

# Strategies associated with COVID-19 vaccine coverage among nursing home staff

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## Abstract

**Background:** After the first of three COVID-19 vaccination clinics in U.S. nursing homes (NHs), the median vaccination coverage of staff was 37.5%, indicating the need to identify strategies to increase staff coverage. We aimed at comparing the facility-level activities, policies, incentives, and communication methods associated with higher staff COVID-19 vaccination coverage.

**Methods:** *Design.* Case-control analysis.

*Setting.* Nationally stratified random sample of 1338 U.S. NHs participating in the Pharmacy Partnership for Long-Term Care Program.

*Participants.* Nursing home leadership.

*Measurement.* During February 4–March 2, 2021, we surveyed NHs with low (<35%), medium (40%–60%), and high (>75%) staff vaccination coverage, to collect information on facility strategies used to encourage staff vaccination. Cases were respondents with medium and high vaccination coverage, whereas controls were respondents with low coverage. We used logistic regression modeling, adjusted for county and NH characteristics, to identify strategies associated with facility-level vaccination coverage.

**Results:** We obtained responses from 413 of 1338 NHs (30.9%). Compared with facilities with lower staff vaccination coverage, facilities with medium or high coverage were more likely to have designated frontline staff champions (medium: adjusted odds ratio [aOR] 3.6, 95% CI 1.3–10.3; high: aOR 2.9, 95% CI 1.1–7.7) and set vaccination goals (medium: aOR 2.4, 95% CI 1.0–5.5; high: aOR 3.7, 95% CI 1.6–8.3). NHs with high vaccination coverage were more likely to have given vaccinated staff rewards such as T-shirts compared with NHs with low coverage (aOR 3.8, 95% CI 1.3–11.0). Use of multiple strategies was associated with greater likelihood

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of facilities having medium or high vaccination coverage: For example, facilities that used  $\geq 9$  strategies were three times more likely to have high staff vaccination coverage than facilities using  $< 6$  strategies (aOR 3.3, 95% CI 1.2–8.9).

**Conclusions:** Use of designated champions, setting targets, and use of non-monetary awards were associated with high NH staff COVID-19 vaccination coverage.

#### KEYWORDS

coronavirus, long-term care facility, nursing home, staff, vaccination, vaccine hesitancy

## INTRODUCTION

There is a pressing need to vaccinate both nursing home (NH) residents and staff against COVID-19, because of high rates of SARS-CoV-2 infection and mortality in this setting. As of January 2021, considerable variation existed in vaccine uptake among residents and staff across NHs.<sup>1</sup> After the first of three vaccine clinics offered by the federal Pharmacy Partnership Program (PPP), median staff vaccination coverage in U.S. nursing homes was only 37.5%, considerably lower than resident vaccination coverage.<sup>2</sup> Reasons for staff hesitation or vaccine declination are multifactorial and include concerns about the speed of the vaccines' development, vaccine side effects, and distrust of government and pharmaceutical companies, especially among historically marginalized groups exposed to medical racism.<sup>3</sup>

Because COVID-19 staff vaccine hesitancy is multifactorial, the use of multiple approaches might be more effective to increase uptake than any single strategy. Interventions to increase NH influenza vaccination have demonstrated that multimodal education<sup>4</sup> and education combined with financial incentives<sup>5,6</sup> can increase staff uptake.<sup>7</sup> Prior studies to improve NH adoption of effective strategies on other topics, such as advance care planning, suggest that educational interventions might be most effective when peer champions reinforce the messaging.<sup>5,6</sup>

To help NH leaders, policymakers, and others identify and prioritize strategies to increase COVID-19 vaccine acceptance among staff, we administered an electronic survey to a random sample of U.S. NHs selected according to staff vaccination rates. We aimed at evaluating the strategies facility leaders reported implementing that were associated with high COVID-19 vaccination coverage among staff. We hypothesized that NHs that used multiple strategies, offered financial or other incentives, or identified frontline staff champions would have higher staff vaccine uptake.

### Key points

- Designating a frontline champion; setting targets; offering t-shirts, merchandise, or other gifts to vaccinated staff; and using multiple strategies might be associated with higher COVID-19 vaccination coverage among nursing home staff.
- Findings could help leaders seeking to increase COVID-19 vaccine uptake among nursing home staff.

### Why does this paper matter?

COVID-19 vaccination coverage among nursing home staff remains below desired levels to assure the protection of residents and staff in this high-risk setting. This study provides important insight into the facility-level strategies associated with higher COVID-19 vaccine uptake among staff.

## METHODS

### Study design and participants

We selected a random sample of NHs from 49 states and the District of Columbia that participated in the Centers for Disease Control and Prevention (CDC) national Pharmacy Partnership for Long-Term Care Program (PPP) during December 18, 2020–March 2021.<sup>8</sup> The PPP enlisted two national retail pharmacies to conduct three on-site vaccination clinics at facilities starting the week of December 21, 2020. The PPP utilized both available two-dose vaccines (i.e., Pfizer-BioNTech & Moderna).

To estimate COVID-19 vaccination coverage among staff for the sampling strata, we calculated the proportion

of staff vaccinated as of January 28, 2021, using the methods previously described<sup>1</sup>: a count of staff with at least one dose of a two-dose vaccine series divided by the estimated count of unique staff working in the facility from the Centers for Medicare & Medicaid Services (CMS) Payroll-Based Journal data from quarter 3 of 2020.

### **Selection of nursing homes with low, medium, and high vaccination coverage**

Our goal was to evaluate the association of strategies used to encourage vaccination among healthcare workers in NHs with vaccination coverage, not to estimate the frequency of their use. Therefore, in each of the 49 states and Washington, DC, we used a stratified random sampling frame to identify up to 35 NHs with low, medium, or high staff vaccination coverage after the first vaccination clinics. To ensure we had three distinct groups (i.e., low, medium, and high vaccination coverage), we established cut-points based on the national distribution of COVID-19 vaccination coverage among staff as of January 28, 2021, with a median of 37.5% of staff vaccination coverage.<sup>1</sup> Using the SurveySelect procedure in SAS, in each state, we randomly selected up to 10 facilities with low COVID-19 vaccination coverage among staff (<35% of staff) after the first clinic, 10 facilities with medium coverage (40%–60% of staff), and 15 facilities with high vaccination coverage (>75% of staff). We selected >75% as high coverage because this was the recommended target level for vaccinated staff by the American Healthcare Association (AHCA) at the time, and we selected <35% as low coverage based on the median level of vaccinated staff after the first clinic. We omitted facilities with vaccination coverage between these cut-points. Many states did not have a sufficient number of facilities that met the medium or high vaccination coverage thresholds at the time of sampling. If a state had fewer than the goal number of facilities in each case group (10 for the medium vaccination coverage stratum; 15 for the high vaccination coverage stratum), we included all eligible facilities in that stratum. Our final sample included 1338 facilities.

### **Survey design and administration**

We conducted a web-based survey during February 4–March 2, 2021, after NHs participating in the PPP had completed at least one clinic. We identified activities and policies to be included in the survey instrument using a collaborative approach, drawing on the evidence base for NH staff COVID-19 vaccine hesitancy,<sup>3</sup> influenza vaccination interventions,<sup>9</sup> and experiences shared with our team by NH partners. The survey included multiple-choice and

open-ended questions about messaging, communication (including mode of communication, use of social media, and who authored the messages or led education sessions), and financial and other incentives offered to vaccinated staff, as well as respondents' perceptions of staff vaccine hesitancy and other barriers (see Table S1). It included use of policies to promote vaccine acceptance, such as “soft mandates” referred to as declination forms (i.e., documentation that staff are aware of risks and benefits of vaccination and have declined) and employer mandates. It also captured facilities' CMS Certification Number (CCN) to match responses with facilities in our sample and to link survey responses with county- and facility-level characteristic data.

When available, we used the primary contact in each facility provided as part of the PPP to disseminate the survey; in some instances, the same email address was provided for multiple facilities (e.g., if the address was associated with multiple facilities in a corporation). Because the online survey system automatically removes duplicate email addresses, this resulted in 136 facilities without email addresses. When email addresses were available ( $n = 1202$ ), we sent a unique survey link and up to two completion reminders, on February 12 and February 18, 2021, asking that the recipient either respond to or share the survey with the person best positioned to do so. The AHCA (four contributing authors) likewise sent a reminder to complete the survey on February 12, 2021. Separately, we asked a trade association in each state to send a generic survey link to all facilities in the sample and to issue reminders at 1 and 2 weeks. In the case of duplicate responses from the same facility ( $n = 52$ ), the most complete survey was considered, or if equally complete, the earliest response.

### **Data sources**

We linked survey data with facility-level characteristics from the LTCfocus.org dataset, a publicly available database that includes Certification and Survey Provider Enhanced Reports (CASPER) data captured by state surveyors and Nursing Home Compare data (facility size, facility ownership, five-star rating)<sup>10</sup>; county demographics (percentage of persons in racial and ethnic minority groups in the county since staff demographics data were not available) from the Area Health Resource File<sup>11</sup>; political leaning of the county where the facility was located (voted predominantly Democratic vs. Republican in 2020 Presidential election) from voting statistics compiled from Politico, Fox News, and the New York Times<sup>12</sup>; and county COVID-19 prevalence data from a publicly available database that includes a seven-day average of daily confirmed cases by county.<sup>13</sup>

## Reassignment of staff vaccination

We initially categorized facilities' level of staff vaccination based on coverage achieved by January 28, 2021, as reported through the PPP. However, a majority of facilities (i.e., 96%) held a second or third clinic by the time respondents completed the survey. Therefore, prior to completing analyses, we used updated staff vaccination rates (measured through the PPP) as of February 19, 2021, to reassign any facilities to the medium or high strata if they increased their staff vaccination coverage by that date. Because facilities with low coverage might have implemented additional strategies after the first clinic, reassignment should best account for reverse causality.

## Measurement

For facility and county characteristics, we categorized facility size as small (<75 beds), medium (75–150 beds), or large (>150 beds); county Medicare enrollment by tertiles as low (<17.5% of residents), medium (17.5%–28.5%), or high (>28.5%); percentage of persons in any racial or ethnic minority groups (i.e., American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian, other Pacific Islander or Hispanic) in the county by quartiles as low (<5%), medium (5%–30%), or high (>30%); and seven-day COVID-19 prevalence (as of December 31, 2020) based on CMS classification as green (<5%), yellow (5%–10%), or red (>10%).<sup>14</sup>

We tallied positive responses (i.e., responses indicating the NH reported implementing the strategy) and categorized the total number of strategies implemented by each facility into tertiles (possible range: 0–25 strategies; lowest tertile: 0–5; middle tertile: 6–8; and highest tertile:  $\geq 9$ ).

## Analysis

If a respondent used a general survey link, we used the self-reported CCN to link the facility survey to staff vaccination data. Where a CCN was missing or invalid, we used information provided such as facility name, city, state, ZIP code (provided by respondents), and/or internet provider address (captured by online survey system) to identify a facility's CCN. We conducted all analyses using the classification after reassignment.

We examined facility and county characteristics among eligible NHs compared to those who responded to the survey stratified by their staff vaccine coverage group assignment. We used Wilcoxon rank sum tests to compare numeric NH characteristics, and chi-square tests for categorical characteristics. Where a trend test was

appropriate, we used a Mann–Kendall trend test for numeric variables and Cochran–Armitage trend test for categorical variables. We analyzed responses using a multinomial logistic regression model, with the low staff–COVID-19 vaccination coverage group (<35%) as the referent or control group. Models were adjusted for characteristics shown in prior studies to be associated with vaccine hesitancy, which included state; facility characteristics (percent of residents enrolled in Medicare, facility size, urban/rural); percentage of racial and ethnic minority groups in the county; political leaning; COVID-19 prevalence in the community; number of clinics held by February 19, 2021; and whether the survey was completed before or after the most recent vaccine clinic. We determined adjusted odds ratios (aORs) and 95% confidence intervals (CIs).

We performed statistical analyses using SAS version 9.1 (Cary, NC).

Because NH staff responded to the survey in a professional capacity and did not provide personal information, this analysis was not considered human subjects research or subject to Institutional Review Board approval.

## RESULTS

### Respondent characteristics

After identifying respondents with missing or invalid CCNs and deduplicating survey responses, we obtained 413 responses (30.9% of 1338 sampled NHs). Compared with nonrespondents in the sample, respondents were more likely to be nonprofit (respondents: 30%; nonrespondents 24%;  $p < 0.007$ ) and have higher average five-star ratings (respondents: 3.7; nonrespondents: 3.4;  $p = 0.002$ ) (Table S2). Other characteristics did not differ by survey response status.

Among the 413 respondent facilities, 16% had low COVID-19 vaccine coverage, 28% had medium coverage, and 56% had high coverage. Compared with facilities with low vaccination coverage, facilities with medium or high vaccination coverage differed in several ways. Facilities with medium and high vaccination coverage were significantly more likely to be nonprofit and located in urban areas, and have five-star ratings and better three-year average health inspection survey scores (Table 1). Other characteristics did not differ by coverage group.

### Activities and policies

Two individual activities or policies were associated with a greater likelihood of medium or high vaccination

coverage compared with low coverage: (1) designation of frontline staff champions (medium vaccination coverage: aOR: 3.6, 95% CI 1.3–10.3; high vaccination coverage: aOR: 2.9, 95% CI 1.1–7.7), and (2) setting a goal or target for the percent of staff vaccinated prior to the first clinic (medium vaccination coverage: aOR: 2.4, 95% CI 1.0–5.5; high vaccination coverage: aOR: 3.7, 95% CI 1.6–8.3) (Figure 1A). However, these strategies or policies were only used by a quarter to half of facilities with medium or high coverage (Table S3). Compared with control facilities, those with medium vaccination coverage were more likely to report designating a leadership champion (aOR medium 2.7, 95% CI 1.1–10.3). However, high coverage facilities were not more likely than control facilities to have designated a leadership champion (aOR high: 1.2, 95% CI 0.5–2.7). Policies including requiring staff to sign

a declination form were reported by approximately half of facilities in each group (i.e., 48%, 54%, and 48% in low, medium, and high groups), whereas employment mandates were rarely used (i.e., 0%, 1%, and 3% in low medium and high group). Policies prohibiting unvaccinated staff from working at multiple facilities were seldomly reported (i.e., 3%, 2%, and 4% among low, medium, and high groups; Table S3).

## Incentives

Facilities with high vaccination coverage were more likely to report providing vaccinated staff t-shirts or other merchandise, compared with facilities with low coverage (aOR: 3.8, 95% CI 1.3–11.0) (Figure 1B). None of the

**TABLE 1** Respondent nursing home characteristics, by staff COVID-19 vaccination coverage

	Staff COVID-19 vaccination group			<i>p</i> -value <sup>a</sup>
	Low (<35%) ( <i>N</i> = 66) <i>n</i> (%)	Medium (40%–60%) ( <i>N</i> = 116) <i>n</i> (%)	High (>75%) ( <i>N</i> = 231) <i>n</i> (%)	
Certified beds (mean ± SD)	91 ± 42	112 ± 57	99 ± 60	0.22
Ownership <sup>b</sup>				
For-profit	46 (70%)	86 (74%)	130 (57%)	0.012
Not-for-profit	15 (23%)	26 (22%)	83 (36%)	
Government	5 (8%)	4 (3%)	17 (7%)	
Insurance type				
Medicare (without Medicaid)	1 (2%)	1 (1%)	14 (6%)	0.024
Medicare and Medicaid	65 (98%)	115 (99%)	217 (94%)	
Star rating (mean + SD)	2.9 ± 1.3	3.4 ± 1.3	4.0 ± 1.2	<0.001
Health survey score (mean + SD)	86 ± 104	66 ± 65	43 ± 49	<0.001
Urban <sup>b</sup>	27 (42%)	78 (68%)	170 (75%)	<0.001
County % minority, (mean ± SD)	24 ± 19	30 ± 21	26 ± 19	0.986
COVID-19 prevalence <sup>c</sup>				
Green (<5%)	21 (32%)	28 (24%)	84 (36%)	0.036
Yellow (5%–10%)	35 (53%)	76 (66%)	133 (58%)	
Red (>10%)	10 (15%)	12 (10%)	14 (6%)	
Number of vaccine clinics completed <sup>b</sup>				
One	7 (11%)	2 (2%)	14 (6%)	<0.001
Two	29 (45%)	63 (56%)	80 (36%)	
Three	29 (45%)	48 (42%)	131 (58%)	

<sup>a</sup>Statistical tests used were Mann–Kendall trend test for numeric variables, Cochran–Armitage trend test for urban/rural status, and chi-square test for other categorical variables. *p*-values are for comparison across coverage levels.

<sup>b</sup>Ownership is missing data from one facility; urban location is missing data from five facilities; number of vaccine clinics was missing from 10 facilities.

<sup>c</sup>COVID-19 vaccination coverage among staff. COVID-19 prevalence as of December 31, 2020, with classification of green, yellow, and red based on CMS classification of 7-day average test positivity for COVID-19 in the county.<sup>14</sup>



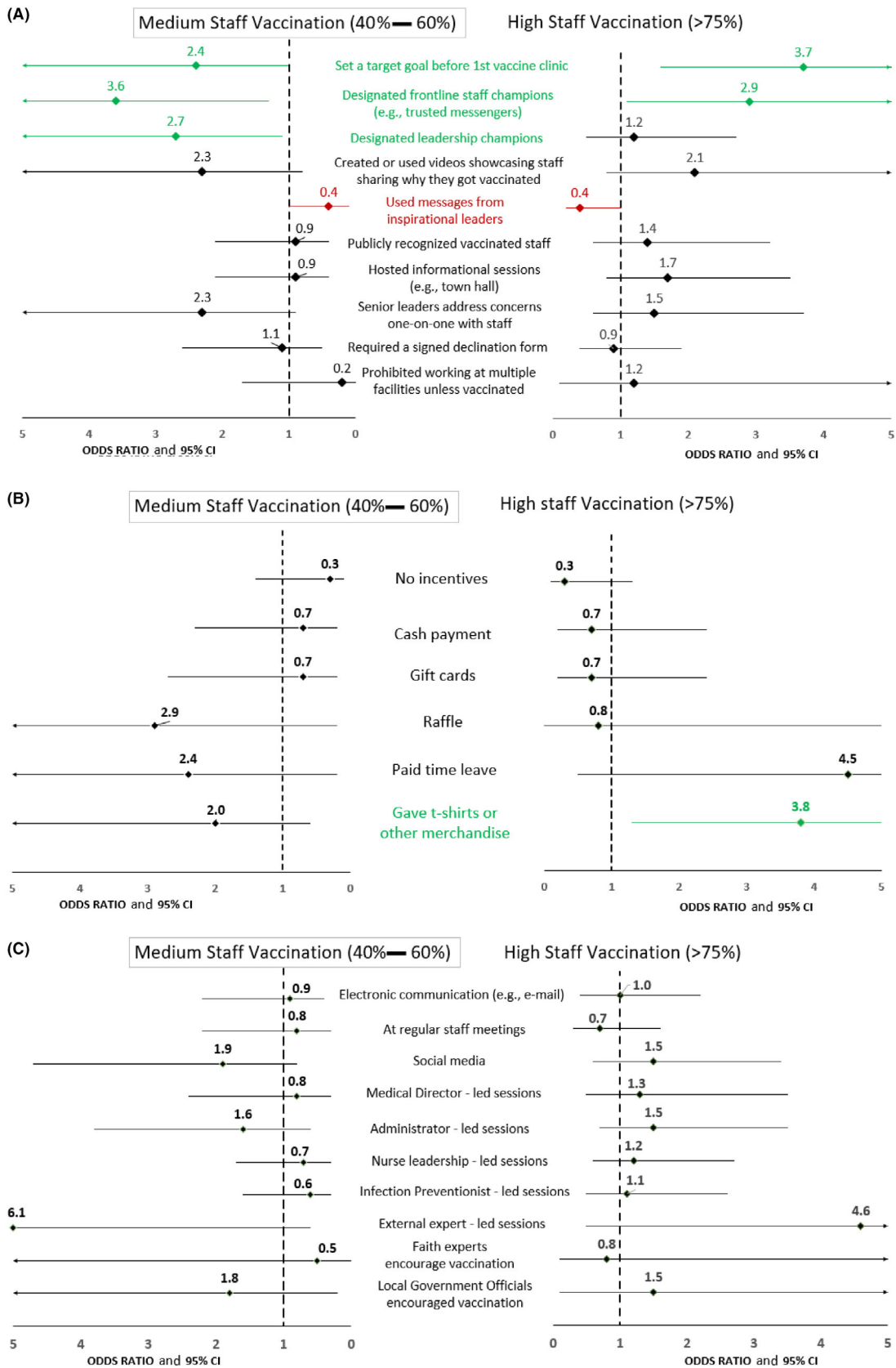


FIGURE 1 Legend on next page.

other incentives (e.g., raffle) were associated with likelihood of medium or high vaccination coverage, but these other incentives were seldom used in no more than 10% of facilities (Table S3).

## Communication methods

None of the communication methods used to promote vaccine uptake were associated with likelihood of facilities having either medium or high vaccination coverage compared with facilities with low coverage (Figure 1C). However, these methods were commonly used by all three groups; approximately three-quarters reported using electronic communication (e.g., email) and staff meetings to share information, and one-third of respondents reported using social media (Table S3).

## Number of strategies used

Reported use of 6–8 or  $\geq 9$  strategies (i.e., total number of activities and policies, incentives, and communications) was associated with a greater likelihood of facilities having high or medium staff coverage. For example, facilities that used  $\geq 9$  strategies (vs.  $< 6$  strategies) were three times more likely to have high vaccination coverage than low coverage (aOR 3.3, 95% CI 1.2–8.9; Table 2). For every additional strategy used, there was 10% increased odds the facility would have high (vs. low) coverage (aOR: 1.1, 95% CI 1.0, 1.3).

## Awareness of individuals or groups discouraging vaccination

Table 2 describes the association between facility awareness of barriers to vaccination and vaccination coverage in staff. Facilities in the high vaccination group were more likely to be aware of a single staff member (aOR 5.5, 95% CI 1.5–19.6) who was discouraging other staff

from being vaccinated or of a particular group of staff members who were reluctant to get vaccinated (aOR 4.4, 95% CI 1.9–10.5) compared with facilities with low vaccination coverage. In contrast, facilities that were unaware of anyone discouraging staff vaccination were less likely to have high vaccination coverage compared with facilities with low vaccination coverage (aOR 0.3, 0.1–0.5).

## DISCUSSION

This is the first study, to our knowledge, to characterize the strategies used by U.S. NH leaders to promote COVID-19 vaccine uptake among staff. Compared with facilities with low staff COVID-19 vaccination coverage, facilities with medium or high vaccination coverage were more likely to report using specific strategies, such as goal-setting and identifying frontline champions, and to employ a greater total number of strategies. Facilities with high coverage were also more likely to report giving rewards to vaccinated staff, such as t-shirts. These findings provide a potential road map for NH leaders, policymakers, and others seeking to prioritize strategies to increase staff COVID-19 vaccination coverage in this high-risk setting.

Our findings are in line with prior research on NH influenza vaccination uptake and clinical quality improvement efforts showing an association between the number of strategies conducted and higher vaccine coverage.<sup>9</sup> Facilities that employ greater numbers of strategies may have more actively engaged leadership. Research has also demonstrated that facilities that set goals in a targeted domain outperform those that do not.<sup>15,16</sup> While our findings suggest the identification of frontline champions may be helpful to increase staff COVID-19 vaccine coverage, messaging from inspirational leaders was associated with lower levels of vaccine coverage. Successful response models to prior epidemics including H1N1 and Ebola have required strong community engagement and a “bottom-up” approach to address contextual influences on vaccine hesitancy such as religious or cultural

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**FIGURE 1** presents the adjusted odds ratios (aORs) and 95% confidence intervals (CIs) comparing facilities with medium or high staff vaccination coverage to facilities with low staff vaccination coverage as the control or referent group. Models were adjusted for state; facility characteristics (percent of residents enrolled in Medicare, facility size, urban/rural); percentage of non-White minorities in the county; political leaning; COVID-19 prevalence in the community; number of clinics held by February 19, 2021; and whether the survey was completed before or after the latest vaccine clinic. aORs that were significantly associated with either medium or high vaccination coverage are in green and those with low vaccination coverage in red. Compared with facilities with low vaccination coverage among staff, facilities with medium or high vaccination coverage among staff were more likely to have designated frontline staff champions or set vaccination goals, and facilities with high vaccination coverage were more likely to have given vaccinated staff t-shirts or other gifts. Most other activities and policies (A), incentives (B), and communication methods (C) used by respondents to promote COVID-19 vaccine uptake among nursing home staff did not differ by vaccination coverage group

**TABLE 2** Selected factors associated with medium or high COVID-19 vaccination coverage among staff in nursing homes

	<b>Odds ratio: medium staff coverage (vs. low staff coverage)</b>	<b>Odds ratio: high staff coverage (vs. low staff coverage)</b>
Number of strategies (per each additional activity reported) <sup>a</sup>	1.1 (1.0, 1.3) <sup>†</sup>	1.1 (1.0, 1.3) <sup>‡</sup>
6–8 strategies (vs. 0–5 strategies) <sup>a</sup>	3.1 (1.2, 8.1)	2.7 (1.1, 6.6)
≥9 strategies (vs. 0–5 strategies) <sup>a</sup>	3.3 (1.1, 9.6)	3.3 (1.2, 8.9)
Awareness that a single staff member discouraged vaccination	2.7 (0.8, 9.8)	5.5 (1.5, 19.6)
Awareness that a small group of staff members discouraged vaccination	1.2 (0.5, 3.0)	2.2 (0.9, 5.1)
Awareness that staffs' friends or family members discouraged vaccination	1.5 (0.6, 3.6)	1.4 (0.6, 3.0)
Awareness that residents' family members discouraged vaccination	0.4 (0.1, 1.5)	0.3 (0.1, 1.0)
Not aware of anyone discouraging vaccination	0.5 (0.2, 1.1)	0.3 (0.1, 0.6)

<sup>a</sup>Yes responses in each category (e.g., activities and policies, incentives, and communication) were summed across categories to derive the number of strategies conducted at each facility. The total number of strategies was divided into tertiles (possible range: 0–25) as low (0–5), medium (6–8), or high (≥9).

<sup>†</sup>*p* = 0.07.

<sup>‡</sup>*p* = 0.04.

reservations.<sup>7</sup> This may explain why frontline champions appeared to be more successful than outside inspirational leaders in encouraging vaccination in our study. Our findings suggest that no single strategy can address all of the underlying reasons why staff delay or decline vaccination, rather that facilities reporting a multifaceted approach to

promoting vaccination achieved higher vaccination rates than those using fewer number of strategies.

Among our significant findings was that facilities with high vaccination coverage were more likely to give t-shirts or other gifts to vaccinated staff. In contrast, none of the financial incentives were commonly used even among high coverage facilities, and so it remains unclear whether these activities are associated with better levels of vaccine coverage. Some have speculated that financial incentives can be perceived as coercive and actually increase vaccine hesitancy.<sup>17,18</sup>

Increased leadership awareness of vaccine-hesitant staff and their reasons might enable the use of more tailored or focused implementation approaches that are effective at overcoming vaccine hesitancy. We found that NHs with high vaccination coverage were more likely to report knowledge of barriers to staff vaccination (such as an individual or group of individuals discouraging vaccination), suggesting these leaders might be more engaged and create contextually specific solutions to overcome hesitancy.

While studies suggest that “soft” vaccination mandates, such as declination forms, are highly effective in increasing influenza vaccine uptake among healthcare workers,<sup>19,20</sup> we found no difference in the likelihood of facilities that reported requiring such forms having medium or high vaccination coverage. This might be because declination forms were used frequently in all three groups, and because influenza declination requires non-vaccinated employees to wear a mask, whereas masks are currently mandated in all healthcare facilities regardless of COVID-19 vaccination status. Even among strategies where we found significant differences, such as the use of frontline champions, the frequency of use was relatively low (<32%).

We note several limitations. First, we do not have information on how well NHs implemented various practices. It is likely that implementation strategies varied, to some extent, based on leadership and other organizational characteristics. Second, respondents likely differed from nonrespondents in important, unmeasurable ways, related to both the individual completing the survey (i.e., motivational biases to participate and social desirability bias) and the facility (i.e., leadership, culture, and context). The higher response rate for high vaccination coverage facilities suggests that they differ from facilities with low and medium vaccination coverage. Third, responses reflect the knowledge and perceptions of a single person on behalf of a facility. Fourth, our survey was also administered during the window of time when the second and third PPP clinics were occurring in some respondents' NHs, and respondents were reassigned to their level of vaccine coverage in the midst of the PPP



clinics. Our results would not address how facilities that lagged in vaccination coverage early improved coverage. While we reclassified facilities to minimize misclassification of coverage, we did not evaluate improvement as an outcome. Finally, our estimates of coverage were limited to facilities that participated in the PPP, relied on secondary data sources for staff denominators, and did not take into account agency staff working across multiple facilities.<sup>21</sup>

CMS recently announced regulations to mandate staff vaccination in NHs,<sup>22</sup> yet many facilities are struggling to achieve high staff vaccination coverage. The results of this survey suggest that NHs should consider adopting multiple strategies to encourage staff COVID-19 vaccination that may include identifying frontline champions, setting goals for vaccination coverage among staff, and providing small gifts (e.g., t-shirts) to staff who get vaccinated. The results from this survey provide actionable strategies for facilities seeking to increase COVID-19 vaccine uptake among NH staff. Future research can prospectively evaluate the implementation of such strategies.

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#### CONFLICT OF INTEREST

The authors declare no conflicts of interest.

#### AUTHOR CONTRIBUTIONS

Rosa R. Baier, Sarah D. Berry, and David R. Gifford conceived of the study and were involved in all aspects of designing, administering, and analyzing the survey. Michael Leitson assisted with data management, sample selection, and the analytic approach. Courtney Bishnoi and Urvi Patel assisted with survey design and interpretation of results. Ruth Link-Gelles and Radhika Gharpure provided vaccination uptake, clinic schedule, and contact information and helped identify the sampling frame. Natalia Goukova helped to design the analytic approach and performed the data analysis. All authors contributed to drafting and revising this manuscript and approved the final version.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

**Appendix S1.** Supporting Information.

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