By Adam Dean, Jamie McCallum, Simeon D. Kimmel, and Atheendar S. Venkataramani

Resident Mortality And Worker Infection Rates From COVID-19 Lower In Union Than Nonunion US Nursing Homes, 2020–21

ABSTRACT Since the start of the COVID-19 pandemic, nursing home residents have accounted for roughly one of every six COVID-19 deaths in the United States. Nursing homes have also been very dangerous places for workers, with more than one million nursing home workers testing positive for COVID-19 as of April 2022. Labor unions may play an important role in improving workplace safety, with potential benefits for both nursing home workers and residents. We examined whether unions for nursing home staff were associated with lower resident COVID-19 mortality rates and worker COVID-19 infection rates compared with rates in nonunion nursing homes, using proprietary data on nursing home–level union status from the Service Employees International Union for all forty-eight continental US states from June 8, 2020, through March 21, 2021. Using negative binomial regression and adjusting for potential confounders, we found that unions were associated with 10.8 percent lower resident COVID-19 mortality rates, as well as 6.8 percent lower worker COVID-19 infection rates. Substantive results were similar, although sometimes smaller and less precisely estimated, in sensitivity analyses.

Adam Dean (adamdean@gwu.edu), George Washington University, Washington, D.C.

Jamie McCallum, Middlebury College, Middlebury, Vermont.

Simeon D. Kimmel, Boston University School of Medicine and Boston Medical Center, Boston, Massachusetts.

Atheendar S. Venkataramani, University of Pennsylvania, Philadelphia, Pennsylvania.

From the start of the pandemic through April 2022, roughly one million Americans had died from COVID-19. Nursing home residents accounted for more than 150,000 of these deaths, making nursing homes the epicenter of the pandemic in the United States.[1,2] Nursing homes have also been very dangerous places for workers: More than one million nursing home workers in the US had been infected with SARS-CoV-2 as of April 2022, and more than 2,000 had died.[2]

Prior studies of COVID-19 outbreaks in nursing homes have identified several factors associated with worse outcomes for residents and staff.[3,4] Nursing homes in counties with higher rates of SARS-CoV-2 transmission experienced higher resident mortality rates, and many facili-

ties faced staffing shortages and insufficient supplies of personal protective equipment.[5] Nursing home worker infection rates and resident mortality rates have also been linked to nursing home staff being employed in multiple facilities and lacking access to paid sick leave.[6,7]

Research also suggests that labor unions play an important role in improving workplace safety, with potential benefits for nursing home workers and residents.[8–11] Unionized workers in essential industries have better access to paid sick leave, SARS-CoV-2 testing, and personal protective equipment, and they may also be less likely to work multiple jobs and to live in settings associated with SARS-CoV-2 transmission.[7,12,13] Such factors may decrease COVID-19 infection rates among nursing home workers, reduce the spread of COVID-19 between workers and nurs-

ing home residents, and thereby lower resident COVID-19 mortality rates. However, whether labor unions were associated with lower COVID-19 mortality rates nationally is not known. Our prior work, a single-state study, found lower resident COVID-19 mortality rates in unionized than in nonunionized nursing homes during the first wave of the pandemic.[14] It is not clear, however, whether these results generalize to other states and more recent periods of the pandemic, when all nursing homes, whether unionized or not, had the opportunity to adopt best practices identified during earlier waves.

To update our previous findings, we examined the association between union status and nursing home resident COVID-19 deaths, using new, proprietary data on nursing home unions and data on COVID-19 mortality among nursing home residents from multiple waves of the pandemic from all forty-eight continental US states. To explore one mechanism through which labor unions may reduce resident COVID-19 mortality rates, we also analyzed the association between union status and nursing home worker COVID-19 infection rates—a relationship that, likewise, has not been systematically assessed.

Study Data And Methods

We estimated the association between the presence of a labor union and cumulative COVID-19 mortality rates for residents in US nursing homes from June 8, 2020, through March 21, 2021—a period that spans the summer 2020 and winter 2020–21 COVID-19 waves. We used publicly available data from the Centers for Medicare and Medicaid Services (CMS) on resident COVID-19 mortality rates. Of note, our study period avoids the systematic undermeasurement of COVID-19 deaths in nursing homes seen in CMS data before June 2020.[15] We obtained new, proprietary data from the Service Employees International Union (SEIU) on whether a labor union represented any workers in a given nursing home in all US states except Alaska and Hawaii. These data are not limited to nursing homes organized by SEIU; they also include the union status of nursing homes in which a different labor union represents nursing home workers.

STUDY SAMPLE We included all nursing homes in the continental United States for which CMS reported data on resident COVID-19 deaths. Facilities for which there were missing data on key covariates were excluded.

OUTCOMES The main outcome was the total number of nursing homes residents who died from COVID-19 from June 8, 2020, through March 21, 2021. The secondary outcome was the total number of nursing homes workers who

tested positive for SARS-CoV-2 during the same period.

PRIMARY EXPLANATORY VARIABLE Facilities with labor unions representing workers were defined as having a union in our cohort. Labor unions represent different types of workers throughout different nursing homes, including certified nursing assistants, registered nurses, dietitians, maintenance workers, and other staff. The union status of all nursing homes was last updated March 16, 2021.

COVARIATES To address potential confounding in the relationship between nursing home resident COVID-19 mortality, worker infections, and nursing home union status, we obtained data on a range of nursing home– and area-level characteristics previously associated with COVID-19 outbreaks in nursing homes. We obtained nursing home–level data on ratios of staff hours to resident days (for registered nurses, certified nursing assistants, and licensed practical nurses), percentage of residents whose primary support came from Medicaid or Medicare, percentage of residents who were White, residents' average age, Resource Utilization Groups-III nursing case-mix index of resident acuity, and chain and for-profit status from Brown University's LTCFocus project, a comprehensive database used in a number of studies on COVID-19 in nursing homes that includes data through 2017.[5,16] We gathered data on nursing home occupancy rates, number of resident-days, number of staff-days, and the Five-Star Quality Rating System (updated January 2021) from CMS. We also obtained county-level data on confirmed cases of COVID-19 per 100 residents from USAFacts (accessed June 6, 2021). For our secondary analysis of worker COVID-19 infection rates, we gathered data on the county-level percentage of Health Care and Social Assistance workers who are Black from the Census Bureau's Quarterly Workforce Indicators (2020, quarter 1).

STATISTICAL ANALYSIS We first estimated descriptive statistics for the main outcome and covariates separately for nursing homes with and without unions. To examine the association between nursing home resident COVID-19 mortality rates and the presence of a labor union, we estimated cross-sectional, multivariable negative binomial regression models (using the number of resident-days as an exposure term). We calculated nursing home–level resident-days by multiplying the average number of residents by the number of days in our period of study. In adjusted models, we included county-level confirmed COVID-19 cases per capita to adjust for the prevalence of disease in the surrounding county, as well as county population (log-trans-

Industrywide unionization would have been associated with approximately 8,000 fewer resident deaths.

formed), to account for the possibility that more populous counties may contain more unidentified cases. Because the quality of nursing homes may influence resident COVID-19 mortality rates, we adjusted for the overall Five-Star Quality Rating System score, which is based on health inspections, staffing, and fifteen different physical and clinical measures for nursing home residents.[16] Similarly, we adjusted for chain and for-profit status, as previous research associated these ownership characteristics with the quality of care. Because staffing shortages may increase the probability of a COVID-19 outbreak, we adjusted for staff-hours-to-resident-days ratios for registered nurses, certified nursing assistants, and licensed practical nurses.[5]

We also adjusted for the percentage of residents whose primary support came from Medicaid (as COVID-19 has disproportionately affected those with low incomes) and percentage of residents who are White (as COVID-19 infections and deaths are unevenly distributed across racial demographics).[17,18]

Because COVID-19 mortality rates are known to increase along with age and comorbidities, we included the average age of residents, the average age of residents squared, the average resident acuity, and the percentage of residents whose primary support came from Medicare (people receiving care after an acute inpatient hospitalization).[19] We also adjusted for each facility's occupancy rate, as more crowded facilities may have been more likely to suffer COVID-19 outbreaks. Finally, we included state fixed effects to adjust for state-specific characteristics and policy responses to the pandemic.[20]

We then explored how the association between resident COVID-19 mortality rates and labor unions varied during our period of study. We began by plotting unadjusted weekly resident COVID-19 mortality rates for nursing homes with and without unions. We then estimated cross-sectional, multivariable negative binomial regression models for two different periods: the spring 2020 wave (June 8–September 13, 2020) and the 2020–21 winter wave (September 14, 2020–March 21, 2021). The outcome in these analyses was the cumulative number of resident COVID-19 deaths during each period, using the average number of nursing home resident-days as an exposure term. These models adjusted for the same covariates as our main model, with county-level COVID-19 case rates measured from the first week to the last week of each period.

SECONDARY ANALYSIS As a secondary analysis, we examined a mechanism that may link labor unions to lower COVID-19 mortality rates in nursing homes: COVID-19 infection rates among nursing home workers. We used cross-sectional, multivariable negative binomial regression analysis to estimate the association between COVID-19 infection rates among nursing home workers and the presence of a labor union. In this analysis, the main outcome was the number of confirmed COVID-19 cases among nursing home workers, with the number of nursing home worker-days as an exposure term. We adjusted for the same county- and facility-level variables as in models for the main outcome, with the exception of resident age, acuity, and percentage supported by Medicare, as these are unlikely to confound COVID-19 worker infection rates. Instead of adjusting for the nursing home–level percentage of residents who were White, as we did in the nursing home resident mortality model, we adjusted for the county-level percentage of health care workers who were Black (nursing home–level data on the racial breakdown of workers were not available).

We then explored how the association between COVID-19 worker infection rates and nursing home union status varied during our period of study. We started by plotting unadjusted weekly worker COVID-19 infection rates for nursing homes with and without unions. We then estimated cross-sectional, multivariable negative binomial regression models for two different periods: the spring 2020 wave (June 8–September 13, 2020) and the 2020–21 winter wave (September 14, 2020–March 21, 2021). The outcome in these analyses is the cumulative number of worker COVID-19 infections during each period, using the number of nursing home worker-days as an exposure term. These models adjusted for the same covariates as the main model for our secondary analysis, with county-level COVID-19 case rates measured from the first week to the last week of each period.

For all models, we computed 95 percent confidence intervals derived from robust standard errors clustered at the county level for all regression models. All analyses were conducted using

R, version 1.0.153, and Stata, version 15.0.

SENSITIVITY ANALYSES We assessed the robustness of our findings regarding resident COVID-19 mortality rates and worker COVID-19 infection rates to several analyses. First, because county-level COVID-19 infection rates varied temporally throughout our study period, we estimated time series cross-sectional models using weekly resident COVID-19 deaths and weekly worker COVID-19 infections while adjusting for weekly county-level COVID-19 infection rates (lagged two weeks). Second, as nursing homes that experienced resident COVID-19 infections in spring 2020 may have gone on to have relatively better COVID-19 outcomes in subsequent periods of the pandemic, we adjusted for whether or not a nursing home reported any resident COVID-19 infections by June 7, 2020, the week before our study period. Third, the availability of COVID-19 vaccines in early 2021 may have confounded the relationships between labor unions and resident COVID-19 deaths and between labor unions and worker COVID-19 infections. Because CMS did not release data on worker vaccination rates until summer 2021, we therefore adjusted for the percentage of nursing home workers who were fully vaccinated as of August 8, 2021. As an alternative sensitivity test, we ended our study period December 27, 2020, before COVID-19 vaccines were widely available in nursing homes. Fourth, to make union and nonunion nursing homes more comparable, we excluded the five states (Arizona, Oklahoma, Texas, Utah, and Wyoming) that have zero unionized nursing homes, as well as the 2,141 US counties that have zero unionized nursing homes. Fifth, we performed a sensitivity test for unmeasured confounding, using the E-value methodology proposed by Tyler VanderWeele and Peng Ding.[21]

Sixth, to focus our analysis on variation across union and nonunion nursing homes within the same counties, as in some prior work, we estimated a series of negative binomial and Poisson models including county fixed effects.[22,23] However, the available within-county variation was very limited: 79 percent of counties in our sample had zero unionized nursing homes, a problem that was exacerbated further by the inclusion of a rich set of nursing home–level covariates. To address this lack of variation, we estimated models including all covariates, as well as models including a single propensity score summarizing these covariates. Even so, we interpreted these models with caution, given the well-known bias in negative binomial models when numerous fixed effects are included and the inconsistency of Poisson models when the outcome is overdispersed.[24]

Facilities without unions may be especially vulnerable to poor outcomes for patients and workers.

LIMITATIONS This study had limitations. First, even with the inclusion of a rich set of covariates and sensitivity analyses, the observational study design precluded causal interpretations. Second, many of the nursing home–level covariates were last measured in 2017, which may have introduced measurement error. Third, union status was only available as a binary measure, which prevented us from examining how resident mortality rates and worker infection rates varied with the percentage or type of workers who are union members. Fourth, unionized nursing homes may have been more likely to test residents and workers for SARS-CoV-2, potentially biasing our results against our hypotheses. Finally, more research is needed on the mechanisms through which labor unions may reduce COVID-19 worker infection rates in nursing homes. Although data are available for SARS-CoV-2 testing rates and access to personal protective equipment, we lacked data on other potential mechanisms including paid sick leave, infection control policies, reduced employment in multiple facilities, and lower risk in workers' living environments.

Study Results

PRIMARY ANALYSIS: RESIDENT MORTALITY

▶ **DESCRIPTIVE STATISTICS:** We identified 15,073 nursing homes in the forty-eight continental United States for which CMS reported resident COVID-19 deaths. A total of 1,723 facilities were excluded because of missing data on covariates, resulting in a study cohort of 13,350 nursing homes.

Health care worker unions were present in 2,242 (16.8 percent) nursing homes. Unionized facilities had lower resident COVID-19 mortality rates, licensed practical nurse and certified nursing assistant staff-to-resident-hour ratios, percentage of residents who were White, chain affiliation rates, quality ratings, rates of Medicare-supported residents, and surrounding county-level COVID-19 infection rates (exhibit 1).

EXHIBIT 1

Characteristics of nursing homes with and without labor unions in the continental United States, June 8, 2020–March 21, 2021

Variables	Nonunion (n = 11,108)		Union (n = 2,242)	
	Mean or proportion	SD	Mean or proportion	SD
NURSING HOME LEVEL				
Resident COVID-19 deaths per 1,000 resident-days	0.35	0.43	0.25**	0.33
Residents with Medicaid[a] (%)	59.15	22.57	65.28**	19.60
Residents with Medicare[a] (%)	13.55	12.32	12.53**	10.10
For-profit[b]	0.69	—[c]	0.77**	—[c]
Chain[b]	0.61	—[c]	0.48**	—[c]
Star quality rating (range: 1–5)	3.29	1.40	3.02**	1.39
Occupancy (%)	71.54	16.48	73.61**	13.44
White residents (%)	82.05	20.33	70.80**	25.74
Staff-to-resident ratios				
Registered nurses	0.45	0.35	0.48**	0.28
Licensed practical nurses	0.85	0.36	0.80**	0.30
Certified nursing assistants	2.34	0.69	2.28**	0.56
Average age of residents (years)	79.81	6.79	77.64**	6.95
Resident acuity[d]	1.18	0.17	1.19**	0.16
Worker-days	16,363	90.72	23,683**	343.35
Resident-days	20,268	99.67	30,171**	397.22
COUNTY LEVEL				
COVID-19 cases (per 100 residents)	8.76	2.42	7.65**	2.03
Population	722,550	1,683,067	1,113,485**	1,711,919

SOURCE Authors' analysis of data on labor unions, nursing home and county covariates, and resident COVID-19 deaths from the Service Employees International Union, Centers for Medicare and Medicaid Services, Brown University's LTCFocus project, USAFacts, and the Census Bureau. **NOTES** This exhibit presents the mean value of each covariate in nursing homes with and without unions. T-tests were calculated to compare the means across nursing homes with and without unions. [a]Residents' primary source of support. [b]Z-tests were calculated to compare proportions for the dummy variables of "for-profit" and "chain." [c]Not applicable. [d]Resource Utilization Groups-III nursing case-mix index. Higher values indicate greater resident acuity. $**p < 0.05$

Unionized facilities also had higher registered nurse staff-to-resident-hour ratios, resident occupancy rates, for-profit rates, rates of Medicaid-supported residents, and surrounding county-level populations, as well as higher numbers of worker-days and resident-days (exhibit 1). The percentage of nursing homes that were unionized was highest in the Northeast and lowest in the South (online appendix exhibit A1).[25]

There were 90,870 COVID-19 resident deaths in our cohort of nursing homes during the period of study. The facility with the highest number of confirmed resident COVID-19 deaths had 114 deaths, or 3.06 deaths per 1,000 resident-days (data not shown). In the 2,242 unionized nursing homes, the mean resident COVID-19 mortality rate was 0.25 per 1,000 resident-days; in the 11,108 nonunionized nursing homes, it was 0.35 per 1,000 resident-days (exhibit 1).

Our plot of unadjusted weekly resident COVID-19 mortality rates showed that nursing homes with unions had lower mortality rates than nursing homes without unions during the majority of our period of study (exhibit 2).

▶ **ADJUSTED RESULTS:** Our adjusted negative binomial regression analyses found a negative association between unions and resident COVID-19 mortality rates from June 8, 2020, through March 21, 2021. During this period, labor unions were associated with 10.8 percent lower resident COVID-19 mortality rates (95% CI: 3.9, 17.3; $p = 0.003$) (exhibit 3, model 1). When we estimated our model during just the summer 2020 wave, unions were associated with 7.6 percent lower resident COVID-19 mortality rates, but this association was not significant (95% CI: −7.2, 20.3; $p = 0.299$). When we estimated our model during just the winter 2020–21 wave, unions were associated with 9.3 percent lower resident COVID-19 mortality rates (95 percent CI: 1.7, 16.4; $p = 0.018$) (data not shown).

SECONDARY ANALYSIS: WORKER INFECTIONS

▶ **DESCRIPTIVE STATISTICS:** In our secondary analysis of COVID-19 worker infection rates, we used data from a larger cohort of nursing homes. Of 15,136 facilities reporting data on worker COVID-19 infections, 1,687 were excluded as result of missing data on covariates, resulting in a sample of 13,449 nursing homes. In the 2,302 unionized nursing homes in this sample, the mean worker COVID-19 infection rate was 1.66 per 1,000 worker-days; in the 11,147 nonunion-

EXHIBIT 2

Unadjusted weekly nursing home resident COVID-19 mortality rates, weeks ending June 14, 2020–March 21, 2021

Resident deaths (per 1,000 resident-days)
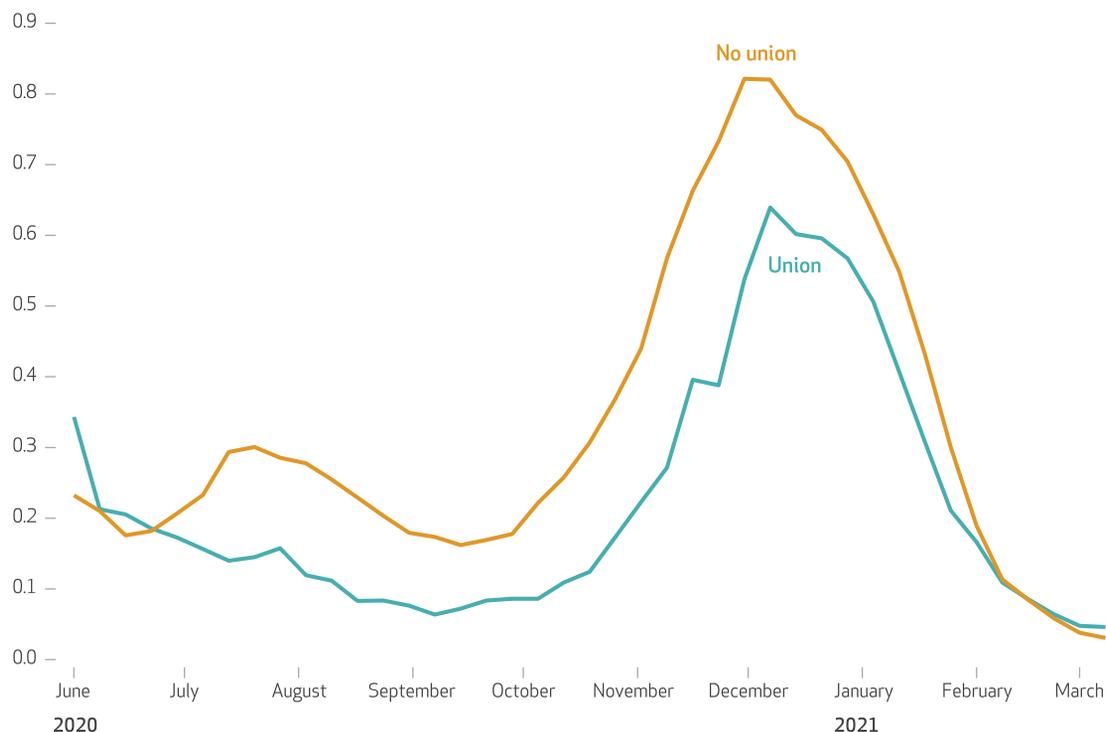
SOURCES Service Employees International Union and Centers for Medicare and Medicaid Services.

ized nursing homes, it was 2.21 per 1,000 worker-days (data not shown).

Our plot of weekly, unadjusted worker COVID-19 infection rates showed that unionized nursing homes had lower infection rates for the majority of our period of study (exhibit 4). Similar to our plot of resident COVID-19 mortality rates, unadjusted worker COVID-19 infection rates were higher in unionized facilities during June 2020, when the pandemic was concentrated in the highly unionized Northeast.

▶ ADJUSTED RESULTS: In adjusted negative binomial regression analyses, we found that labor unions were associated with 6.8 percent lower worker COVID-19 infection rates from June 8, 2020, through March 21, 2021 (95% CI: 2.7, 10.7; $p = 0.001$) (exhibit 3, model 2). When we estimated our model during just the summer 2020 wave, unions were associated with 4.6 percent lower worker COVID-19 infection rates, but this association was not significant (95% CI: −3.4, 12.0; $p = 0.253$). When we estimated our model during just the winter 2020–21 wave, unions were associated with 8.0 percent lower worker COVID-19 infection rates (95% CI: 3.8, 12.0; $p < 0.001$) (data not shown).

SENSITIVITY ANALYSES Our results regarding both resident COVID-19 mortality rates and

worker COVID-19 infection rates were similar when we analyzed these rates weekly (appendix exhibit A2);[25] adjusted for nursing homes that reported resident COVID-19 infections before our study period (appendix exhibit A3);[25] adjusted for worker COVID-19 vaccination rates (appendix exhibit A4);[25] ended our study period December 27, 2020, before COVID-19 vaccines were widely available (appendix exhibit A5);[25] and excluded states and counties that had zero unionized nursing homes (appendix exhibit A6).[25] Simulating the potential effect of an unmeasured confounder being as impactful as being located in the highest quintile of county-level COVID-19 infection rates (versus the lowest quintile) did not reverse our substantive findings (appendix exhibit A7).[25] Our substantive findings were similar when we estimated negative binomial and Poisson models with county fixed effects and a summary propensity score, although the precision of our estimated coefficients varied across models (appendix exhibits A8 and A9).[25] The Poisson regression model with summary propensity scores found that unions were associated with 8.6 percent lower resident COVID-19 mortality rates ($p = 0.039$; appendix exhibit A8).[25] Using the same modeling approach, we found that unions were associ-

ated with 2.8 percent lower worker COVID-19 infection rates, but these results were not significant ($p = 0.284$; appendix exhibit A9).[25] However, when using negative binomial regression with summary propensity scores, we found that unions were associated with 5.4 percent lower worker COVID infection rates ($p = 0.034$; appendix exhibit A9).[25]

Discussion

Among 13,350 nursing homes across the forty-eight continental United States from June 8, 2020, through March 21, 2021, the presence of a labor union was associated with 10.8 percent lower resident COVID-19 mortality rates. This link between labor unions and lower resident COVID-19 mortality rates may be related to union efforts to prevent worker COVID-19 infections, thus decreasing the spread of COVID-19 between nursing home staff and residents. Consistent with this hypothesized mechanism, the presence of a labor union was associated with 6.8 percent lower COVID-19 infection rates for workers.

Our results, along with prior work on nursing homes, suggest that labor unions may play a critical role in reducing COVID-19 morbidity and mortality in nursing homes.[14] With more than 75,000 COVID-19 deaths among residents in nonunionized nursing homes during our study period, our results suggest that industry-wide unionization would have been associated with approximately 8,000 fewer resident deaths.

In general, labor unions give workers a collective voice in workplace decision making and may enable them to notify management of workplace hazards without fear of retribution.[8,26] Since the start of the pandemic, SEIU and other labor unions representing nursing home workers have advocated for numerous policies that may decrease worker infection risk, including paid sick leave, access to personal protective equipment, surveillance SARS-CoV-2 testing, and the isolation of infected residents.[27] "It's pretty simple—the safer we are, the safer they are," said Rosalind "Ros" Reggans, a certified nursing assistant from the Chicago, Illinois, area. "And with a union you have more [personal protective equipment], you can get a day off if you're sick, you get more COVID pay…you can negotiate with your supervisor face to face to make things work. All of that helps residents, too, because we're not infecting them as much if we have better standards for ourselves" (Reggans, personal communication, January 7, 2021). More research is needed to analyze the various mechanisms through which unions may improve COVID-19 outcomes and how the impact of these efforts may vary across states and times. Because worker

EXHIBIT 3

Adjusted incidence rate ratios for resident COVID-19 deaths and worker COVID-19 infections in nursing homes, by labor union status and other factors, June 8, 2020–March 21, 2021

Variables	Resident deaths (model 1)[a]	Worker infections (model 2)[b]
NURSING HOME LEVEL		
Union	0.892***	0.932***
For-profit	1.095***	0.958***
Chain	1.016	0.999
Occupancy rate (%)	0.998***	1.003****
Average age	1.238****	—[c]
Average age squared	0.999****	—[c]
Acuity	1.011	—[c]
White residents (%)	1.005****	—[c]
Ratio of staff to residents		
Registered nurses	0.963	1.027
Licensed practical nurses	1.041	1.017
Certified nursing assistants	0.934***	0.999
Five-star quality rating		
Two stars	0.971	0.995
Three stars	0.967	1.008
Four stars	0.898***	0.992
Five stars	0.878***	0.987
Primary payer for residents (%)		
Medicaid	0.999	0.999****
Medicare	0.997**	—[c]
Worker-days	—[c]	(exposure)
Resident-days	(exposure)	—[c]
COUNTY LEVEL		
COVID-19 cases (per 100 population)	1.058****	1.048****
Black health care workers (%)	—[c]	0.995****
N	13,350	13,449
Pseudo R²	0.0165	0.0282

SOURCE Authors' analysis of data on labor unions, nursing home covariates, resident COVID-19 deaths, and worker COVID-19 infections from Service Employees International Union, Centers for Medicare and Medicaid Services, Brown University's LTCFocus project, USAFacts, and the Census Bureau. **NOTES** Results are based on cross-sectional, multivariable negative binomial regression with standard errors clustered at the county level. Coefficients show the estimated incident rate ratio comparing nursing homes with labor unions to nursing homes without labor unions. The 95% confidence intervals for the model were calculated using robust standard errors clustered at the county level. [a]Model 1 estimates the association between labor unions and resident COVID-19 deaths with the number of resident-days as an exposure term. [b]Model 2 estimates the association between labor unions and worker COVID-19 infections with the number of worker-days as an exposure term. [c]Not applicable. **p < 0.05 ***p < 0.01 ****p < 0.001

vaccination rates are associated with lower resident mortality rates, additional research should also examine the relationship between unions and nursing home vaccine policies.[23]

Resident COVID-19 deaths and worker COVID-19 infections have varied geographically and temporally throughout the pandemic. We found that unadjusted weekly resident mortality rates and unadjusted weekly worker infection rates were both lower in unionized facilities throughout most of our study period. Resident mortality rates and worker infection rates were both briefly higher in unionized facilities during the first weeks of our study period. We hypothesize that this was likely because the pandemic's first wave was concentrated in the Northeast—the region

EXHIBIT 4

Unadjusted weekly nursing home worker COVID-19 infection rates, weeks ending June 14, 2020–March 21, 2021

Worker infections (per 1,000 worker-days)
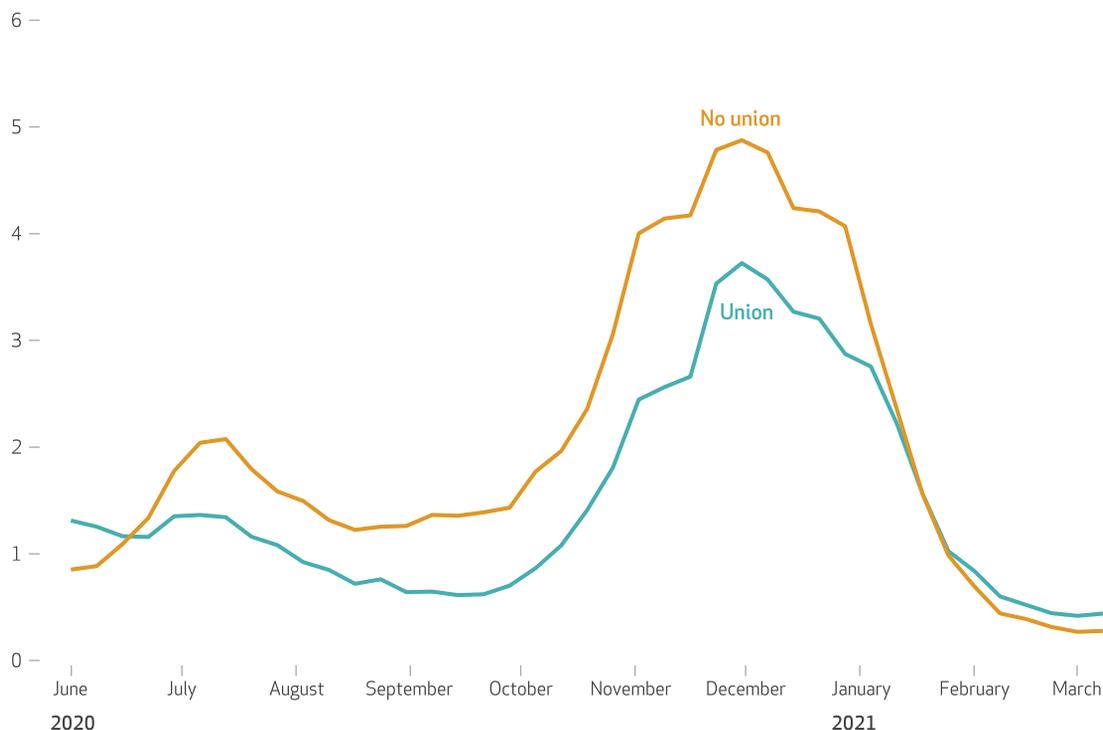
SOURCES Service Employees International Union and Centers for Medicare and Medicaid Services.

in our sample with the highest percentage of unionized nursing homes (41.2 percent versus 11.3 percent for all other states).

In adjusted regression analyses, we found that the negative association between labor unions and resident COVID-19 mortality rates, as well as the negative association between labor unions and worker COVID-19 infection rates, were both strongest during the winter 2020–21 wave, when COVID-19 cases spiked throughout the United States. During the summer 2020 wave, labor unions were negatively associated with resident COVID-19 mortality rates and worker COVID-19 infection rates, but these associations were not statistically significant. These results may be driven by the summer wave's concentration in the South, a region of the country in which a low percentage of nursing homes are unionized (6.4 percent in the South versus 22.4 percent in the rest of the US), which decreased our statistical power to detect a difference between union and nonunion facilities. In addition, a higher density of restrictive right-to-work laws may weaken labor unions in this region, and thereby decrease differences between union and nonunion facilities.[28]

When we replaced state fixed effects with county fixed effects and estimated negative binomial

and Poisson models with propensity scores, the associations between labor unions and our COVID-19 outcomes were negative and of meaningful magnitudes from a public health standpoint, although not statistically significant in all specifications. However, the lack of statistical significance and, in some specifications, attenuated coefficients was not surprising, given the relative lack of within-county variation in union status, known biases when using numerous fixed effects in negative binomial models, and inconsistency of Poisson models when the outcome is overdispersed.[24] Nonetheless, we acknowledge that unobserved county-level COVID-19 policies and adherence to public health guidelines may have biased our main results.

The finding that labor unions were associated with decreased resident mortality and worker infections has implications for public health leaders, nursing home administrators, patients, and workers, who share the goal of decreasing COVID-19 infections and mortality. As COVID-19 infections continue to affect nursing homes, facilities without unions may be especially vulnerable to poor outcomes for patients and workers. Beyond nursing homes, our results are consistent with recent studies that find that labor unions were associated with better infection con-

trol policies and COVID-19 outcomes for essential workers in education and retail.[9,29]

Conclusion

During the COVID-19 pandemic, labor unions were associated with lower resident COVID-19 mortality rates and lower worker COVID-19 infection rates in nursing homes across the continental United States. Labor union representation of nursing home workers may play an important role in the safety of both nursing home patients and workers. ∎

NOTES

1 Grabowski DC, Mor V. Nursing home care in crisis in the wake of COVID-19. JAMA. 2020;324(1): 23–4.
2 Centers for Medicare and Medicaid Services. COVID-19 nursing home data [Internet]. Baltimore (MD): CMS; 2022 Mar 1 [cited 2022 Mar 8]. Available from:https://data.cms.gov/covid-19/covid-19-nursing-home-data
3 Roxby AC, Greninger AL, Hatfield KM, Lynch JB, Dellit TH, James A, et al. Detection of SARS-CoV-2 among residents and staff members of an independent and assisted living community for older adults—Seattle, Washington, 2020. MMWR Morb Mortal Wkly Rep. 2020; 69(14):416–8.
4 Li Y, Temkin-Greener H, Shan G, Cai X. COVID-19 infections and deaths among Connecticut nursing home residents: facility correlates. J Am Geriatr Soc. 2020;68(9):1899–906.
5 McGarry BE, Grabowski DC, Barnett ML. Severe staffing and personal protective equipment shortages faced by nursing homes during the COVID-19 pandemic. Health Aff (Millwood). 2020;39(10):1812–21.
6 Barnett ML, Grabowski DC. Nursing homes are ground zero for COVID-19 pandemic. JAMA Health Forum [serial on the Internet]. 2020 Mar 24 [cited 2022 Mar 8]. Available from: https://jamanetwork.com/journals/jama-health-forum/fullarticle/2763666
7 Chen MK, Chevalier JA, Long EF. Nursing home staff networks and COVID-19. Proc Natl Acad Sci U S A. 2021;118(1):e2015455118.
8 Sojourner AJ, Yang J. Effects of union certification on workplace-safety enforcement: regression-discontinuity evidence. Ind Labor Relat Rev. 2020;75(2):373–401.
9 Dean A, McCallum J, Kimmel S, Venkataramani A. Iowa school districts were more likely to adopt COVID-19 mask mandates where teachers were unionized. Health Aff (Millwood). 2021;40(8):1270–6.
10 Morantz AD. Coal mine safety: do unions make a difference? Ind Labor Relat Rev. 2013;66(1):88–116.
11 Weil D. Enforcing OSHA: the role of labor unions. Ind Relat. 1991;30(1): 20–36.
12 Hertel-Fernandez A, Naidu S, Reich A, Patrick Y. Understanding the COVID-19 workplace: a view from the essential workforce [Internet]. New York (NY): Roosevelt Institute; 2020 Jun [cited 2022 Mar 8]. Available from: https://roosevelt institute.org/wp-content/uploads/2020/07/RI_SurveyofEssential Workers_IssueBrief_202006-1.pdf
13 Karmakar M, Lantz PM, Tipirneni R. Association of social and demographic factors with COVID-19 incidence and death rates in the US. JAMA Netw Open. 2021;4(1): e2036462.
14 Dean A, Venkataramani A, Kimmel S. Mortality rates from COVID-19 are lower in unionized nursing homes. Health Aff (Millwood). 2020;39(11): 1993–2001.
15 Shen K, Loomer L, Abrams H, Grabowski DC, Gandhi A. Estimates of COVID-19 cases and deaths among nursing home residents not reported in federal data. JAMA Netw Open. 2021;4(9):e2122885.
16 Gorges RJ, Konetzka RT. Staffing levels and COVID-19 cases and outbreaks in U.S. nursing homes. J Am Geriatr Soc. 2020;68(11):2462–6.
17 Baena-Díez JM, Barroso M, Cordeiro-Coelho SI, Díaz JL, Grau M. Impact of COVID-19 outbreak by income: hitting hardest the most deprived. J Public Health (Oxf). 2020;42(4):698–703.
18 Karaca-Mandic P, Georgiou A, Sen S. Assessment of COVID-19 hospitalizations by race/ethnicity in 12 states. JAMA Intern Med. 2021; 181(1):131–4.
19 Davies NG, Klepac P, Liu Y, Prem K, Jit M, Eggo RM, et al. Age-dependent effects in the transmission and control of COVID-19 epidemics. Nat Med. 2020;26(8):1205–11.
20 Miller KEM, Gorges RJ, Konetzka RT, Van Houtven CH. The metrics matter: improving comparisons of COVID-19 outbreaks in nursing homes. J Am Med Dir Assoc. 2021; 22(5):955–959.e3.
21 VanderWeele TJ, Ding P. Sensitivity analysis in observational research: introducing the E-value. Ann Intern Med. 2017;167(4):268–74.
22 McGarry BE, Gandhi AD, Grabowski DC, Barnett ML. Larger nursing home staff size linked to higher number of COVID-19 cases in 2020. Health Aff (Millwood). 2021;40(8): 1261–9.
23 McGarry BE, Barnett ML, Grabowski DC, Gandhi AD. Nursing home staff vaccination and Covid-19 outcomes. N Engl J Med. 2022;386(4):397–8.
24 Greene W. Functional form and heterogeneity in models for count data. Hanover (MA): Now Publishers; 2007.
25 To access the appendix, click on the Details tab of the article online.
26 Freeman RB, Medoff JL. What do unions do? New York (NY): Basic Books; 1984.
27 Philbrick IP, Abelson R. Health care unions find a voice in the pandemic. New York Times [serial on the Internet]. 2021 Jan 28 [last updated 2021 Jan 29; cited 2022 Mar 8]. Available from: https://www.nytimes.com/2021/01/28/health/covid-health-workers-unions.html
28 Ellwood DT, Fine G. The impact of right-to-work laws on union organizing. J Polit Econ. 1987;95(2): 250–73.
29 Crowell NA, Hanson A, Boudreau L, Robbins R, Sokas RK. Union efforts to reduce COVID-19 infections among grocery store workers. New Solut. 2021;31(2):170–7.