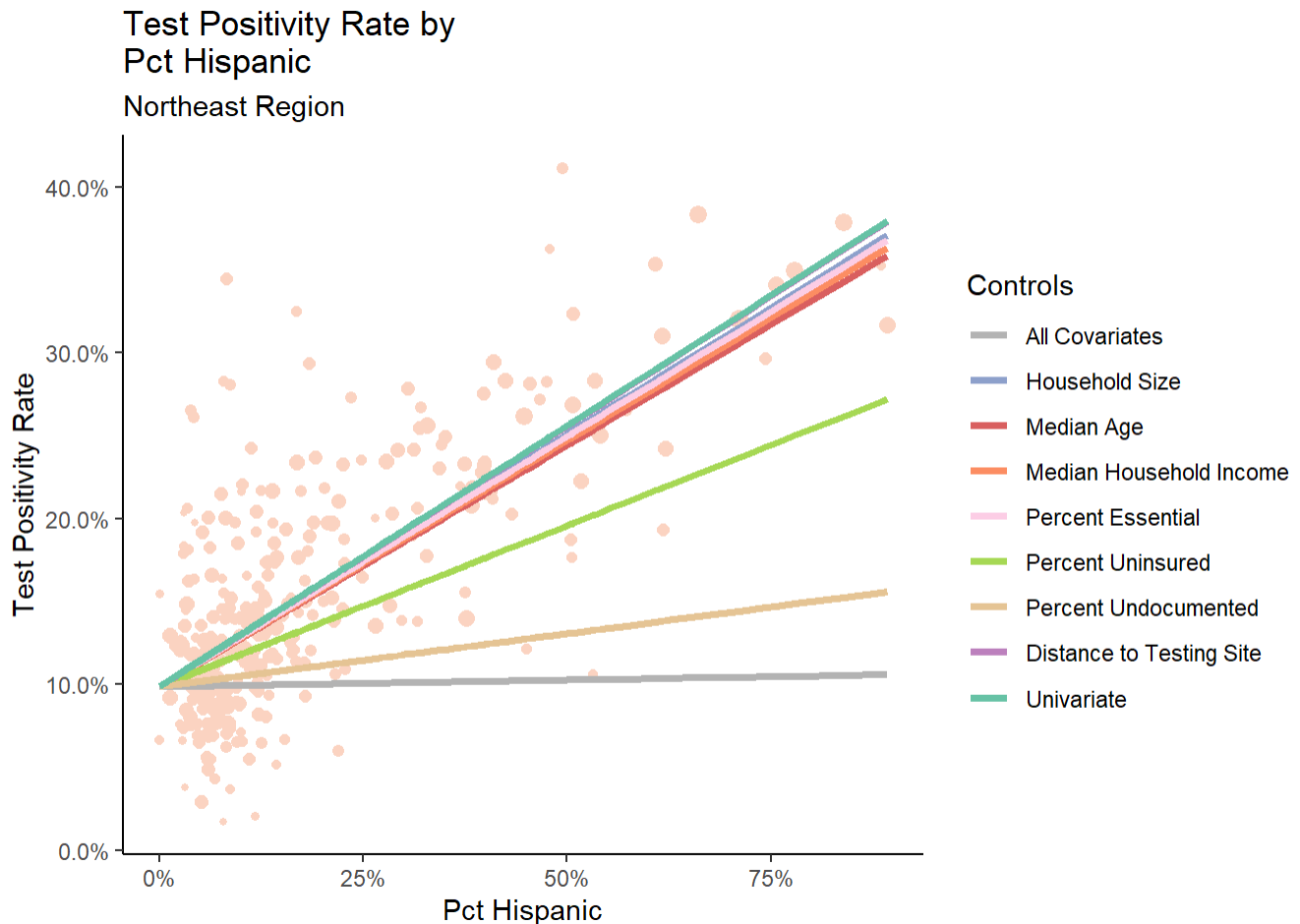### Test Positivity Rate by Pct Hispanic
Northeast Region

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between percent Hispanic and test positivity rate is **not robust**. While it appears strong on the surface, it can be almost entirely explained by the fact that ZIPs with more Hispanic residents also have more undocumented residents.

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APPENDIX J: COMMUNITY COMPOSITION OF ESSENTIAL WORKERS

Appendix J.1. Relationship between Test Positivity Rates and Community Composition of Essential Workers (Illinois & Northeast Region)

Test Positivity Rate by Percent Essential Workers
Illinois
$R = 0.21$, $p = 4e\text{-}06$

Test Positivity Rate by Percent Essential Workers
Northeast Region
$R = 0.44$, $p < 2.2e\text{-}16$

Testing by Percent Essential Workers
Illinois
$R = -0.22$, $p = 3.1e\text{-}16$

Testing by Percent Essential Workers
Northeast Region
$R = 0.33$, $p = 1e\text{-}09$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between the percentage of a community area's residents who are essential workers and the area's test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix J.2. Multivariate Regression Analysis for Percent Essential Workers (Northeast Region)
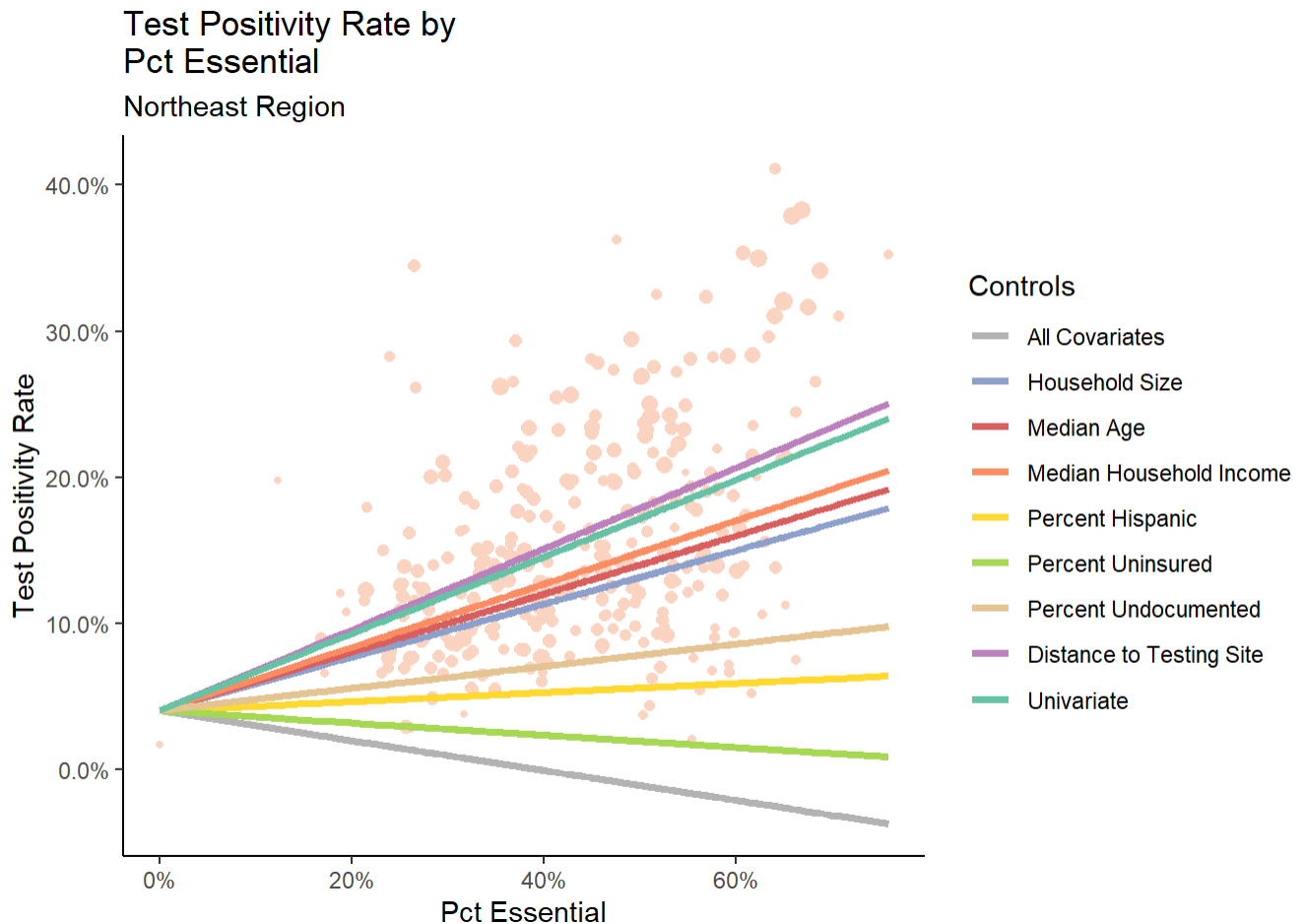
Test Positivity Rate by
Pct Essential
Northeast Region

Controls
— All Covariates
— Household Size
— Median Age
— Median Household Income
— Percent Hispanic
— Percent Uninsured
— Percent Undocumented
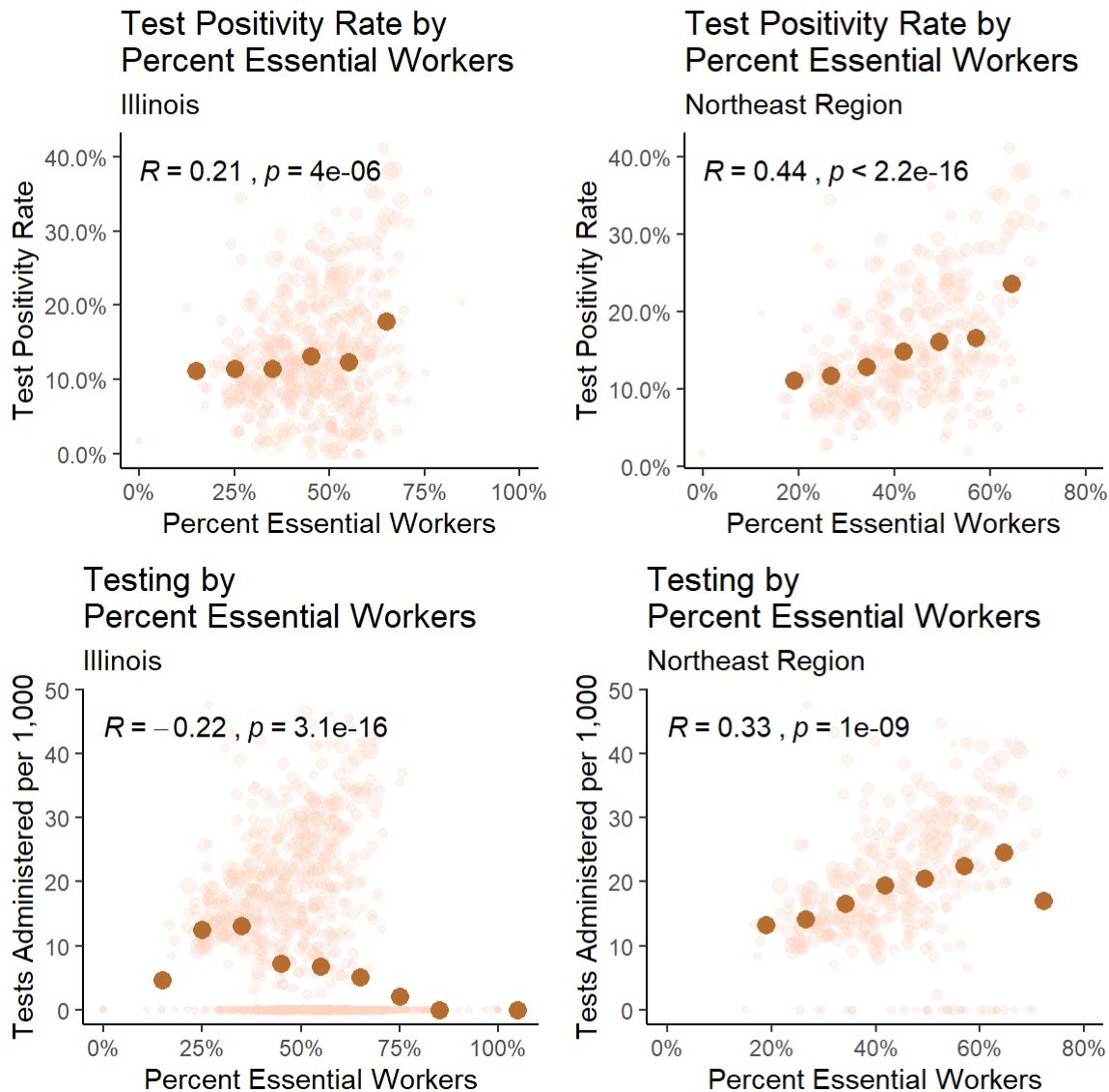— Distance to Testing Site
— Univariate

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between percent essential workers and test positivity rate is **not robust**. Though it appears strong on the surface, this relationship can almost entirely be explained by the fact that ZIPs with more essential workers have more Hispanic residents, more undocumented residents, and higher rates of uninsured residents.

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APPENDIX K: COMMUNITY AREA MEDIAN INCOME

Appendix K. 1. Relationship Between Test Positivity Rates and Area Median Income (Illinois & Northeast Region)
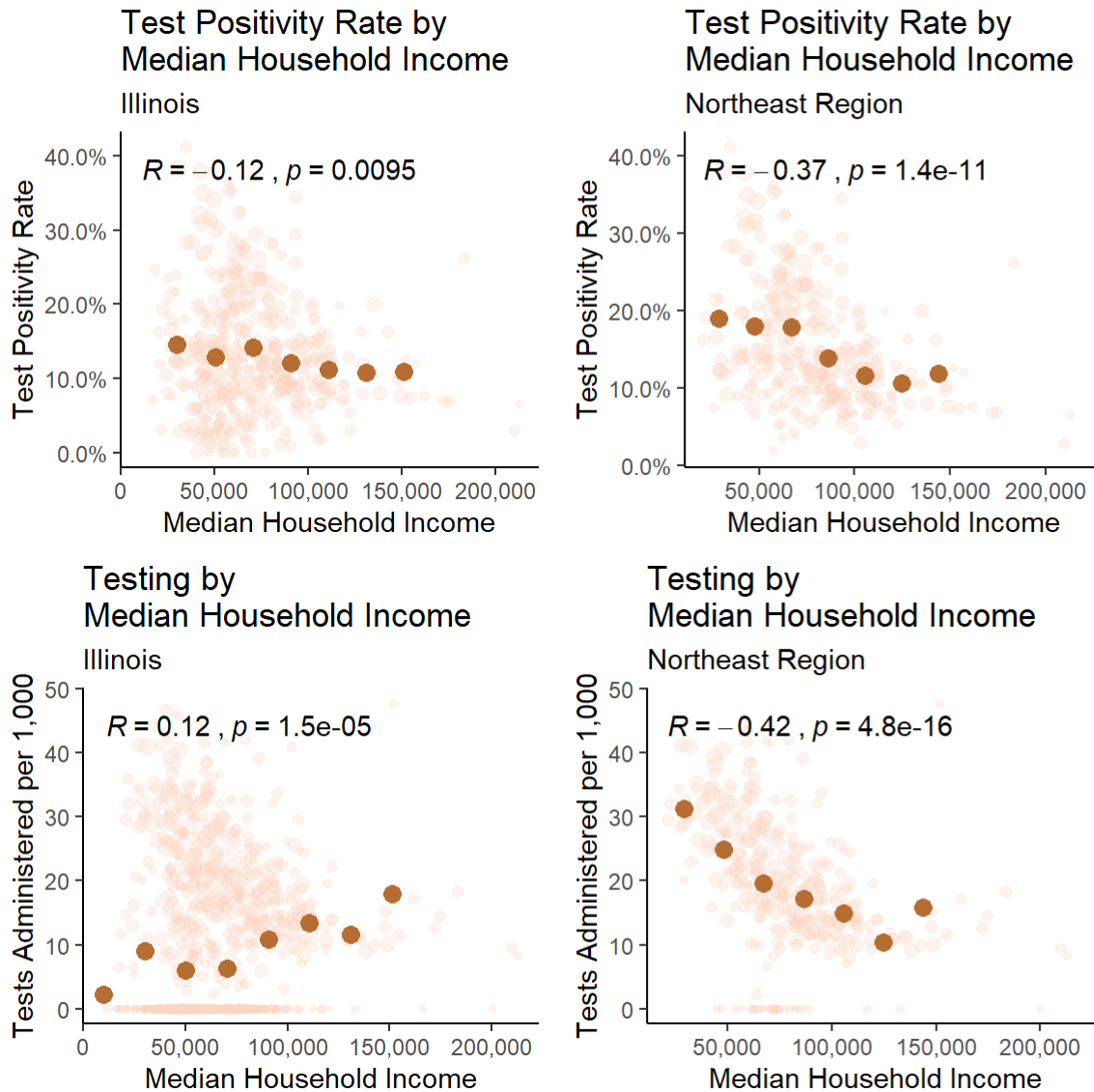
Test Positivity Rate by Median Household Income
Illinois

$R = -0.12$, $p = 0.0095$

Test Positivity Rate by Median Household Income
Northeast Region

$R = -0.37$, $p = 1.4e\text{-}11$

Testing by Median Household Income
Illinois

$R = 0.12$, $p = 1.5e\text{-}05$

Testing by Median Household Income
Northeast Region

$R = -0.42$, $p = 4.8e\text{-}16$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between an area's median income and its test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix K.2. Multivariate Regression Analysis for Median Household Income (Northeast Region)
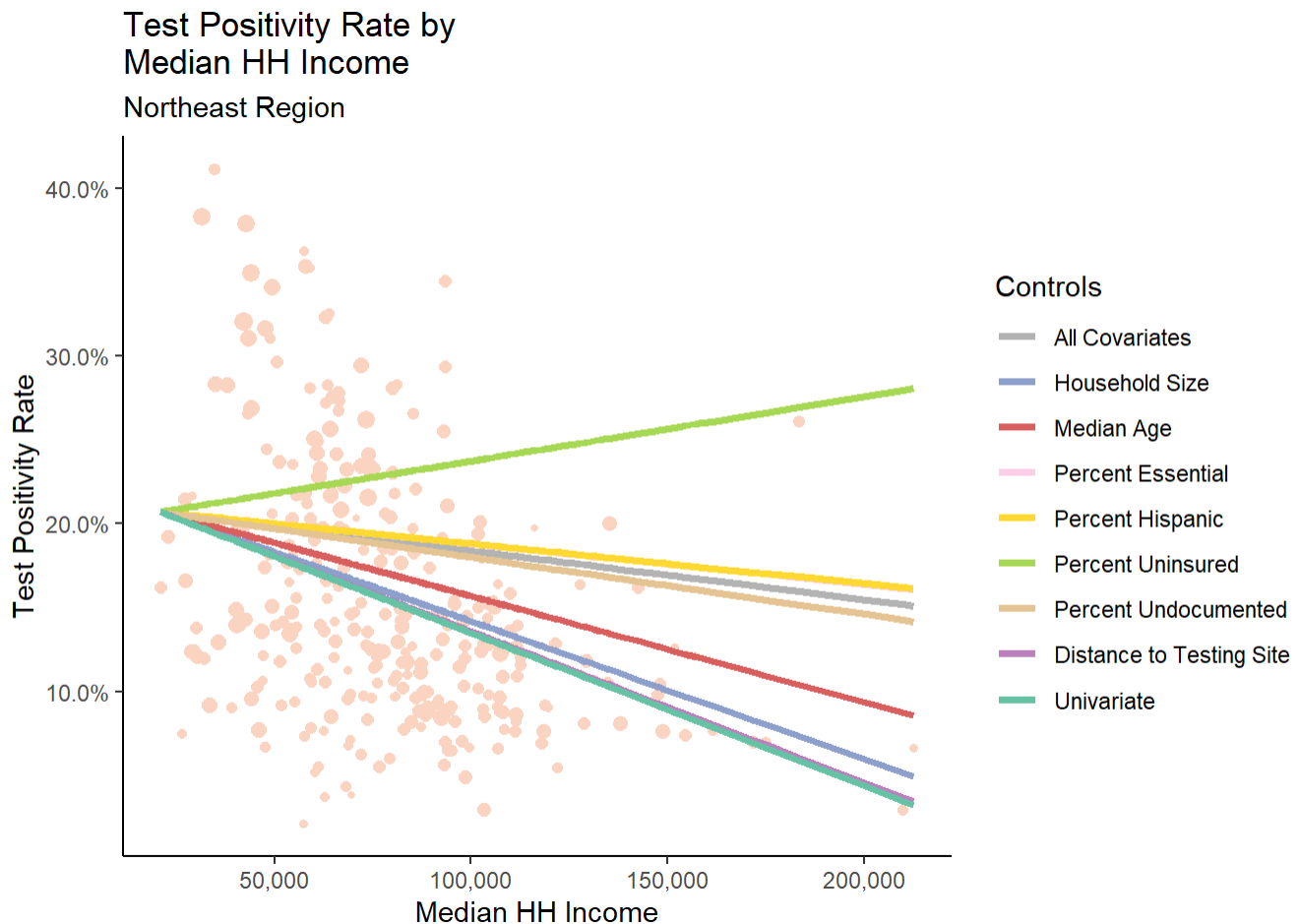
Test Positivity Rate by Median HH Income
Northeast Region

Controls
All Covariates
Household Size
Median Age
Percent Essential
Percent Hispanic
Percent Uninsured
Percent Undocumented
Distance to Testing Site
Univariate

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between median household income and test positivity rate is **not robust**. Though it appears strong on the surface, this relationship can almost entirely be explained by the fact that wealthier ZIPs have lower rates of uninsured residents and higher rates of Hispanic and undocumented residents.

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APPENDIX L: COMMUNITY AREA MEDIAN AGE

Appendix L.1. Relationship Between Test Positivity Rates and Community Area Median Age (Illinois & Northeast Region)
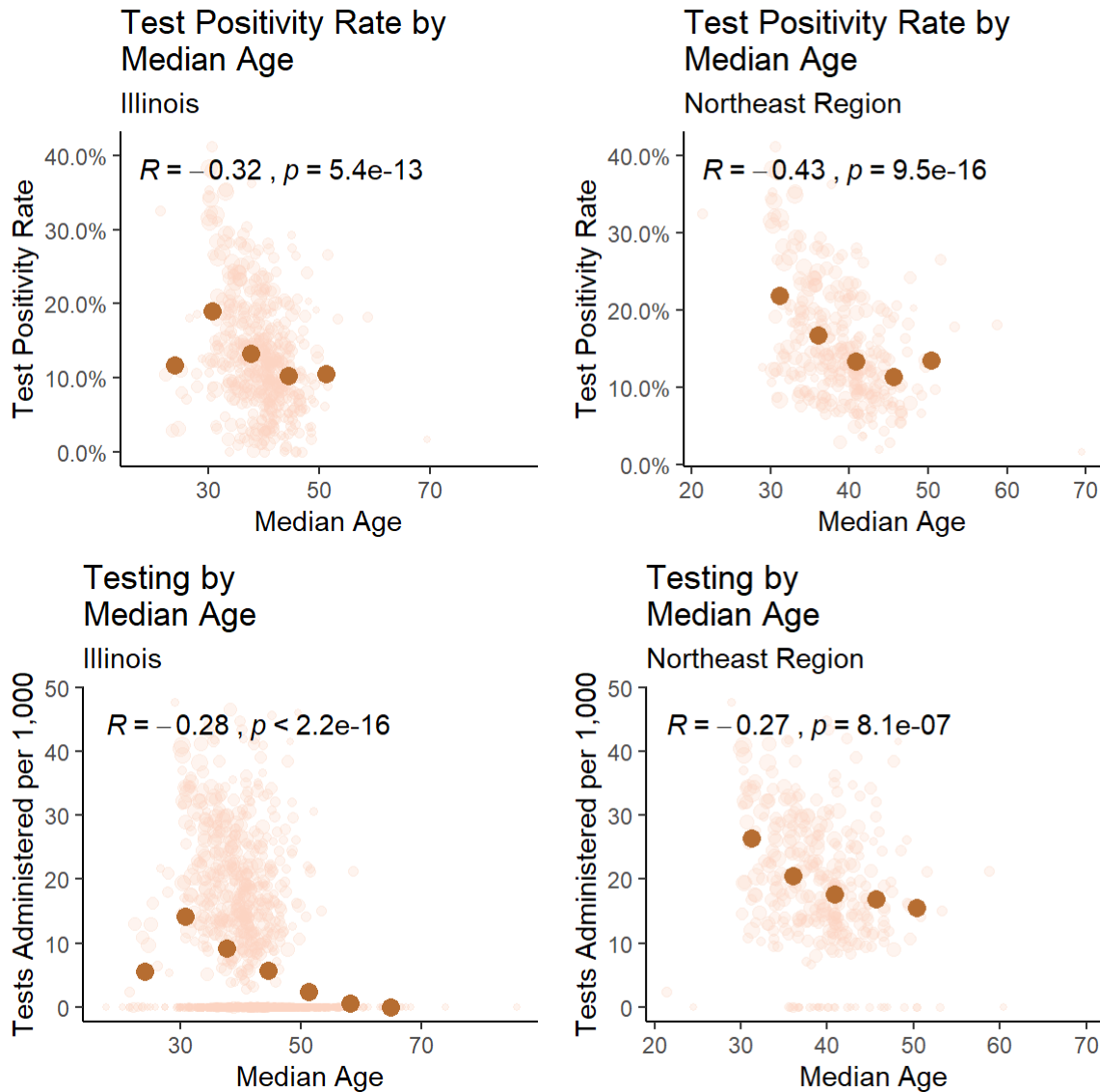
Test Positivity Rate by Median Age
Illinois

$R = -0.32$, $p = 5.4e\text{-}13$

Test Positivity Rate by Median Age
Northeast Region

$R = -0.43$, $p = 9.5e\text{-}16$

Testing by Median Age
Illinois

$R = -0.28$, $p < 2.2e\text{-}16$

Testing by Median Age
Northeast Region

$R = -0.27$, $p = 8.1e\text{-}07$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between community area median age and test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix L.2. Multivariate Regression Analysis for Community Area Median Age
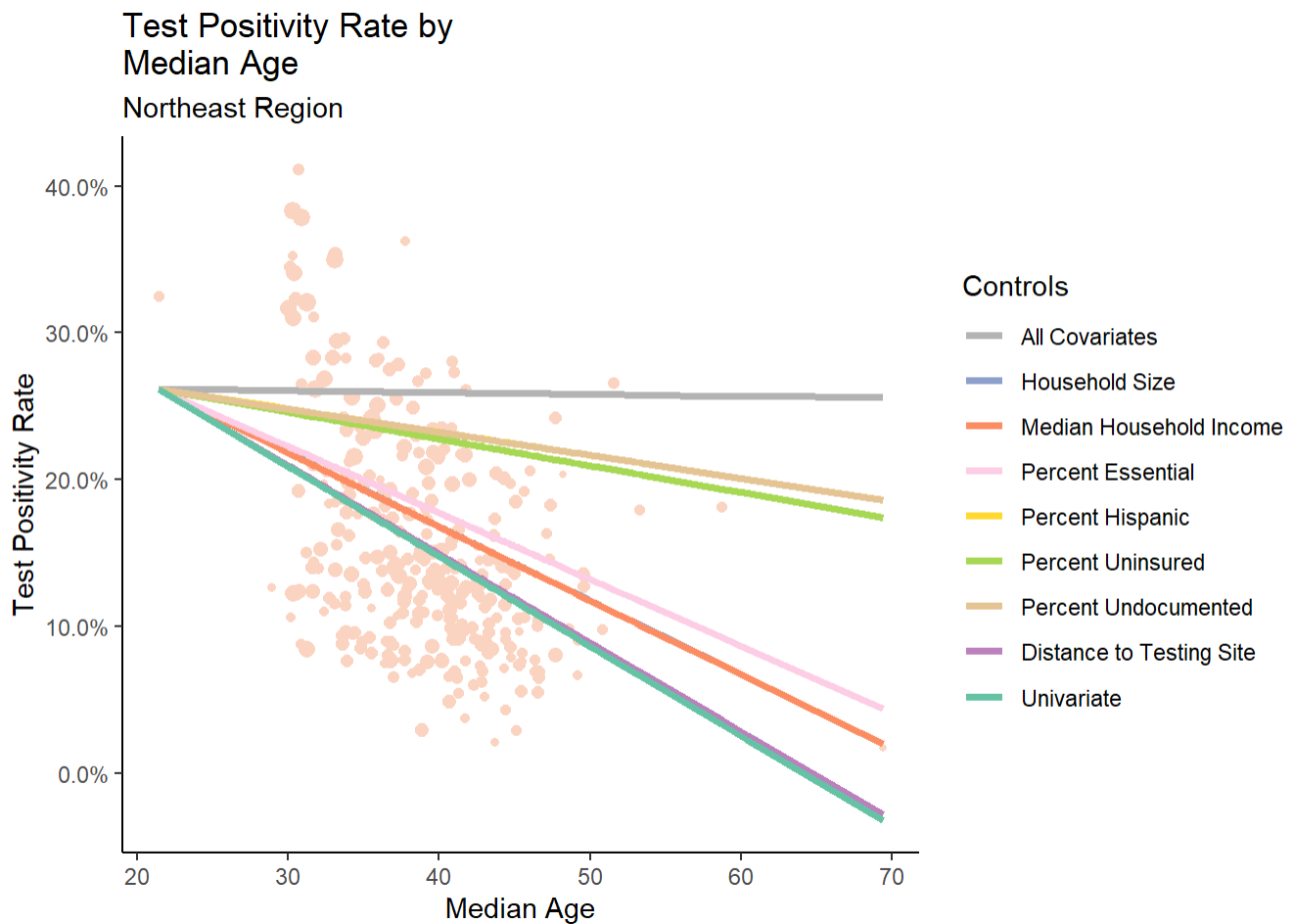
Test Positivity Rate by Median Age
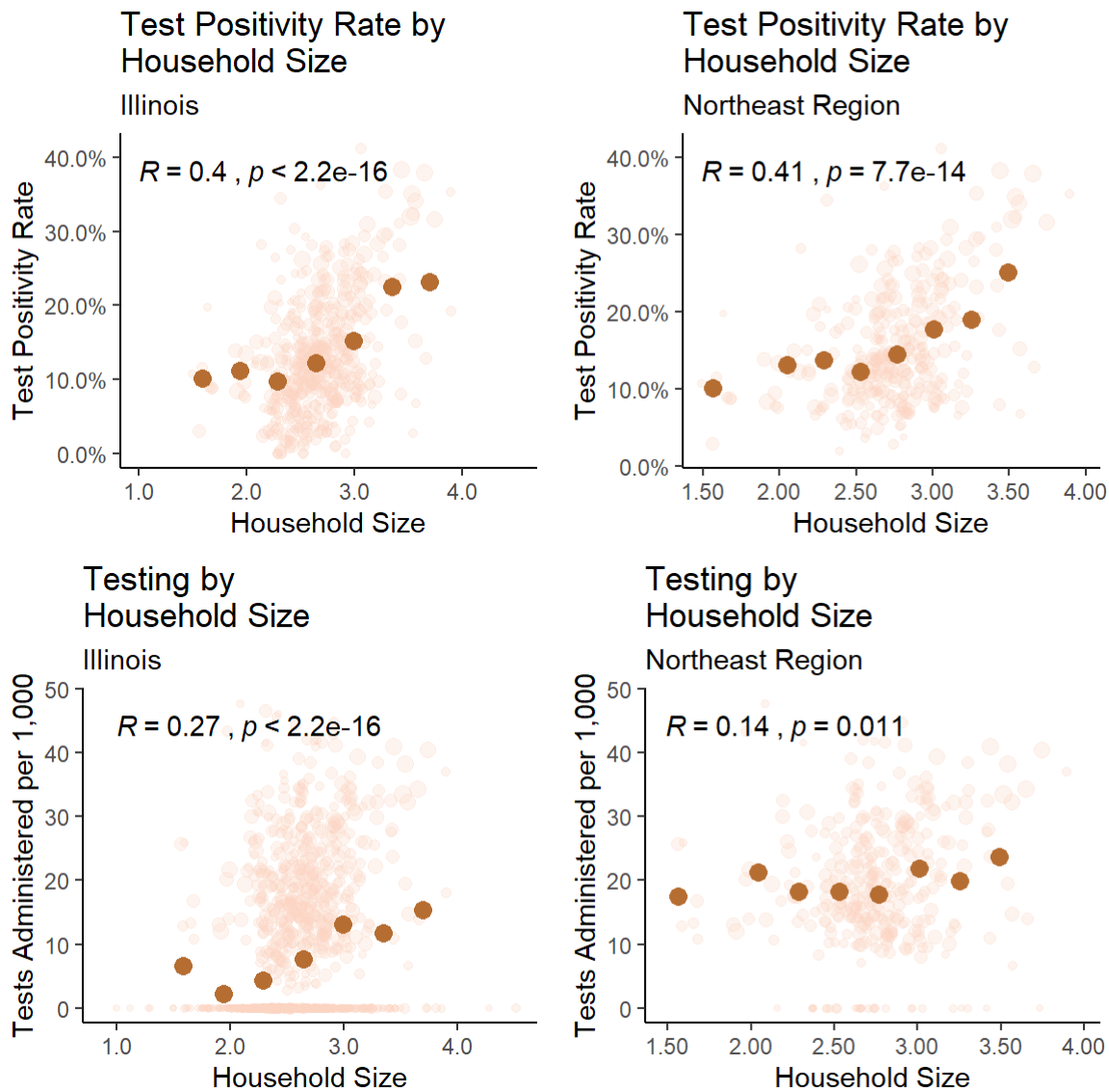Northeast Region

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between median age and test positivity rate is **not robust**. Though it appears moderately strong on the surface, this relationship is driven by differences in undocumented and uninsured populations across ZIP codes.

Appendix M.1. Relationship Between Test Positivity Rates and Household Size (Illinois & Northeast Region)

Test Positivity Rate by Household Size
Illinois

$R = 0.4$, $p < 2.2e\text{-}16$

Test Positivity Rate by Household Size
Northeast Region

$R = 0.41$, $p = 7.7e\text{-}14$

Testing by Household Size
Illinois

$R = 0.27$, $p < 2.2e\text{-}16$

Testing by Household Size
Northeast Region

$R = 0.14$, $p = 0.011$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between household size and test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix M.2. Multivariate Regression Analysis for Household Size (Northeast Region)
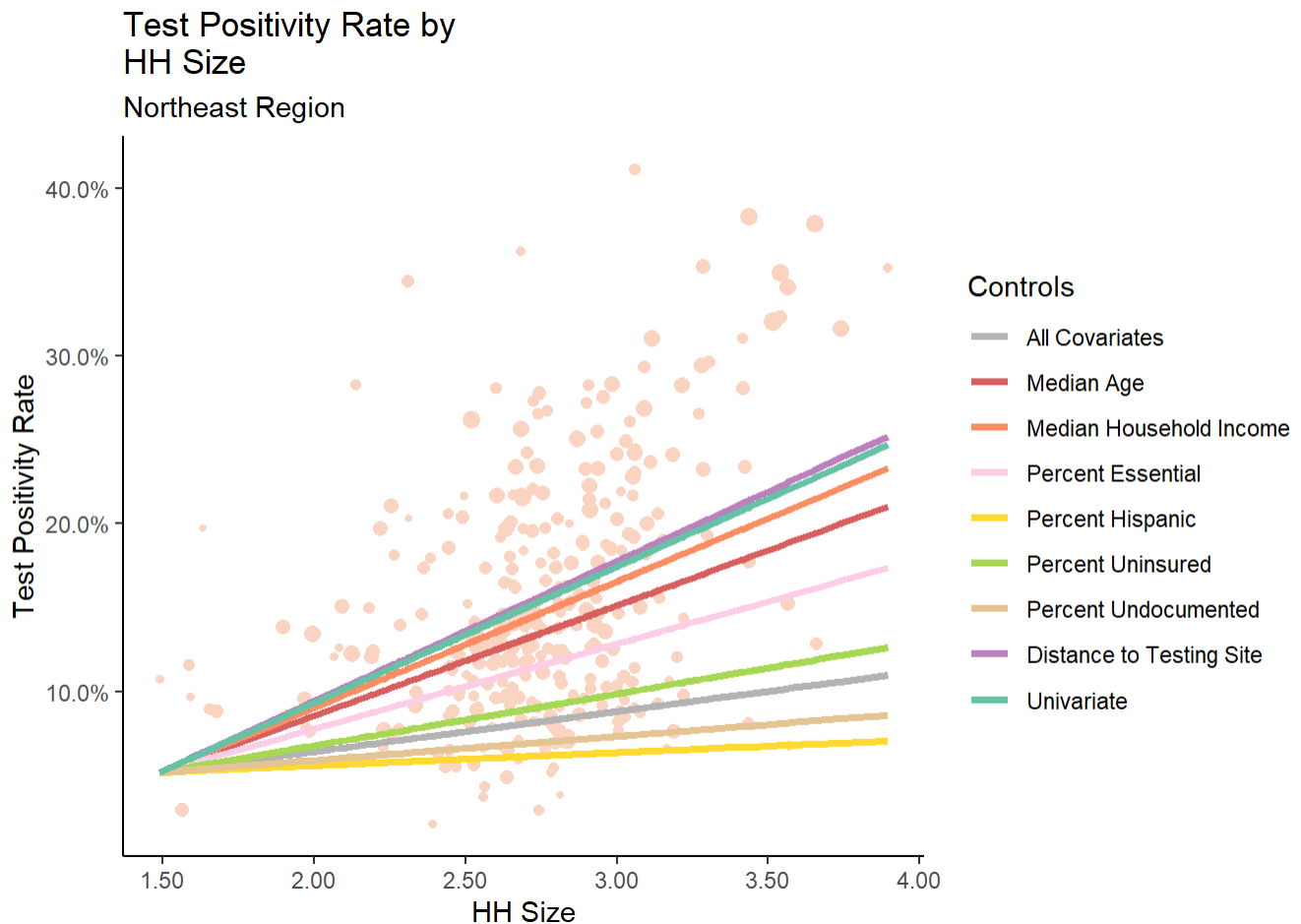
Test Positivity Rate by HH Size
Northeast Region

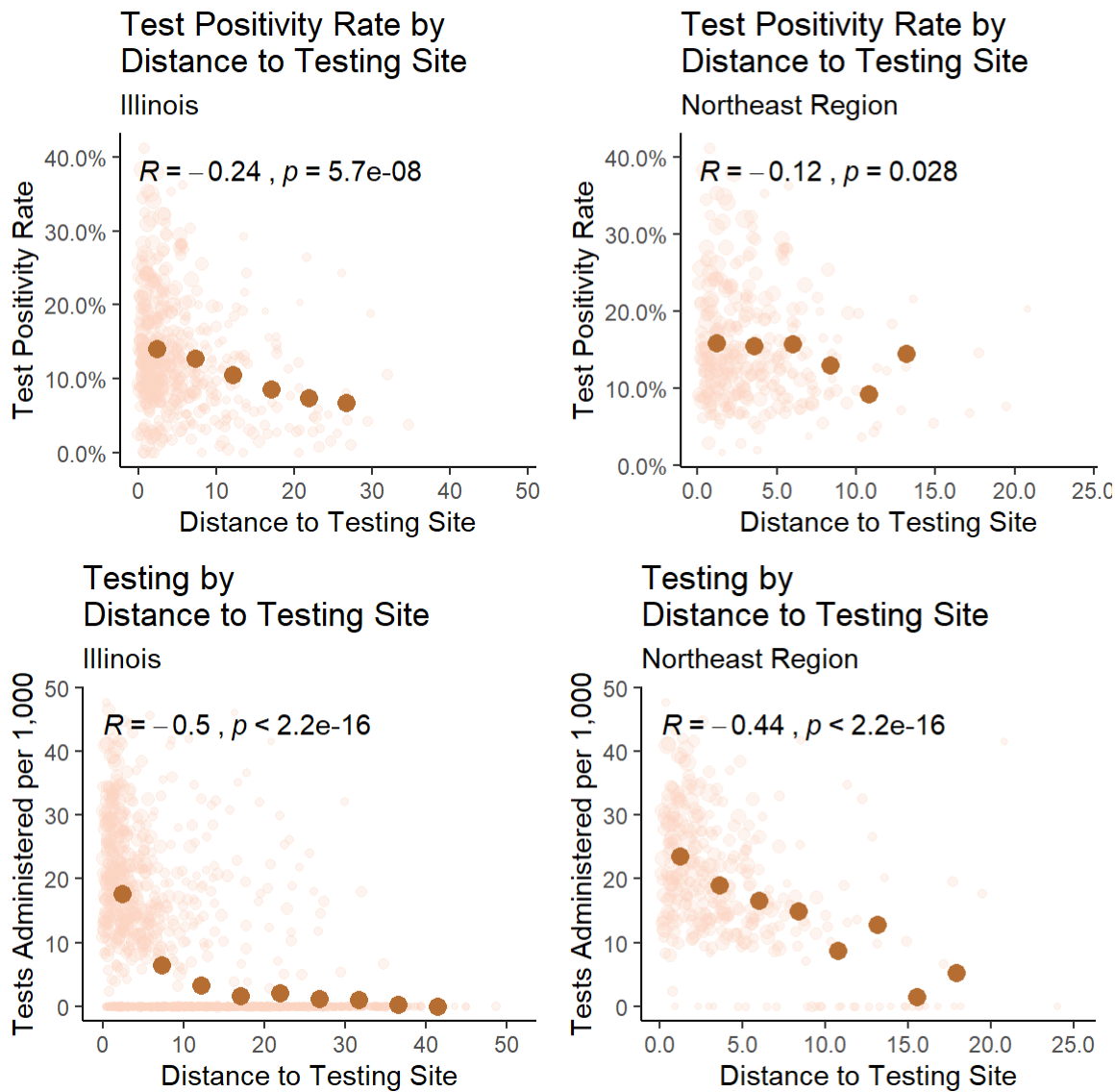Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between household size and test positivity rate is **not robust**. Though it appears strong on the surface, this relationship can almost entirely be explained by the fact that ZIPs with larger average households have larger Hispanic and undocumented populations.

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APPENDIX N: PROXIMITY TO TESTING SITE

Appendix N.1. Relationship Between Test Positivity Rates and Proximity to a Testing Site (Illinois & Northeast Region)

Test Positivity Rate by Distance to Testing Site

Illinois

$R = -0.24$, $p = 5.7e\text{-}08$

Test Positivity Rate by Distance to Testing Site

Northeast Region

$R = -0.12$, $p = 0.028$

Testing by Distance to Testing Site

Illinois

$R = -0.5$, $p < 2.2e\text{-}16$

Testing by Distance to Testing Site

Northeast Region

$R = -0.44$, $p < 2.2e\text{-}16$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

In the following plot, we draw lines of best fit to represent the relationship between a ZIP code's distance to a testing site and the ZIP code's test positivity rate. A *steeper* line represents a stronger relationship, while a *flatter* line represents a weaker relationship. We run each relationship through a **"robustness check"** where we control for other factors and determine if the relationship remains strong (in which case the relationship is "robust" - it *can't* be explained by other factors) or if it becomes weak (in which case the relationship isn't "robust" - it *can* be explained by other factors).

Appendix N.2. Multivariate Regression Analysis for Distance to Testing Site (Northeast Region)
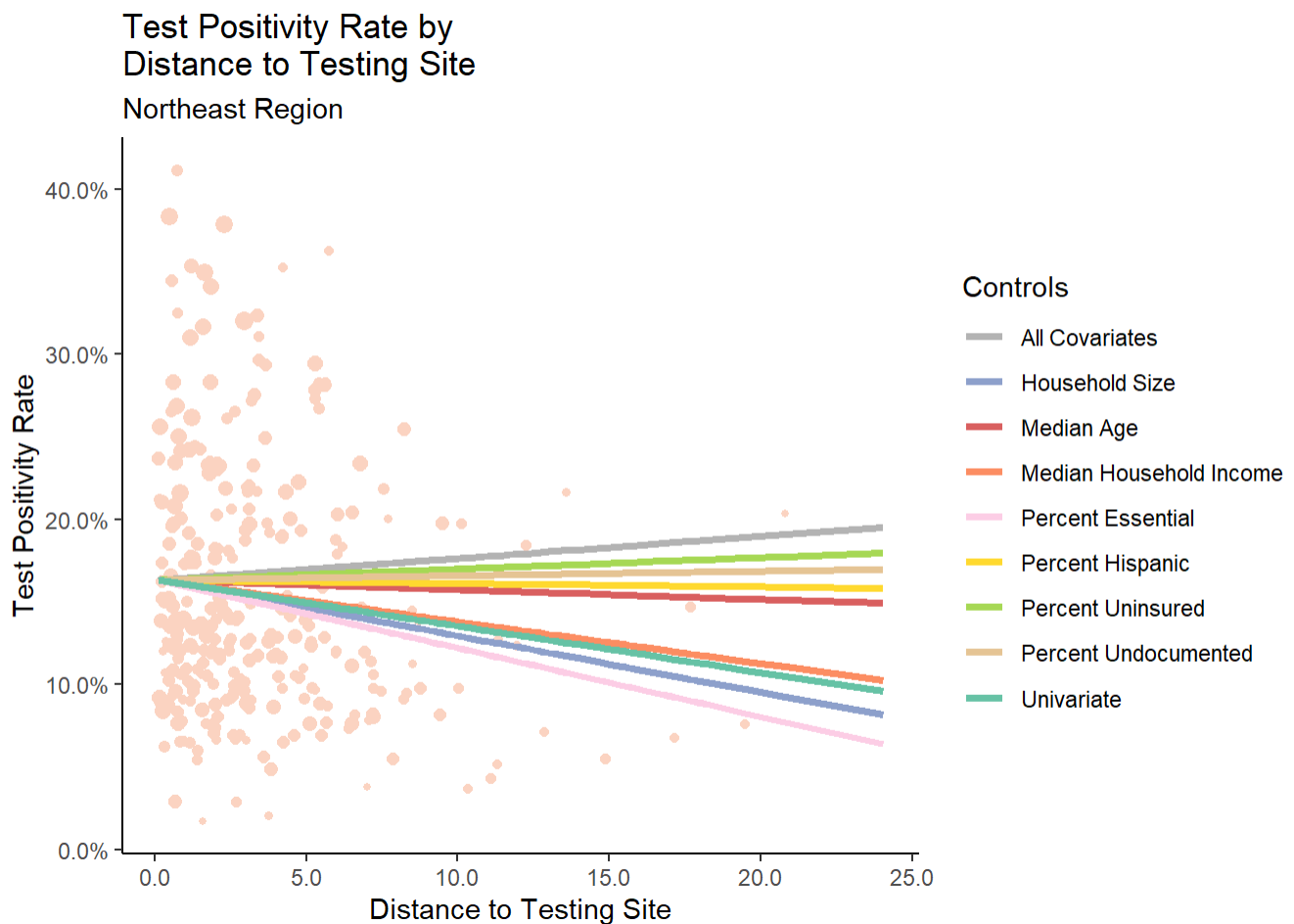
Test Positivity Rate by Distance to Testing Site
Northeast Region

Sources: Illinois Department of Public Health, American Community Survey, Department of Homeland Security. Retrieved May 17, 2020.

This plot shows that the relationship between distance to testing site and test positivity rate is **not robust**. Though it appears moderately strong on the surface, this relationship is driven by differences in undocumented and uninsured populations across ZIP codes.

Test Positivity Rate by Percent Black
Illinois

$R = 0.085$, $p = 0.059$

Test Positivity Rate by Percent Black
Northeast Region

$R = -0.021$, $p = 0.71$

Testing by Percent Black
Illinois

$R = 0.45$, $p < 2.2e\text{-}16$

Testing by Percent Black
Northeast Region

$R = 0.46$, $p < 2.2e\text{-}16$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

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APPENDIX P: COMMUNITY COMPOSITION OF WHITE RESIDENTS (ILLINOIS & NORTHEAST REGION)
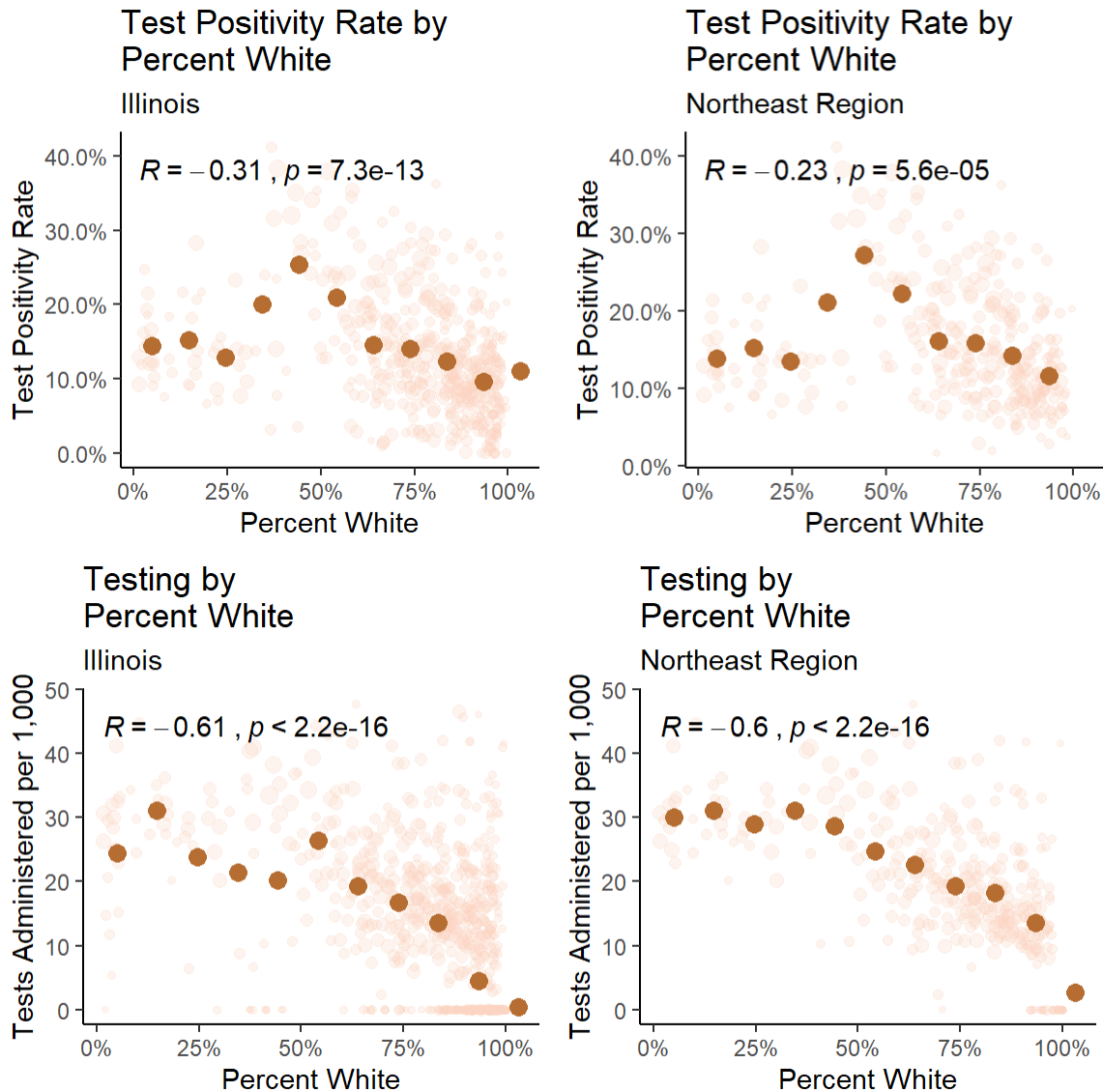
Test Positivity Rate by Percent White
Illinois

$R = -0.31$, $p = 7.3$e-13

Test Positivity Rate by Percent White
Northeast Region

$R = -0.23$, $p = 5.6$e-05

Testing by Percent White
Illinois

$R = -0.61$, $p < 2.2$e-16

Testing by Percent White
Northeast Region

$R = -0.6$, $p < 2.2$e-16

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

Test Positivity Rate by Distance to Hospital
Illinois

$R = -0.093$, $p = 0.037$

Test Positivity Rate by Distance to Hospital
Northeast Region

$R = -0.19$, $p = 0.00058$

Testing by Distance to Hospital
Illinois

$R = -0.51$, $p < 2.2e\text{-}16$

Testing by Distance to Hospital
Northeast Region

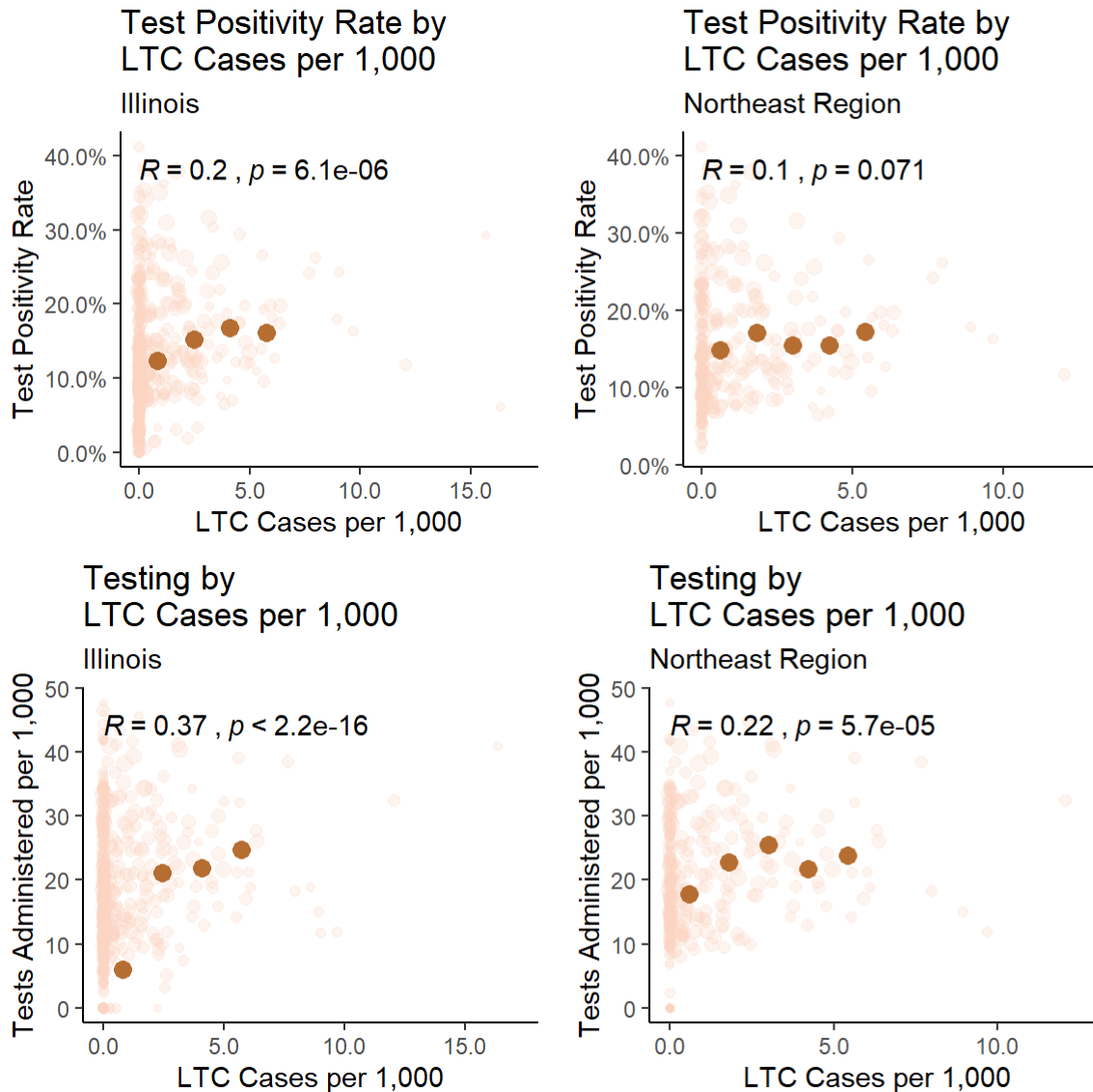$R = -0.43$, $p < 2.2e\text{-}16$
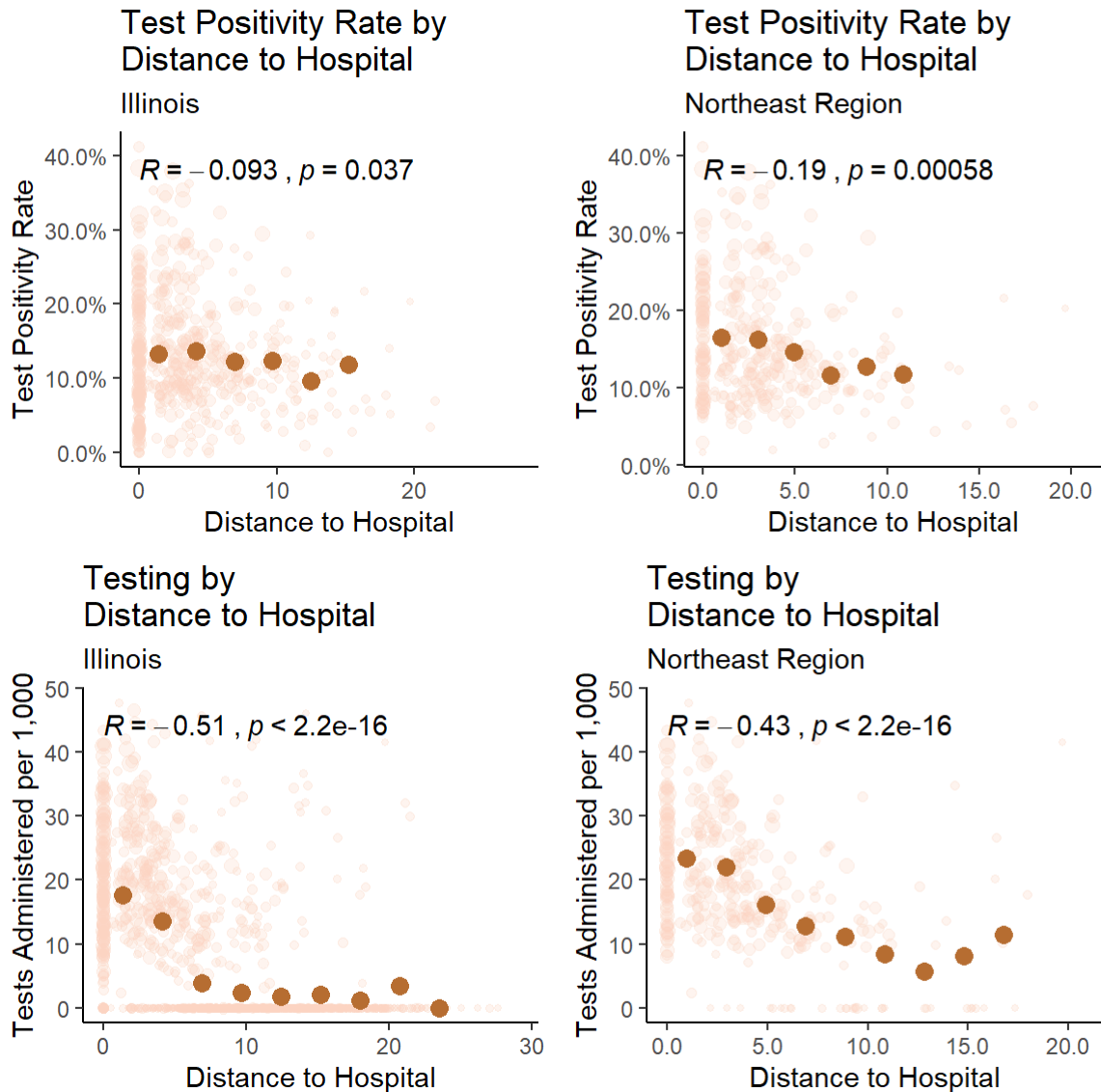
Sources: Illinois Department of Public Health, American Community Survey, American hospital Association. Retrieved May 17, 2020.

APPENDIX R: COMMUNITY AREA POPULATION DENSITY (ILLINOIS & NORTHEAST REGION)
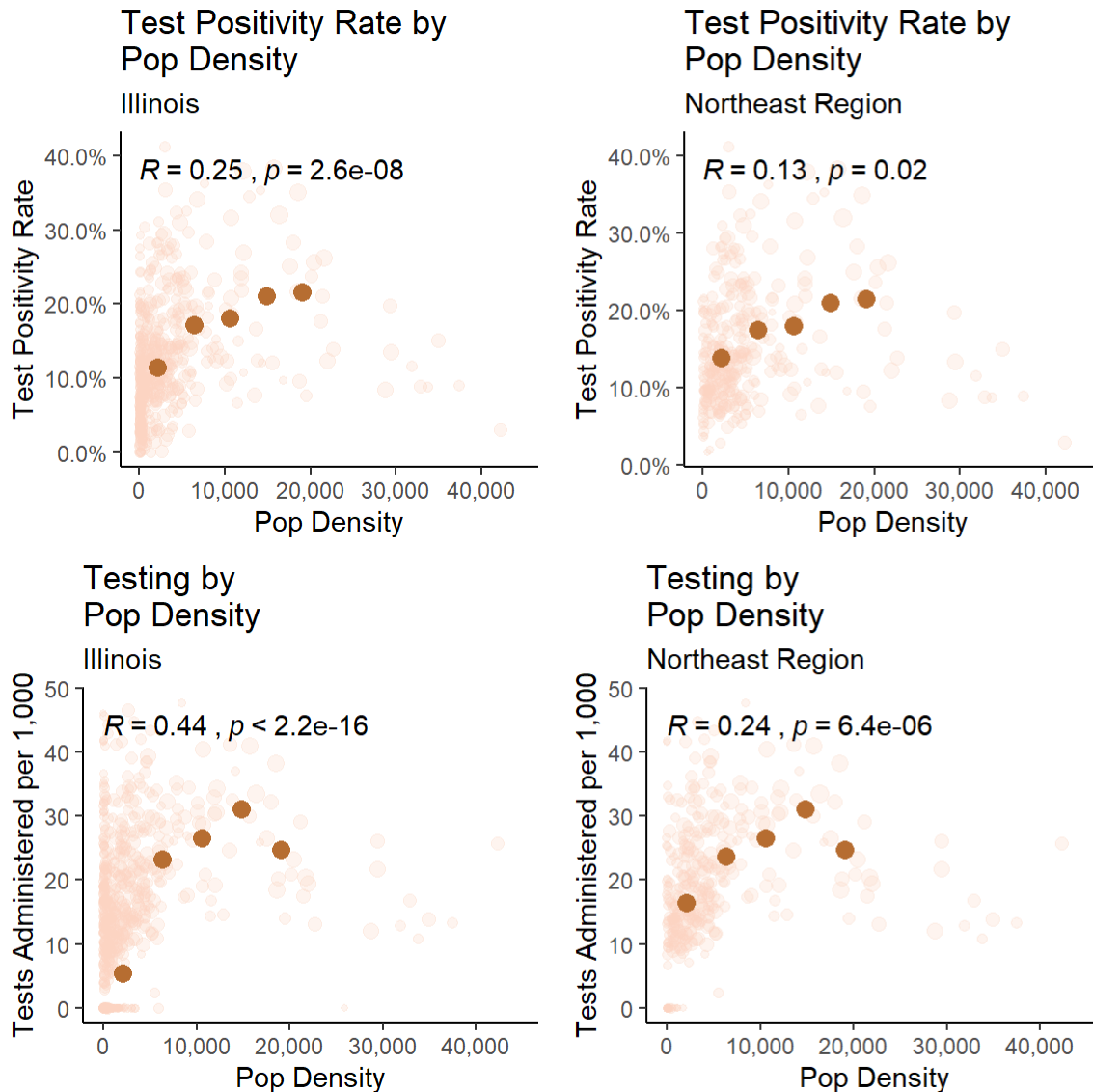
Test Positivity Rate by Pop Density
Illinois

$R = 0.25$, $p = 2.6e\text{-}08$

Test Positivity Rate by Pop Density
Northeast Region

$R = 0.13$, $p = 0.02$

Testing by Pop Density
Illinois

$R = 0.44$, $p < 2.2e\text{-}16$

Testing by Pop Density
Northeast Region

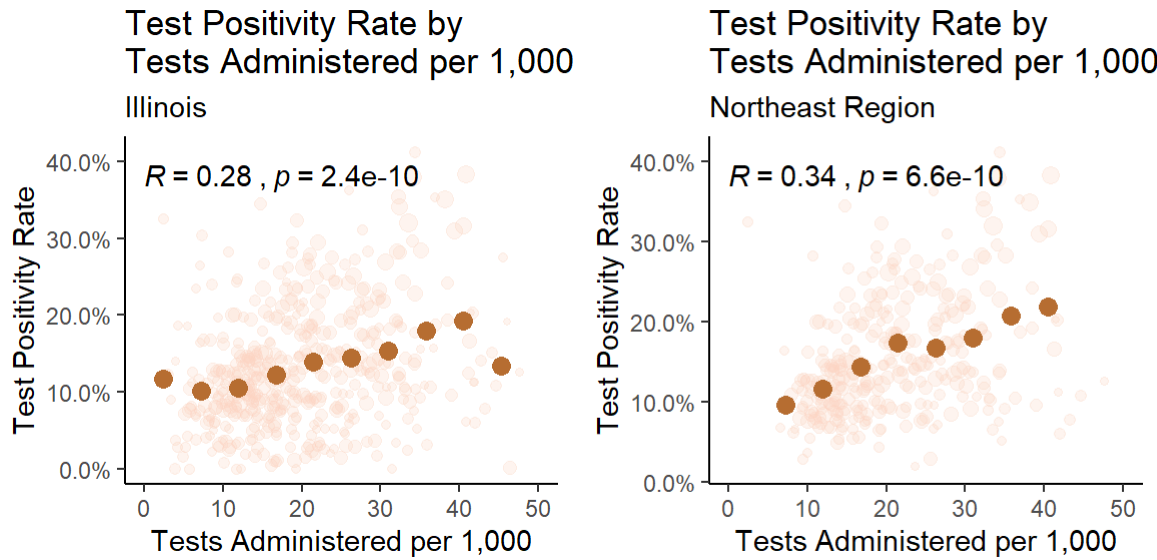$R = 0.24$, $p = 6.4e\text{-}06$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

APPENDIX S: PERCENT IN LONG-TERM CARE FACILITIES (ILLINOIS & NORTHEAST REGION)

Test Positivity Rate by LTC Cases per 1,000
Illinois

$R = 0.2$, $p = 6.1e\text{-}06$

Test Positivity Rate by LTC Cases per 1,000
Northeast Region

$R = 0.1$, $p = 0.071$

Testing by LTC Cases per 1,000
Illinois

$R = 0.37$, $p < 2.2e\text{-}16$

Testing by LTC Cases per 1,000
Northeast Region

$R = 0.22$, $p = 5.7e\text{-}05$

Sources: Illinois Department of Public Health, American Community Survey. Retrieved May 17, 2020.

Test Positivity Rate by Tests Administered per 1,000
Illinois

$R = 0.28$, $p = 2.4e$-10

Test Positivity Rate by Tests Administered per 1,000
Northeast Region

$R = 0.34$, $p = 6.6e$-10

Sources: Illinois Department of Public Health. Retrieved May 17, 2020.