The Association of COVID-19 Infection and Vaccination Rates in Florida

Patrick Bernet, PhD

ABSTRACT

Objective: This study investigates the association of COVID-19 infection and vaccination rates with 2020 presidential election voting preference in Florida counties and the moderating role of age, race, ethnicity, and other community characteristics.

Methods: Florida county COVID-19 infection and vaccination counts through September 2021 were supplemented with socioeconomic characteristics and 2020 presidential election results. Poisson regression measured the association of infection and vaccination rates with county political preferences, race, ethnicity, and other county demographic and economic characteristics. For models of April through September 2021 infection rates, the same county characteristics were assessed alongside county vaccination levels.

Results: Each 1% increase in county full vaccination rates was associated with 82.47 fewer infections per 100 000 during the span of April to September 2021. Vaccination rate was the largest and most statistically significant determinant of vaccine era infections. Each 1% increase in the county share of votes for the 2020 Republican presidential candidate was associated with 109.7 more COVID-19 infections per 100 000 through March 2021 and a 0.546% decrease in county vaccination rates through September 2021.

Conclusions: At the county level, COVID-19 vaccination rates are associated with infection rates, with a higher county population proportion of fully vaccinated associated with fewer infections per 100 000. County political preference in the 2020 presidential election is significantly associated with county-level COVID-19 infection and vaccination rates.

KEY WORDS: COVID-19, politics, race, vaccination

Through September 2021, Florida remains one of the most infected states, with more than 17% of residents testing positive for SARS-CoV-2, the virus that causes COVID-19.[1] Florida also remains dangerously underprotected, with more than 40% not fully vaccinated.[2] Florida is one of the oldest states, with 1 in 5 residents 65 years and older.[3] This is the same age group most likely to die from COVID-19 infection.[4] If the prevaccination period cast Florida into a perfect storm of accelerating infections among a large vulnerable population, subsequent low vaccination rates steer the state right into the next tempest brought by the Omicron variant.

The first waves of the pandemic occurred during the 2020 presidential election campaign. Offering the third most electoral votes and much more closely contested than Texas and California, Florida received extraordinary levels of political messaging, much of which focused on the pandemic.[5-7] Multiple studies find masking and distancing behaviors strongly associated with county political preference.[5,8] Large surveys have found respondents' political affiliation was associated with their level of knowledge about the pandemic, its risks, and their adoption of protective behaviors.[9] Compliance with stay-at-home mandates, voluntary self-quarantine, and recreational mobility limits were similarly associated with political preference,[10] as was online spending when stay-at-home orders were instituted, consistent with greater distancing precautions.[7] Internet search volume for pandemic-relating terms was associated with area preferences in the 2020 presidential election.[11] While the COVID-19 pandemic may have elevated the politicization of masking, distancing, and other nonpharmaceutical interventions, vaccination has been a political issue for years.[12]

Author Affiliation: *Florida Atlantic University, Boca Raton, Florida.*

The author declares no conflicts of interest.

Correspondence: *Patrick Bernet, PhD, Florida Atlantic University, 777 Glades Rd, Boca Raton, FL 33431 (Pbernet@outlook.com).*

DOI: 10.1097/PHH.0000000000001509

Beyond preventive precautions, many factors contribute to infection and vaccination rates. Individuals who are older are less likely to become infected, more likely to die if infected, and more likely to get vaccinated.[13-16] Areas with higher proportions of young people experience higher infection and mortality rates across all ages.[16,17] Non-White individuals are more likely to die if infected and are less likely to get vaccinated.[13,15-17] Counties with lower proportions of those proficient in English had higher infection and mortality rates.[18] Some occupations and industries increase infection risks.[14] Individual and childhood poverty rates are associated with higher mortality rates, and community poverty levels are associated with higher infection rates.[10,13,15,16,18-22] Finally, men are significantly more likely to die once infected, regardless of age.[13]

The association of community-level political preference and community health outcomes existed even before the pandemic. Areas voting for the Republican presidential candidate in 2016 experienced higher mortality rates, shorter life expectancies, and worse levels of overall public health.[23] Significantly elevated rates of drug-, alcohol-, or suicide-related mortality, the so-called "deaths of despair," are also found in these counties.[24] Furthermore, these areas have historically had lower proportions of those receiving routine flu vaccines.[23] Entering the pandemic thusly, such counties were primed for worse outcomes.

Recognizing the strong role of social interaction in pandemic spread,[5] this study adopts a county-level perspective to look for shared characteristics of counties where larger proportions of residents have been infected or are not fully vaccinated.

Methods

Data sources and measures

County infection counts, based on all 3 539 268 individual cases of COVID-19 infection through September 2021, were retrieved from the Centers for Disease Control and Prevention (CDC)[4] and then summarized into case counts for each of Florida's 67 counties. Counts of those fully vaccinated were similarly sourced from the CDC[4] and summarized by county. Infection and vaccination rates are stated as rates per 100 000 residents using county population estimates from American Community Survey 5-year estimates (2014-2018).[3] Rates were computed for several spans: through March 2021; April 2021 through September 2021; and for the entire pandemic-to-date period through September 2021. Prior pandemic research identifies county characteristics associated with COVID-19 spread and severity,[15,25] including population proportion of those older than 65 years, population density, and poverty rates, all drawn from American Community Survey 5-year estimates. Core determinants also include proportions covered by health insurance.[26] Although some COVID-19 studies employ income instead of poverty,[5,7,9] Florida's high concentration of retirees with fixed incomes makes the poverty measure more broadly relevant.

In addition to core predictors, this study focuses on the potential association of 3 key POPULATION characteristics: COUNTY race and ethnicity composition, and COUNTY political preference. Population proportions of Black non-Hispanic and Hispanic are derived from the American Community Survey. 2020 presidential election vote tallies were obtained from the Florida Department of State. To facilitate comparison of different-sized counties, all measures are represented as population proportions. Similarly, both infection and vaccination rates are evaluated using the same set of determinants to identify potential commonalities.

This study focuses on 3 questions across 2 periods: the prevaccine era through March 2021, when vaccination supplies were extremely limited; and the vaccine era starting April 2021, when vaccination status depended more on personal choice than availability. In the first period, this study asks how infection rates relate to county race, ethnicity, political preference, and other determinants when vaccines were not widely available. In the second period, when vaccines became broadly available, this study incorporates vaccination rates when measuring the relationship of determinants. As many studies have identified a strong association between county political preference and precautionary health behaviors,[5,7-9,11,16] second period models include an interaction term between vaccination rate and county vote proportions in the 2020 presidential election. And finally, again in the second era, this study tests the association of county-level vaccination rates with county characteristics. Each question is tested through an independent cross-sectional analysis because the way in which characteristics such as community race, ethnicity, and political preference are associated with vaccination rates may be different from their association with infection rates. Furthermore, each cross-sectional analysis is rerun during different time spans because the way those characteristics are associated with infection rates in the prevaccine era may change once vaccination rates are considered.

The first and third questions—prevaccine era infection rates and vaccination rates once available—hold insight into the consistency of community health outcomes and precautions. Do areas with higher infection rates before vaccine availability also have lower vaccination rates later? The first and second questions—infection determinants without and with vaccine

availability—hold insight into the effectiveness of the vaccine itself. Are higher vaccination rates associated with lower infection rates at the county level?

Statistical analysis

A summary overview of county characteristics starts the analysis, with *t* tests highlighting differences between counties with vaccination rates above the statewide median level and those below. County traits include socioeconomic features related to pandemics, as well as COVID-19 infection and vaccination rates. The association of community characteristics with COVID-19 infections and vaccinations is then tested through regression models. With all dependent variables stated as rates per 100 000, a generalized linear model with a Poisson distribution was employed. Analysis is not population weighted because the intent is to measure community characteristics and not to infer individual attributes. Institutional review board review was waived as all data were obtained from publicly available data sets. Analysis was conducted using Stata v16.1. The choice of analysis methods was informed by prior COVID-19 studies that employ the same race, ethnicity, age, and socioeconomic status indicators, drawn from the same data sources.[19,20]

Results

The breadth and depth of differences among Florida counties are on display in Table 1. County infection rates average 16 565 per 100 000 residents through September 2021, with higher rates in the counties with below-median vaccination rates (18 206) than in those with above-median rates (14 873). Reflecting the sharpness of the divide, this difference, along with almost all others, is statistically significant at the .01 level. The initial period through September 2020 shows below-median vaccinating counties experiencing significantly higher infection rates (4578) than above-median counties (2756). The span of October 2020 to March 2021 saw no significant difference. But in the vaccine era running April to September 2021, below-median vaccinating counties again

TABLE 1
County Characteristics and COVID-19 in Florida[a]

County Characteristics	State Total		Counties With Below-Median Vaccination Rates		Counties With Above-Median Vaccination Rates		*P*
	Mean	SD	Mean	SD	Mean	SD	
COVID-19 infections per 100 000 through Sep 2020	3 681	2 000	4 578	2 255	2 756	1 126	.00
COVID-19 infections per 100 000 Oct 2020 to Mar 2021	5 767	1 106	5 875	1 068	5 656	1 150	.42
COVID-19 infections per 100 000 Apr 2021 to Sep 2021	7 117	1 287	7 753	1 310	6 462	879	.00
COVID-19 infections per 100 000 through Sep 2020	3 681	2 000	4 578	2 255	2 756	1 126	.00
COVID-19 infections per 100 000 through Mar 2021	9 448	2 459	10 453	2 393	8 412	2 095	.00
COVID-19 infections per 100 000 through Sep 2021	16 565	3 148	18 206	2 790	14 873	2 569	.00
Republican vote share of 2020 presidential election	63.3	13.6	72.8	8.1	53.7	11.0	.00
Population % fully vaccinated	46.5	11.6	36.8	6.0	56.5	6.2	.00
Population % Black	14.1	9.3	14.3	7.4	14.0	11.1	.90
Population % Hispanic	14.7	13.2	11.8	11.9	17.6	14.0	.07
Population % aged 65+ y	21.6	7.7	19.4	4.5	24.0	9.6	.01
Population density per square mile (logged)	5.0	4.7	4.1	1.0	6.0	1.0	.00
% Uninsured	15.3	3.3	15.8	3.9	14.8	2.6	.21
% Poverty	16.2	5.3	19.4	4.9	13.0	3.5	.00
N	67		34		33		

[a] *Infections and vaccinations as of September 2021 (N = 67). P is 2-sided P value for difference between counties with above-median vaccination rates and counties with below-median vaccination rates. Data sources: American Community Survey, County Health Rankings, the Behavioral Risk Factor Surveillance System, and the Centers for Disease Control and Prevention. Used with permission.*

experienced significantly higher infection rates (7753) than above-median counties (6462).

The Republican share of the 2020 presidential election was significantly higher (72.8%) in counties with below-median vaccination rates than in above-median counties (53.7%). The Black share of county population did not differ on the basis of vaccination rates, though the Hispanic share was higher (17.6%) in counties with above-median vaccination rates than in below-median counties (11.8%). Counties with above-median vaccination rates were older, with 24.0% of those 65 years and older, while below-median counties were younger, with just 19.4% of those 65 years and older. Finally, counties with below-median vaccination rates were significantly poorer (19.4% living in poverty) than above-median counties (13.0%).

Incorporating the multiple county characteristics simultaneously, Table 2 (column A) estimates the strength and direction of association of each independent variable with county infection rates through March 2021. The coefficient on the political preference variable is statistically significant, showing each 1% increase in a county's vote share for the Republican candidate in the 2020 presidential election was associated with 109.7 additional infections per 100 000. Race and ethnicity are also associated with outcomes, with each 1% increase in Black share of the population associated with 154.5 more infections per 100 000 and each 1% increase in Hispanic share seeing 88.78 more infections per 100 000. Older counties experience fewer infections, with each 1% increase in population share of those 65 years and older associated with 66.3 fewer infections per 100 000.

To assess whether the introduction of readily available vaccines moderated infection rates, this study first retests the model from the earlier period (Table 2, column A) on the rates of infections per 100 000 during the April through September 2021 period (Table 2, column B). In this period, each 1% increase in county vote share going to the 2020 Republican presidential candidate vote share was associated with 62.98 additional infections per 100 000. Among other determinants, coefficients on both race and age were no longer significant. Counties with higher proportions of Hispanics, however, continue to experience higher infection rates, with each 1% increase in population share associated with 52.86 additional infections during the span of April to September 2021.

While the former model (Table 2, column B) measured the association of infections with the core set of socioeconomic characteristics and county political preference in the 2020 presidential election, the next model (C) reassessed the association of infections with the same core set of socioeconomic characteristics but substituted political preference proportions with vaccination rates. Each 1% increase in vaccination rates was associated with 82.47 fewer infections per 100 000 during the span of April to September 2021 (Table 2, column C), while core county characteristic coefficients remained essentially the same. When the model is expanded to consider both political preference and vaccination simultaneously (Table 2, column D), the latter remains a significant determinant, with each 1% increase in vaccination rates associated with 129.60 fewer infections per 100 000 during the span of April to September 2021. The coefficient on political preferences, however, becomes insignificant when evaluated in the presence of vaccination rates.

The final model (Table 2, column E) measures the association of the same set of county characteristics with vaccination rates. Each 1.000% increase in a county's vote share for the 2020 Republican presidential candidate was associated with a 0.546% drop in vaccination rates. Although the county proportion of Black had no significant association with vaccination rates, each 1% increase in Hispanic share was associated with a 0.292% increase in vaccination rates. Counties with higher shares of seniors saw vaccination rates increase 0.535% for each 1% increase in the population proportion of those 65 years and older. Vaccination rates were also lower in areas with higher proportions of those living in poverty or without health insurance.

Discussion

Prior to the ready availability of vaccines, COVID-19 infection rates were associated with several community characteristics, including race, ethnicity, political preference, and age composition. Plotting each county's prevaccine era infection rate by political preference levels in the 2020 presidential election, the distinct upward slope in Figure 1 provides visual support for regression findings. These results are consistent with other studies that find infection rates are significantly associated with county-level political preferences.[16] Other studies have found these same counties with higher infection rates also have lower average precaution levels, including masking, distancing,[8] information seeking,[11] knowledge of risks,[9] and quarantine compliance.[7,10]

The statistical significance of the race coefficient is visually evident in the shading of each county's data point in Figure 1, which shows as black for counties with the highest proportions Black. Generally situated on the upper edge of the curve, this shows that, for any given level of political preference, infection rates are higher still in counties with higher

TABLE 2

Regression Coefficients for County COVID-19 Infection and Vaccination Rates in Florida[a]

	Infections and Vaccinations as of Sep 2021 (N = 67)				
Variable	**A: Infections per 100 000 Through Mar 2021 (95%CI)**	**B: Infections per 100 000 Apr-Sep 2021 (95%CI)**	**C: Infections per 100 000 Apr-Sep 2021 (95% CI)**	**D: Infections per 100 000 Apr-Sep 2021 (95% CI)**	**E: Vaccination Rate Through Sep 2021 (95% CI)**
Republican vote % POTUS 2020	109.7[b] (50.77, 168.66)	62.98[b] (27.43, 98.53)		− 23.17 (−92.71, 46.38)	− 0.546[b] (−0.73, −0.36)
Vaccination %			− 82.47[c] (−133.33, −31.61)	− 129.6[c] (−226.60, −32.59)	
Vote × Vaccination				1.181 (−0.55, 2.91)	
% Black non-Hispanic	154.5[b] (78.18, 230.72)	0.103 (−48.81, 49.02)	− 27.10 (−72.17, 17.97)	− 9.565 (−46.57, 27.44)	− 0.142 (−0.36, 0.08)
% Hispanic, all races	88.78[c] (25.72, 151.84)	52.86[c] (14.99, 90.73)	72.58[b] (40.97, 104.19)	70.10[b] (42.33, 97.86)	0.292[c] (0.10, 0.48)
% Age 65+ y	− 66.30[c] (−107.29, −25.31)	− 47.28 (−104.70, 10.13)	− 3.267 (−54.74, 48.20)	− 23.53 (−87.68, 40.63)	0.535[b] (0.36, 0.71)
Population density/ square mile log	− 144.2 (−530.73, 242.38)	141.1 (−157.13, 439.43)	− 87.20 (−293.86, 119.46)	61.92 (−276.02, 399.87)	− 1.475 (−3.02, 0.07)
% Uninsured	− 111.9 (−353.20, 129.41)	− 188.7 (−381.01, 3.55)	− 259.8[c] (−442.23, −77.35)	− 234.0[c] (−383.34, −84.56)	− 0.833[d] (−1.60, −0.06)
% Poverty	24.94 (−68.72, 118.59)	72.54[d] (4.61, 140.47)	7.813 (−97.88, 113.51)	34.66 (−85.07, 154.39)	− 0.809[b] (−1.12, −0.50)
% High school graduate	21.08 (−37.39, 79.55)	− 24.44 (−58.00, 9.13)	− 28.44 (−60.63, 3.74)	− 24.69 (−53.57, 4.19)	− 0.0230 (−0.15, 0.10)

Abbreviations: CI, confidence interval; POTUS, President of the United States.

[a] *Infection coefficients represent the change in the number of infections per 100 000 residents for each 1% change in the independent variable. Vaccination coefficients represent the change in the population percent (100-relative) vaccinated for each 1% change in the independent variable. Data sources: American Community Survey, County Health Rankings, the Behavioral Risk Factor Surveillance System, and the Centers for Disease Control and Prevention. Used with permission.*

[b] $P < .001$.

[c] $P < .01$.

[d] $P < .05$.

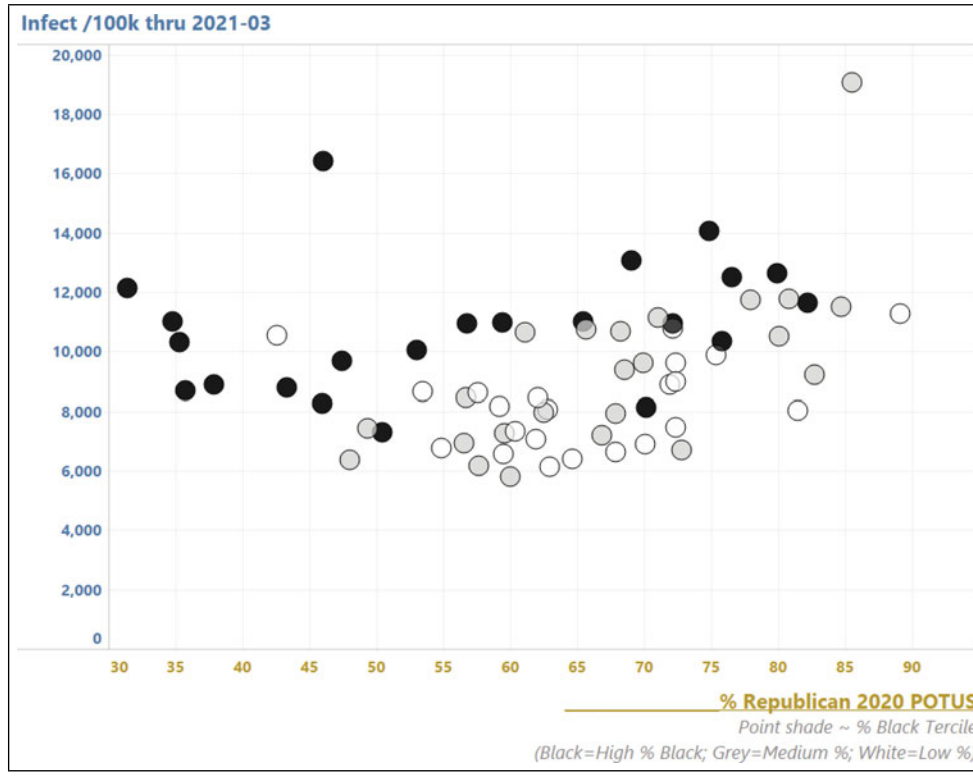

FIGURE 1 COVID-19 Infection Rates by % Republican Vote (With % Black Highlighted) for Cases Reported Through March 2021[a]

[a]The figure represents COVID-19 infection rate per 100 000 for the period through March 2021. Each data point represents one of Florida's 67 counties. Point placement is based on the infection rate per 100 000 (vertically) and the proportion voting Republican in the 2020 presidential election (horizontally). Point shading indicates county % Black, with color transitioning from white for counties with the lowest % Black to black for counties with the highest % Black. N = 67.

Data sources: American Community Survey, County Health Rankings, the Behavioral Risk Factor Surveillance System, and the Centers for Disease Control and Prevention. Used with permission.

Tableau interactive graphic and study data available at https://public.tableau.com/views/FLInfectVax2021-Sepfv234d2/Dashboard1?:language=en-US&:display_count=n&:origin=viz_share_link.

proportions of Black. This strongly reinforces other studies finding higher COVID-19 infection rates in Black communities.[16,20,21]

With easier access to vaccines in the period April through September 2021, regressions show infection rates were most strongly associated with community vaccination penetration (Table 2, column D). Plotting each county's April through September infection rate by the proportion of those fully vaccinated, the graph in Figure 2 shades each county's data point by its population proportion of Hispanic. The black points, representing counties with the highest Hispanic proportions, tend to be on the upper side of the cluster (higher infection rates) but at "downhill" part of the cluster (more vaccinated). This provides visual support for what appeared to be a contradiction. Counties with higher Hispanic proportions were associated with higher vaccination rates (Table 2, column E), but these same counties were associated with higher infection rates (Table 2, column D). The graph in Figure 2 shows how both can occur, as relative to other counties with similar vaccination rates, those with higher Hispanic proportions tended to have higher infection rates. Overall, the higher infection rates of less vaccinating counties visually reinforce regression results that vaccination penetration is the county characteristic most strongly associated with reduced infection rates, just as identified in other studies.[27,28] And consistent with a county-level study in nearby Georgia,[18] Hispanic proportions were strongly associated with higher infection rates, though Black population proportions were not statistically significant.

As demonstration of the multiple ways in which county political preferences are associated with pandemic-related measures, Figure 3 plots vaccination rates as a function of the county 2020 presidential election preferences. The distinct downhill slope visually reinforces regression findings (Table 2, column E) that show vaccination rates decreasing sharply as a function of county political preferences. These findings add to evidence linking low vaccination rates to community preferences in the 2020 presidential

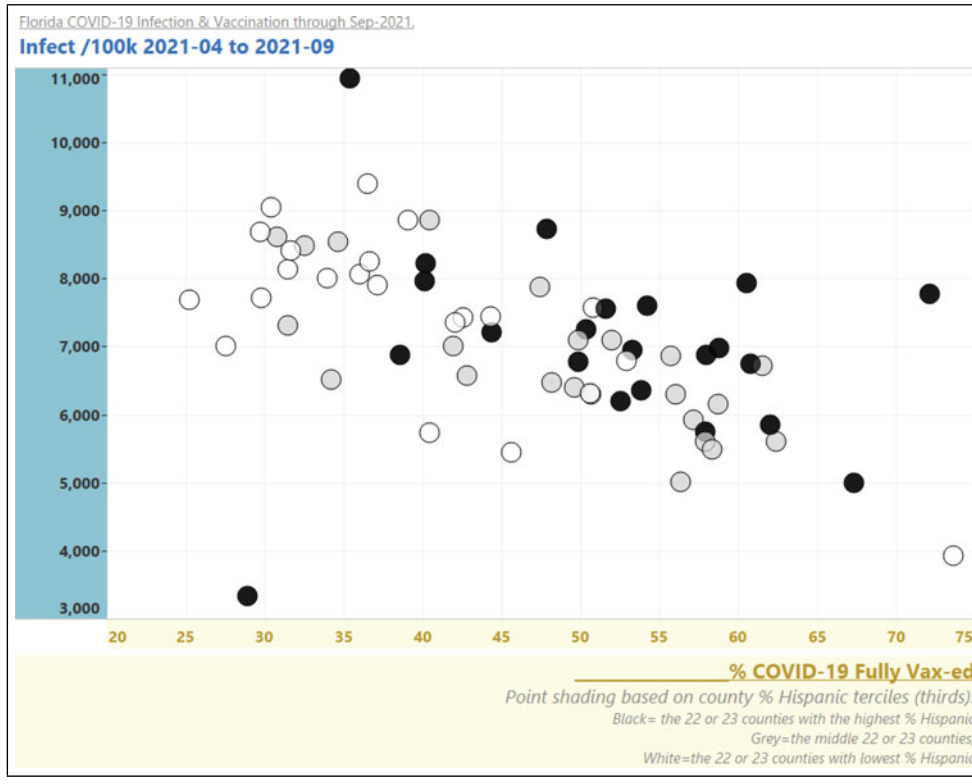

FIGURE 2 COVID-19 Infection Rates by Vaccination Rate (With % Hispanic Highlighted) for April to September 2021[a]

[a]The figure represents COVID-19 infection rate per 100 000 for the period April 2021 through September 2021. Each data point represents one of Florida's 67 counties. Point placement is based on the infection rate per 100 000 (vertically) and the population proportion fully vaccinated (horizontally). Point shading indicates county Hispanic proportion, with color transitioning from white for counties with the highest proportions of Hispanic to black for counties with the lowest Hispanic proportions. N = 67.

Data sources: American Community Survey, County Health Rankings, the Behavioral Risk Factor Surveillance System, and the Centers for Disease Control and Prevention. Used with permission.

Tableau interactive graphic and study data available at https://public.tableau.com/views/FLInfectVax2021-Sepfv234d2/Dashboard1?:language=en-US&:display_count=n&:origin=viz_share_link.

election.[12,22,29] As demonstration of the dangerous situation these same counties were already in, county data points are shaded by infection rates through March 2021. The same counties with lower vaccination rates also tended to have higher infection rates (shaded black) before vaccines were widely available.

The line formed in Figure 3 equating political preference with vaccination rates is more visually pronounced than the looser grouping of county data points in Figure 1, equating political preference with infection rates. Such clarity serves as a graphic demonstration that while infections occur with certainty, infections involve some element of uncertainty in exposure.

Like several other county characteristics, the changing association of infections and vaccinations with the county proportion of those 65 years and older offers insights. Prior to April 2021, infection rates were significantly lower in counties with higher proportions of those 65 years and older (Table 2, column A). Vaccination rates were also significantly higher in counties with higher proportions of those 65 years and older (Table 2, column E). Based on these 2 findings, then, it appears that public health messaging is effectively constructed and focused.[30] However, the lack of significance of the age variable in any model of infections in the period of April to September 2021 (Table 2, columns B-D) indicates that there is still some benefit to increasing vaccination rates in counties with higher proportions of those 65 years and older.

Limitations

Study findings are most accurately understood in the context of several limitations. First, this study is based on infections and vaccinations reported through September 2021. Subsequent activity might introduce new patterns. Second, all historical case line data and vaccination data were removed from public access,[31] replaced with weekly summary reports that cannot support research that could have more

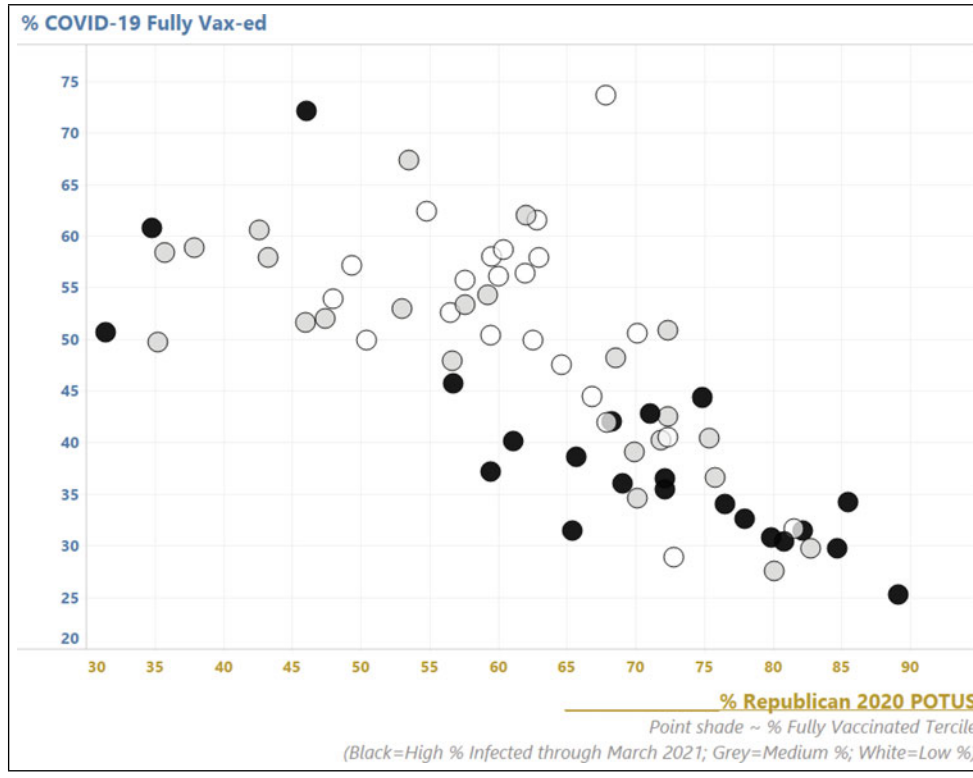

FIGURE 3 COVID-19 Vaccination Rates by % Republican Vote (With Prevaccine Era Infection Rate Highlighted) Through September 2021[a]
Abbreviation: POTUS, President of the United States.
[a]The figure represents population % fully vaccinated against COVID-19 through September 2021. Each data point represents one of Florida's 67 counties. Point placement is based on the population % fully vaccinated (vertically) and the proportion voting Republican in the 2020 presidential election (horizontally). Point shading indicates county cumulative infection rate per 100 000 through March 2021 (prevaccine era), with color transitioning from white for counties with the lowest prevaccine era infection rates to black for counties with the highest prevaccine era infection rates. N = 67.
Data sources: American Community Survey, County Health Rankings, the Behavioral Risk Factor Surveillance System, and the Centers for Disease Control and Prevention. Used with permission.
Tableau interactive graphic and study data available at https://public.tableau.com/views/FLInfectVax2021-Sepfv234d2/Dashboard1?:language=en-US&:display_count=n&:origin=viz_share_link.

precisely identified whether communities at highest risk—elderly, Black, Hispanic, poor—are suffering unduly or protecting adequately. Third, any generalization of findings based on this single-state study should recognize Florida's unique sociopolitical environments. Fourth, while population proportions of smaller counties can be subject to large swings based on just a few cases, this study considers periods lasting at least 6 months, which should average out aberrant months. And finally, as a county-level study, findings should not be extrapolated to individuals. It cannot be determined whether infections are visited upon individuals based on their own race, ethnicity, or political preferences, only that as a community they collectively share the results.

Conclusions and Public Health Implications

This study helps identify community characteristics associated with COVID-19 infection and vaccination rates. Such information can help direct public health focus where it does the most good. For example, this study's findings of persistent high infection rates in counties with higher proportions of Hispanics can help direct tailored communications[30] in areas with lower proportions of English proficiency.[18] Once areas are identified, resources could be invested to reopen the state's case data access[31] and employ local staff to process and communicate those data in a way that is most relevant to each community and through channels and leaders who are trusted by the community.[30]

This study is one of the first to provide evidence for the significant association between higher community-level vaccination rates and lower infection rates. This study also adds to evidence linking county infection rates and vaccination rates with county-level political preferences in the 2020 presidential election.[5,7,9-11] Findings of elevated infections and lower vaccination rates are especially worrisome, as this study finds these are most commonly found

Implications for Policy & Practice

- Study findings provide evidence of vaccination effectiveness at the county level. Counties with higher proportions of those fully vaccinated experience significantly fewer infections.
- Study findings also identify areas with lower vaccination rates, centered mainly in counties with higher Republican shares in the 2020 presidential election, counties with higher rates of poverty, and counties with higher proportions of those uninsured.

in areas already challenged with poverty, uninsurance, and preexisting health disparities.[24,25,32,33] Study findings can help public health agencies demonstrate the effectiveness of vaccination, communicate risks and benefits to policy makers,[30] justify increased resources, and direct those investments to improve the health of all state residents.

References

1. COVID Tracking Project. The COVID Tracking Project. https://covidtracking.com. Published 2020. Accessed November 9, 2020.
2. Data.CDC.gov. COVID-19 vaccinations in the United States, County. https://data.cdc.gov/Vaccinations/COVID-19-Vaccinations-in-the-United-States-County/8xkx-amqh. Published 2021. Accessed July 11, 2021.
3. US Census Bureau. American Community Survey (ACS). https://www.census.gov/programs-surveys/acs. Accessed April 1, 2021.
4. Centers for Disease Control and Prevention. Coronavirus disease (COVID-19). https://www.cdc.gov/coronavirus/2019-ncov/index.html. Published February 11, 2020. Accessed November 9, 2020.
5. Barrios J, Hochberg Y. *Risk Perception Through the Lens of Politics in the Time of the COVID-19 Pandemic*. Cambridge, MA: National Bureau of Economic Research; 2020:w27008.
6. Grossman D. The unintended effects of place based programs: fertility and health effects of urban empowerment zones. *J Health Econ*. 2019;63:114-127.
7. Painter M, Qiu T. Political beliefs affect compliance with COVID-19 social distancing orders [published online ahead of print 2020]. *SSRN J*. doi:10.2139/ssrn.3569098.
8. Katz J, Sanger-Katz M, Quealy K. A detailed map of who is wearing masks in the U.S. *The New York Times*. July 17, 2020. https://login.ezproxy.fau.edu/login?url=https://www.proquest.com/docview/2424597136?accountid=10902. Accessed April 4 2021.
9. Grossman G, Kim S, Rexer J, Thirumurthy H. Political partisanship influences behavioral responses to governors' recommendations for COVID-19 prevention in the United States [published online ahead of print 2020]. *SSRN J*. doi:10.2139/ssrn.3578695.
10. Borgonovi F, Andrieu E. Bowling together by bowling alone: social capital and COVID-19. *Soc Sci Med*. 2020;265:113501.
11. Jiang J, Chen E, Yan S, Lerman K, Ferrara E. Political polarization drives online conversations about COVID-19 in the United States. *Hum Behav Emerg Technol*. 2020;2(3):200-211.
12. Lerer L. How Republican vaccine opposition got to this point. *The New York Times, Late Edition (East Coast)*. July 17, 2021. https://www.proquest.com/nytimes/docview/2552290748/citation/7BFAD90C885643E8PQ/3. Accessed July 17, 2021.
13. Khanijahani A. Racial, ethnic, and socioeconomic disparities in confirmed COVID-19 cases and deaths in the United States: a county-level analysis as of November 2020. *Ethn Health*. 2021;26(1):22-35.
14. Hawkins D. Differential occupational risk for COVID-19 and other infection exposure according to race and ethnicity. *Am J Ind Med*. 2020;63(9):817-820.
15. Desmet K, Wacziarg R. *Understanding Spatial Variation in COVID-19 Across the United States*. Cambridge, MA: National Bureau of Economic Research; 2020.
16. Chambless L. Why do per capita COVID-19 case rates differ between U.S. states? [published online ahead of print November 3, 2020]. *medRxiv*. doi:10.1101/2020.10.16.20213892.
17. Bassett MT, Chen JT, Krieger N. The unequal toll of COVID-19 mortality by age in the United States: quantifying racial/ethnic disparities. *Harv Cent Popul Dev Stud Work Pap Ser*. 2020;19.
18. Nguyen TH, Shah GH, Schwind JS, Richmond HL. Community characteristics and COVID-19 outcomes: a study of 159 counties in Georgia, United States. *J Public Health Manag Pract*. 2021;27(3):251-257.
19. Yang T-C, Choi SE, Sun F. COVID-19 cases in US counties: roles of racial/ethnic density and residential segregation. *Ethn Health*. 2021;26(1):11-21.
20. Millett GA, Jones AT, Benkeser D, et al. Assessing differential impacts of COVID-19 on Black communities. *Ann Epidemiol*. 2020;47:37-44.
21. Tan SB, deSouza P, Raifman M. Structural racism and COVID-19 in the USA: a county-level empirical analysis [published online ahead of print January 19, 2021]. *J Racial Ethnic Health Disparities*. doi:10.1007/s40615-020-00948-8.
22. Sparks G, Kirzinger A, Brodie M. KFF COVID-19 vaccine monitor: profile of the unvaccinated. https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-profile-of-the-unvaccinated. Published June 11, 2021. Accessed July 17, 2021.
23. Kannan VD, Brown TM, Kunitz SJ, Chapman BP. Political parties and mortality: the role of social status and personal responsibility. *Soc Sci Med*. 2019;223:1-7.
24. Bilal U, Knapp EA, Cooper RS. Swing voting in the 2016 presidential election in counties where midlife mortality has been rising in white non-Hispanic Americans. *Soc Sci Med*. 2018;197:33-38.
25. Placzek H, Madoff L. Effect of race/ethnicity and socioeconomic status on pandemic H1N1-related outcomes in Massachusetts. *Am J Public Health*. 2014;104(1):e31-e38.
26. University of Wisconsin Population Health Institute. *County Health Rankings*. Madison, WI: University of Wisconsin Population Health Institute; 2021. https://www.countyhealthrankings.org/county-health-rankings-roadmaps. Accessed April 1, 2021.
27. Moghadas SM, Vilches TN, Zhang K, et al. The impact of vaccination on COVID-19 outbreaks in the United States [published online ahead of print January 2, 2021]. *medRxiv*. doi:10.1101/2020.11.27.20240051.
28. Rosenberg ES, Holtgrave DR, Dorabawila V, et al. New COVID-19 cases and hospitalizations among adults, by vaccination status—New York, May 3-July 25, 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70(37):1306-1311.
29. Ye X. Exploring the relationship between political partisanship and COVID-19 vaccination rate. *J Public Health*. 2021;fdab364. doi:10.1093/pubmed/fdab364.
30. Manganello JA, Penta S, Whalen E. Pandemic communication: challenges and opportunities for local health departments. *J Public Health Manag Pract*. 2022;28(1):6-9.
31. Paz IG. Florida will no longer publish daily coronavirus reports. *The New York Times*. June 5, 2021. https://www.nytimes.com/2021/06/04/world/florida-covid-19-cases-vaccine.html. November 7, 2021.
32. Rodriguez JM. Health disparities, politics, and the maintenance of the status quo: a new theory of inequality. *Soc Sci Med*. 2018;200:36-43.
33. Sloan C, Chandrasekhar R, Mitchel E, Schaffner W, Lindegren ML. Socioeconomic disparities and influenza hospitalizations, Tennessee, USA. *Emerg Infect Dis*. 2015;21(9):1602-1610.