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Increases In COVID-19 Vaccination Among NYC Municipal Employees After Implementation Of Vaccination Requirements

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Abstract

In July 2021 New York City (NYC) instituted a requirement for all municipal employees to be vaccinated against COVID-19 or undergo weekly testing. The city eliminated the testing option November 1 of that year. We used general linear regression to compare changes in weekly primary vaccination series completion among NYC municipal employees ages 18–64 living in the city and a comparison group of all other NYC residents in this age group during May–December 2021. The rate of change in vaccination prevalence among NYC municipal employees was greater than that of the comparison group only after the testing option was eliminated (employee slope = 12.0; comparison slope = 5.3). Among racial and ethnic groups, the rate of change in vaccination prevalence among municipal employees was higher than the comparison group for Black and White people. The requirements were associated with narrowing the gap in vaccination prevalence between municipal employees and the comparison group overall and between Black municipal employees and employees from other racial and ethnic groups. Workplace requirements are a promising strategy for increasing vaccination among adults and reducing racial and ethnic disparities in vaccination uptake.

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Vaccines against COVID-19 approved or authorized by the Food and Drug Administration (FDA) are highly effective in preventing hospitalizations and deaths.[1–3] Maximizing COVID-19 vaccination is critical to saving lives, ending the COVID-19 pandemic, and restoring social and economic life.[4] As of June 30, 2021, 57.4 percent of US adults had completed the primary vaccine series.[5] Vaccination uptake and attitudes vary across geographic, racial, ethnic, and age groups.[5–7] Vaccination disparities reflect and exacerbate long-standing health in-equities.[8] Additional strategies are needed to increase vaccination uptake.

Policies requiring vaccination have been applied successfully across the US to increase influenza vaccination for health care workers and childhood immunization for school-age children and those attending day care.[9–14] Vaccination requirements have also been associated with decreased racial and ethnic disparities in vaccination uptake.[15] Most of the available evidence suggests that vaccination requirements lead to higher uptake when nonmedical exemptions are prohibited or strictly limited and when there are consequences for noncompliance.[14,16–18] The effectiveness of vaccination requirements is rein-forced when vaccines are perceived as safe and accessible.[19]

The first requirements for COVID-19 vaccines in the US were applied to health care workers, who have historically complied with vaccination requirements for infectious diseases such as influenza, measles, and rubella.[18,20,21] Other public and private employers soon followed with their own policies, especially after the FDA granted full approval of the Pfizer-BioNTech COVID-19 vaccine for people ages sixteen and older on August 23, 2021.[22]

New York City (NYC) was one of the first places in the US to expand workplace COVID-19 vaccination requirements beyond the health care sector. On July 26, 2021, the mayor announced that all 360,000 city employees would be required to begin a COVID-19 vaccine series by September 13 or undergo weekly mandatory SARS-CoV-2 testing.[23,24] September 13 also coincided with requirements for full-time return to in-person work for many NYC municipal employees who had been working on a fully or partially remote basis since March 16, 2020. On October 20, 2021, the mayor announced that the weekly testing option for employees would be eliminated after October 29, and unvaccinated employees would be placed on unpaid leave, effective November 1.[25,26] Unvaccinated employees could eventually be subject to termination. On the same day as the mayor's announcement, the NYC commissioner of health signed an order that formalized the requirement and provided details.[27] Municipal employees vaccinated during October 20–29 at city-run sites each received a $500 bonus,[25] in addition to a $100 vaccination incentive offered citywide from July 30 through December 31, 2021.[28] Since March 12, 2021, all public- and private-sector workers in NYC who receive a COVID-19 vaccine or who are sick from its adverse effects have been covered by New York State's paid leave policy.[29] During May–December 2021, additional resources to facilitate equitable vaccine access were in place citywide, including a robust network of community health educators and assistance to accommodate people with disabilities at vaccination sites.[30] There have been more than a dozen legal challenges to the NYC requirements. The requirements have been upheld in all but the most recent challenge; this recent case is under appeal, and the vaccination requirements are still in effect.[31,32]

In this study we evaluated the association between COVID-19 vaccination policies for NYC municipal employees and weekly changes in employee completion of the primary COVID-19 vaccine series in 2021.

Study Data And Methods

NYC MUNICIPAL EMPLOYEE DATA

Two data sets were combined to determine COVID-19 vaccination prevalence for NYC municipal employees during the study period, May 28–December 30, 2021. Vaccination data were obtained from the Citywide Immunization Registry, a repository for data on all COVID-19 vaccine doses administered in NYC. Reporting all administered COVID-19 vaccine doses to the registry was mandated through a New York State executive order and specified in the agreement between the city and providers participating in the COVID-19 vaccination program.[33,34] Because of an interjuris-dictional data-sharing agreement, the Citywide Immunization Registry also captured COVID-19 vaccine doses given to people with NYC addresses who were vaccinated elsewhere in New York State and in New Jersey. Municipal employee data were obtained from the NYC Department of Citywide Administrative Services. Demographic data were self-reported to the department at the time of employment. Citywide Immunization Registry and Department of Citywide Administrative Services data were matched on name, sex, date of birth, and address to identify the weekly aggregate number of municipal employees ages 18–64 with an NYC home address who had completed the COVID-19 primary vaccine series. Matching was done weekly, but the exact day of the week on which the match was performed varied according to when the Citywide Immunization Registry team received the Department of Citywide Administrative Services data. Therefore, the interval between COVID-19 vaccination prevalence points was sometimes slightly longer or shorter than seven days.

We restricted the sample to people ages 18–64 because the majority of people in the municipal workforce (96.2 percent) are in this age group.[35] We restricted the sample to municipal employees with NYC home addresses (80.7 percent of all municipal employees) to facilitate matching with the Citywide Immunization Registry and for exchangeability with the comparison group.[35] A completed COVID-19 primary vaccine series was defined as two doses of the Pfizer-BioNTech or Moderna vaccine or one dose of Johnson & Johnson's Janssen vaccine. The weekly number of municipal employees with a completed primary vaccine series was divided by the weekly number of active municipal employees reported by the Department of Citywide Administrative Services and multiplied by 1,000 to obtain the vaccination prevalence per 1,000 municipal employees.

Cumulative NYC municipal employee vaccination prevalences were adjusted to account for COVID-19 vaccinations that were self-reported to agencies as part of the requirements. Aggregate counts of employees' self-reported vaccinations were obtained from the city's Vaccine Command Center and included people vaccinated outside the Citywide Immunization Registry catchment area and not reported to that registry. The adjustment factor was calculated by dividing the average weekly count of self-reported vaccinations (n = 761) by the average number of municipal employees in the study sample (n = 264,986),

yielding a factor of 0.003. The weekly count of municipal employees with a completed primary vaccine series was adjusted by this factor: ($X + 0.003 \times X$).

COMPARISON-GROUP DATA

To determine COVID-19 vaccination prevalence for residents who were not NYC municipal employees, weekly counts of all NYC residents ages 18–64 who had a completed primary vaccine series in the Citywide Immunization Registry (numerator) and total NYC population counts (denominator) were stratified by race and ethnicity, age group, and sex. NYC population counts were based on 2019 population estimates from the NYC Department of Health and Mental Hygiene, calculated October 9, 2020, and modified from Census Bureau interpolated intercensal population estimates. The population estimates are adjusted and maintained internally by the NYC Department of Health and Mental Hygiene. These estimates do not represent the 2020 census or recent changes to NYC's population as a result of in- or out-migration. NYC municipal employee counts were subtracted from both the numerator and the denominator in each stratum, and the numerator was divided by the denominator. This ratio was multiplied by 1,000 to obtain the vaccination prevalence per 1,000 NYC working-age residents.

ETHICAL REVIEW

This activity was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy. The activity was determined not to require internal human subjects review.[36]

STATISTICAL ANALYSES

To compare changes in weekly vaccination prevalence among NYC municipal employees who lived in the city with changes in weekly vaccination prevalence among all other NYC residents ages 18–64, we used a Poisson generalized linear regression model with weekly vaccination prevalence as an outcome to conduct robust analysis of covariance regressions.[37] Weekly vaccination prevalence for municipal employees and the comparison group were classified in three phases: phase 0, from May 28 to July 22, 2021 (weeks 1–8), before vaccination policies for municipal employees were announced; phase 1, from July 23 to October 11, 2021 (weeks 9–20), including the week of the July 26 announcement of the vaccinate-or-test policy and the following weeks; and phase 2, from October 12 to December 30, 2021 (weeks 21–31), including the October 20 announcement that the testing option would be eliminated and encompassing the period during which unvaccinated municipal employees could be placed on unpaid leave and terminated. In addition to comparisons by week and phase, the difference in regression slopes between municipal employees and the comparison group was tested overall and was stratified by race and ethnicity (Asian, Black, Hispanic, and White), age categories (ages 18–34, 35–54, and 55–64), and sex (male and female). Slope was measured as the change in the prevalence of people with a completed primary vaccine series per week. Analyses were conducted using R, version 3.5.2.

LIMITATIONS

Our study had several limitations. First, the Citywide Immunization Registry captures vaccine doses administered only in NYC, New York State, and New Jersey. The data do not reflect total vaccination prevalence among NYC municipal employees or all other working-age city residents because some people may have been vaccinated in other US jurisdictions or abroad. Although models were adjusted for municipal employees' self-reported vaccinations to partially account for this limitation, it was not possible to make a similar adjustment in the comparison group. The adjustment factor for municipal employees was very small and did not affect the overall results. Second, the analyses were restricted to municipal employees living in NYC; therefore, the results are not representative of all NYC municipal employees, 19.3 percent of whom lived outside the city.[35]

Third, findings regarding uniformed agency employees (such as police, fire, and corrections department staff) are particularly limited for two reasons: a larger proportion of municipal employees in uniformed agencies live outside NYC than is the case for employees in other city agencies, so employees in uniformed agencies were disproportionately excluded from the analyses; and municipal employees in uniformed agencies commonly report their work addresses instead of their home addresses to the Department of Citywide Administrative Services because of security concerns, and therefore they were difficult to match to Citywide Immunization Registry records. Fourth, the number of municipal employees who left the workforce because of the vaccination requirements was not available. The total number of municipal employees was roughly stable throughout the study period, but the extent to which stability may conceal turnover could not be assessed because we only had access to aggregate data for confidentiality reasons. Fifth, race and ethnicity were analyzed as a single, combined variable, and some Hispanic people may have been miscategorized.

A sixth limitation was that municipal employee policies were not the only vaccination policies in effect in NYC during the study period. On July 30 the city started offering $100 to anyone receiving their first COVID-19 vaccine dose at a city-run site. On August 16 the Key to NYC policy was announced, and enforcement began September 13. Key to NYC required COVID-19 vaccination for employees and customers at most indoor venues, including indoor dining, gyms, and entertainment venues.[38] Some NYC municipal employees might have been incentivized to get vaccinated because of the $100 reward or Key to NYC instead of the municipal workforce requirement. These changes also likely increased vaccination prevalence in the comparison group. The additional vaccination policies biased the results to the null and also limited the study's applicability to other locations that did not have similar policies. Seventh, it was not possible to analyze the effect of the $500 bonus separately from the effect of removing the testing option. Weekly vaccination prevalence was our unit of analysis, and we lacked statistical power to conduct separate analyses for the nine-day period when the bonus was offered. Finally, because the vaccination requirement for NYC municipal workers was highly publicized, the policy may have motivated some people in the comparison group to be vaccinated in anticipation of possible employee requirements in other sectors. This phenomenon would also have biased the results to the null.

Study Results

STUDY POPULATION AND DEMOGRAPHICS

The Department of Citywide Administrative Services recorded an average weekly total of 344,402 active municipal employees during the study period. After non-NYC residents (66,402 employees) and people outside the 18–64 age range (13,014 employees) were eliminated, the final sample of NYC municipal employees included an average of 264,986 people per week (exhibit 1). The comparison group included 5,087,070 city residents who met the age criteria and were not municipal employees. The municipal workforce was 57.1 percent female and 42.7 percent male, compared with 51.5 percent and 48.5 percent for the comparison group. Compared with working-age NYC residents who were not municipal employees, the municipal workforce living in NYC had a higher proportion of people who were Black (30.0 percent versus 21.5 percent) and a lower proportion of people who were Hispanic (23.4 percent versus 29.0 percent) or Asian (9.1 percent versus 16.0 percent). Nearly 69 percent of the municipal workforce living in NYC was affiliated with either the Department of Education (42.7 percent) or a uniformed agency (25.8 percent).

CHANGES IN OVERALL VACCINATION PREVALENCE

Increases in the overall weekly prevalence of COVID-19 vaccine series completion varied between study phases and between NYC municipal employees and the comparison group. From May 28 to July 22 (phase 0), the overall weekly prevalence of primary COVID-19 vaccine series completion increased more slowly among municipal employees compared with other working-age NYC residents citywide. The vaccination prevalence among municipal employees went from 485.4 to 537.0 per 1,000 municipal employees compared with an increase from 521.2 to 639.0 per 1,000 other working-age NYC residents (employee slope = 8.1, comparison slope = 18.0; $p < 0.001$). From July 23 to October 11 (phase 1), there was no statistically significant difference in the overall weekly prevalence of COVID-19 primary vaccine series completion for municipal employees and the comparison group, with employee vaccination prevalence changing from 544.8 to 677.0 per 1,000 and the comparison group changing from 647.1 to 768.1 per 1,000 (employee slope = 13.0, comparison slope = 12.0; $p = 0.374$). From October 12 to December 30 (phase 2), vaccination prevalence among municipal employees increased much more quickly than in the comparison group, with an increase from 713.9 to 834.9 per 1,000 among municipal employees compared with an increase from 782.7 to 839.6 people per 1,000 in the comparison group (employee slope = 12.0, comparison slope = 5.3; $p < 0.001$) (exhibit 2 and online appendix exhibit A1).[39]

CHANGES IN VACCINATION PREVALENCE BY RACE AND ETHNICITY

Stratified analyses by race and ethnicity found that Black people started with the lowest vaccination prevalence among NYC municipal employees and in the comparison group. During the thirty-one-week study period, the slope for Black municipal employees' vaccination prevalence was steeper than the slope for Black people in the comparison group (employee slope = 16.0, comparison slope = 11.0; $p < 0.001$). During the same period, the slope for White municipal employees' vaccination prevalence was also steeper than the slope for White people in the comparison group (employee slope = 9.6, comparison slope

= 5.9; $p < 0.001$) (exhibit 3). Among municipal employees, the slope for Black employees was steeper than the slope for White employees (slope for Black employees = 16.0, slope for White employees = 9.6; $p < 0.001$), and by the end of the study period, there was no statistically significant difference in vaccination prevalence between the two groups (819.9 and 841.3 per 1,000, respectively; $p = 0.075$). In the comparison group, vaccination prevalence for Black people remained lower than that for White people at the end of the study period (562.4 and 642.9 per 1,000, respectively; $p < 0.001$) (exhibit 3 and appendix exhibit A2).[39] For Asian and Hispanic people, slopes for municipal employees' vaccination prevalence were lower than slopes in the comparison group over the course of the study period, although the difference among Hispanic people was slightly above the threshold for significance ($p = 0.053$) (exhibit 3).

CHANGES IN VACCINATION PREVALENCE BY AGE GROUP

Stratified analyses by age group found that slopes for NYC municipal employees' vaccination prevalence in each age group were significantly steeper than slopes for the comparison group (exhibit 4). Stratified analyses by sex found that the slope for female employees' vaccination prevalence was significantly steeper than the slope for female comparators (employee slope = 13.0, comparison = 11.0; $p = 0.012$). There was no statistically significant difference in slopes for male employees compared with male comparators.

Discussion

This study represents the first evaluation of workplace COVID-19 vaccination requirements in the US outside of a health care setting and the first study to evaluate a workplace vaccination program with and without a testing option. We found that workplace vaccination requirements in NYC were associated with a significantly greater rate of change in COVID-19 vaccination prevalence for NYC municipal employees compared with similar-age adults in the general NYC working-age population only after the testing option was eliminated, $500 vaccination bonuses were offered, and unvaccinated employees could be placed on unpaid leave and terminated. Vaccination prevalence for municipal employees did not approximate that of the working-age population of NYC residents until after the testing option was removed in phase 2.

Over the course of the full study period, a higher rate of change in NYC municipal employees' vaccination prevalence was observed for Black employees relative to Black NYC working-age residents and White employees relative to White NYC working-age residents. Workplace requirements were also associated with narrowing the gap in vaccination coverage between Black municipal employees and those from other racial and ethnic groups. Vaccination prevalence for Asian and Hispanic municipal employees increased more slowly than for other Asian and Hispanic working-age residents, but overall trends in vaccination prevalence for Asian and Hispanic people during the study period were nevertheless positive for both municipal employees and other working-age residents.

Although our analysis focused on differences in rates of change in vaccination prevalence between NYC municipal employees living in the city and the general working-age

population of NYC residents, it is important to acknowledge that COVID-19 vaccination prevalence for both groups continued to grow throughout the entire study period. The citywide trend can likely be attributed to several factors, including improved access to and education about COVID-19 vaccination and citywide policies (such as monetary incentives and Key to NYC), as well as case surges associated with the Delta and Omicron variants that may have led more people to seek vaccination.[30,40,41] This study is valuable because it provides robust evidence of the additional impact of a workplace requirement without an exception for testing that was applied to a large number of municipal employees. Although the impact of the $500 bonus cannot be disentangled from the impact of the phase 2 requirement, the bonus was offered for only nine days, and the overall pattern of increasing vaccination prevalence for municipal employees continued through November and December, after the bonus ended. We could not establish that the increase in vaccination prevalence among municipal employees over the course of the study period was a result of individual behavior change among existing employees and not employee turnover or termination and replacement with new hires who were already vaccinated.

Our findings are consistent with previous research on states with and without nonmedical exemptions to childhood vaccination for day care and school entry and hospitals with and without consequences for noncompliance with influenza vaccination requirements.[16–18] Those studies concluded that stricter policies, with fewer exemptions, lead to higher vaccination uptake than policies with more exemptions. The behavioral science specific to COVID-19 vaccines is emerging, but early data suggest that COVID-19 vaccination requirements can strengthen the intention to vaccinate in some hesitant adults, and our study supports that assertion.[42,43] The ethical and legal considerations surrounding workplace COVID-19 vaccination requirements are complicated, and a thorough review of the arguments for and against such requirements is beyond the scope of this article.[44,45]

Requiring unvaccinated employees to be tested more frequently than was done in NYC may yield different results; additional research could shed light on this question. Further monitoring is needed to understand the effectiveness of workplace COVID-19 vaccination requirements for private employers and in places other than NYC, among populations with different demographic and political situations and lower baseline COVID-19 vaccination prevalence. The extent to which COVID-19 vaccination requirements may fuel mistrust of public health authorities and reduce vaccination uptake should also be examined.

Conclusion

More than two years after the first COVID-19 vaccines became available in the US, uptake remains a major challenge. Workplace requirements are a promising strategy for increasing vaccination among adults and reducing racial and ethnic disparities in vaccination uptake. Policies without testing options or other exceptions may be most effective in increasing the number of people who are vaccinated, especially in the context of prolonged vaccination campaigns.

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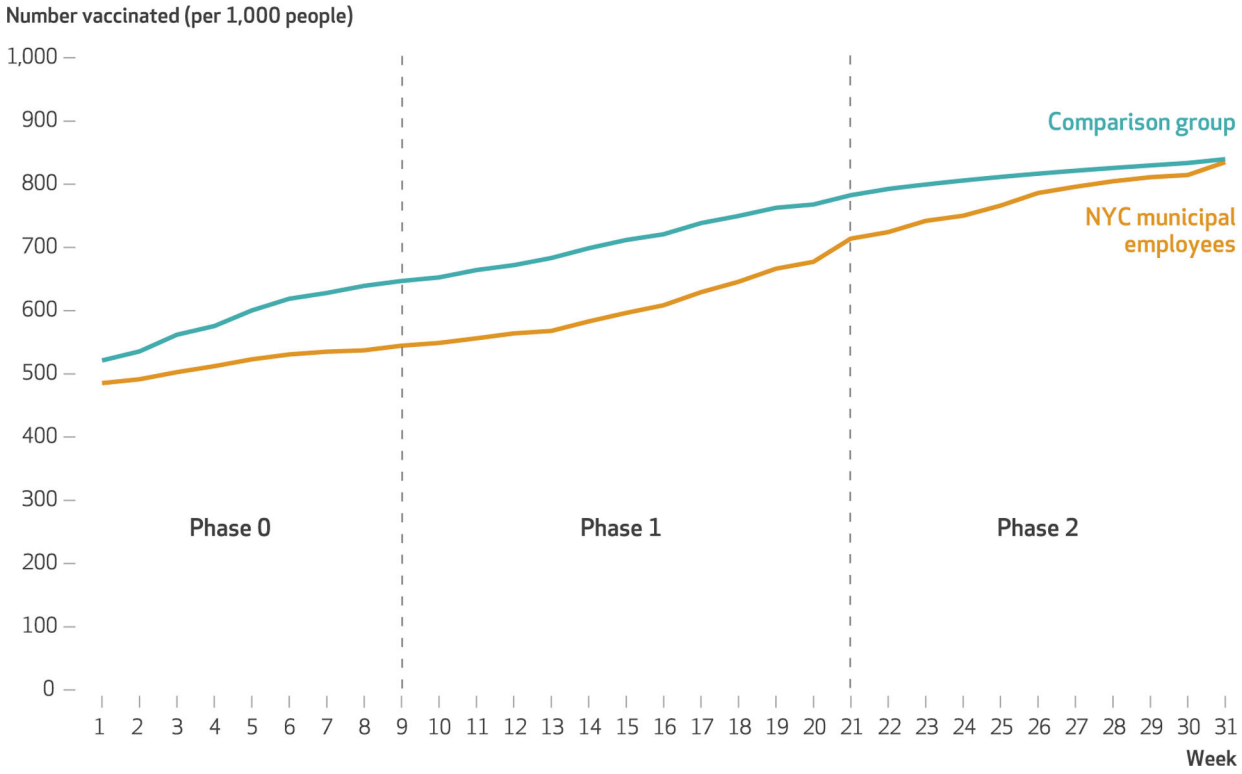

Exhibit 2.

COVID-19 vaccination prevalence among New York City (NYC) municipal employees and a comparison group, May–December 2021

SOURCES NYC Citywide Immunization Registry (2021); NYC Department of Citywide Administrative Services (2021); and NYC Department of Health and Mental Hygiene, using modified data from Census Bureau estimates (2019). **NOTES** The study period was classified in three phases: phase 0, from May 28 to July 22, 2021 (weeks 1–8), before any vaccination policies for NYC municipal employees were announced; phase 1, from July 23 to October 11, 2021 (weeks 9–20), including the week of the July 26 announcement of the vaccinate-or-test policy and the following weeks; and phase 2, from October 12 to December 30, 2021 (weeks 21–31), including the October 20 announcement that the testing option would be eliminated and encompassing the period during which unvaccinated NYC municipal employees could be placed on unpaid leave and terminated. Data points shown represent vaccination prevalence at the end of each week of the study period. Differences in vaccination prevalence between NYC municipal employees and the comparison group (NYC residents who met the age criteria and were not municipal employees) were calculated using Yuen's test on the trimmed mean difference and were significant ($p < 0.05$), except at week 28 ($p = 0.069$); differences in vaccination slopes were calculated using analysis of variance tests and were significant ($p < 0.05$), except during phase 1 ($p = 0.374$). The study was restricted to people ages 18–64. Population counts for the comparison group are described in the exhibit 1 notes. Vaccination prevalence for municipal employees was adjusted to account for vaccinations that were self-reported to NYC agencies as part of the workplace vaccination requirement policies.

Exhibit 1

Characteristics of New York City (NYC) municipal employees and a comparison group, study of vaccination requirements for NYC municipal employees, May–December 2021

Characteristics	NYC municipal employees	Comparison group[a]
Average weekly count[b]	264,986	5,087,070
Age, years		
18–34	29.5%	41.5%
35–54	52.6	39.8
55–64	17.9	18.7
Sex		
Female	57.1	51.5
Male	42.7	48.5
Other	0.2	__[c]
Race and ethnicity[d]		
Asian	9.1	16.0
Black	30.0	21.5
Hispanic	23.4	29.0
White	32.8	31.7
Other races[e]	4.7	1.8
NYC agency affiliation		
Department of Education	42.7	__[c]
Uniformed agency	25.8	__[c]
Other agency[f]	31.5	__[c]

SOURCES NYC Citywide Immunization Registry (2021); NYC Department of Citywide Administrative Services (2021); and NYC Department of Health and Mental Hygiene, using modified data from Census Bureau estimates (2019).

NOTE The study was restricted to people ages 18–64.

[a]The comparison group included all NYC residents who met the age criteria and were not NYC municipal employees.

[b]Population counts for the comparison group are based on 2019 NYC population estimates from the NYC Department of Health and Mental Hygiene, calculated on October 9, 2020, and modified from Census Bureau interpolated intercensal population estimates.

[c]No data available.

[d]Race and ethnicity were analyzed as a single, combined category. All races listed are non-Hispanic, and people with Hispanic ethnicity were coded as Hispanic, regardless of race.

[e]The “other races” category was created by combining people who self-identified as American Indian or Alaska Native or Native Hawaiian/Pacific Islander, as well as people who selected two or more races and people who chose not to disclose their race.

[f]The “other agency” category includes more than 20 additional NYC agencies, including the Department of Transportation, Department of Housing Preservation and Development, Administration for Children’s Services, and Department of Health and Mental Hygiene.

Exhibit 3

COVID-19 vaccination prevalence among New York City (NYC) municipal employees and a comparison group, by race and ethnicity, May–December 2021

Race and ethnicity[a]	NYC municipal employees	Comparison group[b]	*p* value[c]
Starting prevalence (per 1,000)[d]			
Asian	682.1	659.1	0.092
Black	363.9	259.5	<0.001
Hispanic	463.9	368.3	0.129
White	571.1	453.7	<0.001
Ending prevalence (per 1,000)[e]			
Asian	896.0	975.0	<0.001
Black	819.9	562.4	<0.001
Hispanic	826.6	775.1	0.179
White	841.3	642.9	<0.001
Slope within group (people vaccinated per week)			
Asian	7.1	9.0	<0.001
Black	16.0	11.0	<0.001
Hispanic	13.0	14.0	0.053
White	9.6	5.9	<0.001

SOURCES NYC Citywide Immunization Registry (2021); NYC Department of Citywide Administrative Services (2021); and NYC Department of Health and Mental Hygiene, using modified data from Census Bureau estimates (2019).

NOTE The study was restricted to people ages 18–64.

[a] Race and ethnicity are described in the exhibit 1 notes.

[b] The comparison group is defined in the exhibit 1 notes, and population counts are described there.

[c] *p* values for differences in vaccination prevalence are based on Yuen's test on the trimmed mean difference; *p* values for differences in slopes are based on analysis of variance tests.

[d] Starting prevalence is measured at week 1 (week ending June 3, 2021).

[e] Ending prevalence is measured at week 31 (week ending December 30, 2021).

Exhibit 4

COVID-19 vaccination prevalence among New York City (NYC) municipal employees and a comparison group, by age group and sex, May–December 2021

Age group and sex	NYC municipal employees	Comparison group[a]	*p* value[b]
Starting prevalence (per 1,000)[c]			
Ages 18–34	388.1	425.7	0.001
Ages 35–54	492.4	551.5	<0.001
Ages 55–64	613.0	652.3	0.003
Female	498.5	485.1	0.056
Male	466.9	474.4	0.004
Ending prevalence (per 1,000)[d]			
Ages 18–34	787.5	776.5	0.107
Ages 35–54	842.6	876.7	0.003
Ages 55–64	896.3	895.5	0.291
Female	857.3	837.9	0.670
Male	804.1	825.5	0.007
Slope within group (people vaccinated per week)			
Ages 18–34	14.0	12.0	<0.001
Ages 35–54	12.0	11.0	0.002
Ages 55–64	10.0	7.7	<0.001
Female	13.0	11.0	0.012
Male	12.0	11.0	0.478

SOURCES NYC Citywide Immunization Registry (2021); NYC Department of Citywide Administrative Services (2021); and NYC Department of Health and Mental Hygiene, using modified data from Census Bureau estimates (2019).

NOTE The study was restricted to people ages 18–64.

[a]The comparison group is defined in the exhibit 1 notes, and population counts are described there.

[b]*p* values for differences in vaccination prevalence are based on Yuen's test on the trimmed mean difference; *p* values for differences in slopes are based on analysis of variance tests.

[c]Starting prevalence is measured at week 1 (week ending June 3, 2021).

[d]Ending prevalence is measured at week 31 (week ending December 30, 2021).