

Using analogy-based messages to influence attitudes toward workplace COVID-19 vaccination mandates

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Abstract:

Workplace mandates are a highly effective strategy for increasing COVID-19 vaccination rates, and their adoption by United States employers grew throughout 2021. Still, public opinion on these mandates has remained starkly polarized. Drawing from the widespread use of analogies in health communication during the pandemic, we investigated whether analogies to widely-accepted workplace safety rules could affect attitudes toward vaccination mandates. In a survey experiment conducted in September-October 2021, 1194 respondents were randomized to one of three messages about workplace COVID-19 vaccination mandates that included (1) no analogy; (2) an analogy to workplace hard hat policies; or (3) an analogy to workplace smoking bans. Only the smoking analogy increased support for ($b = 0.41$; $p < .001$) and perceived effectiveness of ($b = 0.20$; $p = .037$) workplace vaccination mandates. Moreover, the smoking analogy's effect on perceived effectiveness was greater for unvaccinated respondents ($b = 0.54$; $p = .015$ for interaction) and was mediated via the perceived strength of mandate enforcement (indirect effect = 0.05; 95% confidence interval = [0.01, 0.10]; $P = .006$). Our results demonstrate that policymakers and administrators may use a simple analogy to boost public opinion on workplace mandates for COVID-19 vaccination.

Keywords: COVID-19 vaccine, vaccination mandate, analogy, occupational safety and health, preregistered survey experiment

Despite the widespread availability of safe, effective, and free COVID-19 vaccines in the United States, vaccine hesitancy and refusal led to stalling demand after their initial rollout in 2021 (Centers for Disease Control and Prevention, 2020). To increase vaccination rates, many employers mandated vaccination as a condition of employment, and some businesses mandated vaccination as a requirement for entry or participation in events and activities. In August 2021, the federal government (via the Occupational Safety and Health Administration) further announced that all private employers with more than 100 employees would be mandated to ensure that workers are fully vaccinated against COVID-19 or undergo weekly testing (The White House, 2021). Alongside the previously announced vaccination mandates for federal employees and health care workers, these requirements would have applied to approximately two-thirds of the United States workforce. The OSHA mandate was ultimately struck down by the Supreme Court in January 2022, reflecting its contentiousness among policymakers and the public (*National Federation of Independent Business v. OSHA*, 2022).

Mandates are among the strongest tools available for increasing vaccine uptake (Brewer, Chapman, Rothman, Leask, & Kempe, 2017; Mello et al., 2022), and polls conducted in Fall 2021 indicated that a majority of Americans did indeed approve of COVID-19 vaccination mandates. However, the partisan divide was stark: Democrats overwhelmingly supported them and Republicans overwhelmingly opposed them (Johnson & Fingerhut, 2021). Many institutions and Republican state governments also threatened legal action against mandates, or otherwise signaled that they would not be enforced and thus ineffective (Lyons & Fowler, 2021). Concerns were initially raised about mass resignations following mandate enforcement, and about the legality and ethicality of

mandating vaccines that were not yet fully approved by the Food and Drug Administration (FDA) (Gur-Arie, Jamrozik, & Kingori, 2021; Rothstein, Parmet, & Reiss, 2021). However, reports that around half of unvaccinated employees would rather leave their job than get a COVID-19 vaccine (Hamel et al., 2021) may have been overstated (Albarracin, Jung, Song, Tan, & Fishman, 2021), and many employers introduced mandates after the FDA granted full approval to the Pfizer vaccine in August 2021 (Culp, Corwin, Dukes, & Sinnwell, 2021).

Public support for COVID-19 vaccination mandates would enable policymakers and employers to introduce and enforce vaccination as a condition of employment. One cost-effective way to shape public opinion on mandates is through behaviorally informed messages. Behavioral science research demonstrates framing effects whereby two informationally equivalent presentations of the same message can result in different choices (Smith & Petty, 1996; Tversky & Kahneman, 1985). Although not a formal framing effect, minor differences in the information content of a narrative, or the way in which an argument is presented, can also affect attitudes. For example, presenting COVID-19 vaccination as a social norm leads to increased intentions to get vaccinated (Palm, Bolsen, & Kingsland, 2021), and presenting the human papilloma virus (HPV) vaccine as controversial leads to decreased support for state HPV vaccine mandates (Gollust, Dempsey, Lantz, Ubel, & Fowler, 2010).

Analogies (and metaphors) are commonly used to present COVID-19 related information and to make meaning of the pandemic (Semino, 2021). Public health officials and science communicators have used analogies in attempts to promote vaccination against COVID-19 (Wood & Schulman, 2021), though their real-world effectiveness has been questioned (Wu, 2021). Prior studies have shown that analogies may influence emotions

surrounding pandemic-related stressors (de Saint Preux & Blanco, 2021) and opinions about mitigation strategies (Panzeri, Di Paola, & Domaneschi, 2021). However, in both the context of COVID-19 and in that of public health and policy more broadly, only a few studies have empirically assessed the ability of analogies to shape public opinion, with mixed results (Barabas, Carter, & Shan, 2020; Boscarino, 2019; Landau, Arndt, & Cameron, 2018).

Similarly, no studies to date have investigated how analogy-based messages may influence attitudes toward vaccination mandates. To explore this question, we conducted a three-arm online survey experiment related to the United States federal government's August 2021 announcement about workplace COVID-19 vaccination mandates. The control message described the mandate in a purely informational manner, explaining the requirement and its anticipated consequences for unvaccinated individuals. The two analogy messages also employed analogies to one of two widely-accepted workplace safety rules. First, the requirement to wear a hard hat on a construction site protects the individual wearing the hard hat from injury, just as vaccination against COVID-19 protects the individual who is vaccinated from disease. Second, indoor smoking bans protect co-workers from exposure to secondhand smoke, just as workplaces with high vaccination rates protect co-workers from exposure to the virus.

Analogies are theorized to influence attitudes through at least two mechanisms: first, they can decrease the audience's ability to selectively attend to parts of a message that impede attitude change; second, they can clarify the underlying message by creating associations between familiar and unfamiliar concepts (McCroskey & Combs, 1969). In this sense, we reasoned that our analogies would draw attention away from the informational parts of the message, which emphasized undesirable consequences (e.g., termination of

employment) that could decrease support for the mandate, especially among unvaccinated individuals. Moreover, we chose to create associations between COVID-19 vaccination mandates and hard hat requirements or smoking bans because these workplace rules are familiar to many people, viewed as noncontroversial, and perceived to be well-enforced. The analogy could thus lead participants to conclude that vaccination mandates are also standard, noncontroversial workplace rules that everyone will follow. Consequently, we hypothesized that the hard hat and smoking analogy messages would increase support for vaccination mandates, as well as their perceived effectiveness at increasing employees' likelihood of getting vaccinated, compared to the control message that did not include an analogy.

Finally, hard hat requirements and smoking bans differ in terms of whom they benefit. Hard hat requirements provide personal protection from injury for the person wearing the hard hat. In contrast, smoking bans provide collective protection to coworkers from second-hand smoke; they do not necessarily provide personal protection from smoking-related illnesses, as individuals may continue to smoke outside the workplace. Because personal benefit is generally more motivating than collective benefit, we predicted a greater effect for the hard hat analogy than for the smoking analogy, and a pilot experiment provided directional support for that prediction.

Methods

Participant recruitment

We recruited a convenience sample of 1196 adults residing in the United States to participate in an online survey experiment from September 28 to October 5, 2021. Recruitment was conducted through Amazon Mechanical Turk. Based on a pilot experiment, this provided us

with 86% power to detect a small effect (Cohen's $d = 0.22$). Our study was approved by the University of Pennsylvania Institutional Review Board (#849005).

Survey procedures and measures

After providing informed consent, respondents were randomized to one of three experimental message conditions: (1) the “no analogy” control condition; (2) the “hard hat analogy” condition; or (3) the “smoking analogy” condition (Table 1).

Table 1

Full text of experimental message frame conditions

| No Analogy | Hard Hat Analogy | Smoking Analogy |
|--|---|--|
| As you may know, the federal government recently announced that many employers will be required to mandate vaccination against COVID-19. | As you may know, the federal government recently announced that many employers will be required to mandate vaccination against COVID-19. | As you may know, the federal government recently announced that many employers will be required to mandate vaccination against COVID-19. |
| Employees who stay unvaccinated after the deadline passes may face consequences such as having to frequently get tested for COVID-19 or losing their jobs. | Employees who stay unvaccinated after the deadline passes may face consequences such as having to frequently get tested for COVID-19 or losing their jobs. | Employees who stay unvaccinated after the deadline passes may face consequences such as having to frequently get tested for COVID-19 or losing their jobs. |
| | Some people say that COVID-19 vaccination mandates are like the requirement to wear a hard hat when you're on a construction site. Even if you may not want to wear a hard hat, this requirement is there to protect you from getting hurt. | Some people say that COVID-19 vaccination mandates are like the ban on smoking indoors while you're at work. Even if you may want to smoke indoors, this requirement is there to protect your coworkers from the dangerous health effects of secondhand smoke. |

The two primary dependent variables were attitudinal measures: respondents indicated their support for workplace COVID-19 vaccination mandates (1-7 scale; 1 = “Strongly oppose” ... 7 = “Strongly support”) and their perceptions of mandate

effectiveness, measured by how they thought mandates would change employees' likelihood of getting vaccinated (1-7 scale; 1 = "[Employees will be] much less likely to get vaccinated" ... 7 = "Much more likely to get vaccinated"). The survey questionnaire (available in the Supplement) also recorded a secondary dependent variable that was a behavioral measure: whether or not respondents clicked on a link to read a news report about the mandates (The Associated Press, 2021).

We tested a mediation hypothesis that exposure to the analogy messages would influence the perceived effectiveness of mandates by way of beliefs about their consequences for unvaccinated employees. To assess this potential mediator, we presented to respondents three items designed to measure strength of enforcement of vaccination mandates. Participants estimated the percentage of unvaccinated employees who would leave or lose their jobs (i.e., more severe consequences); estimated the percentage of employers who would offer a COVID-19 testing option as a way to comply with the mandate (i.e., less severe consequences); and indicated how strongly they perceived the mandates would be enforced in a general sense (1-7 scale; 1 = "Very weakly enforced" ... 7 = "Very strongly enforced").

Finally, respondents indicated their COVID-19 vaccination status, and, if unvaccinated, their vaccination intent (1-5 scale; 1 = "Definitely would not [get vaccinated]" ... 5 = "Definitely would"]. Unvaccinated respondents were given the opportunity to click on a link to access the federal government's Vaccine Finder service (Centers for Disease Control and Prevention, 2021).

Statistical analysis

As stated in our preregistered analysis plan ([AsPredicted #75703](#)), we estimated ordinary least squares (OLS) regression models with (1) support for mandates or (2) perceived effectiveness of mandates as continuous dependent variables. The predictor of interest was the message condition (with no analogy as the reference category). Covariates included age range (dichotomized with the cutoff point being the median age range), gender, race, political party affiliation, and COVID-19 vaccination status. We modeled interactions between gender, vaccination status, race, or political affiliation and analogy condition, controlling for the same covariates. We also conducted nonparametric bootstrapped mediation analyses to test whether the relationship between analogy and perceived effectiveness was mediated by perceptions about (1) employees leaving or losing their jobs, (2) employers offering testing options, or (3) mandate enforcement strength. For robustness, we also performed these analyses as logistic regressions, with the dependent variables recoded as binary outcomes (0 = oppose or neutral toward mandate, mandate makes employees less likely to get vaccinated or does not affect likeliness; 1 = support mandate, mandate makes employees more likely to get vaccinated). Finally, we estimated the log odds of clicking through to the news report about the mandate as a function of analogy condition, controlling for the same covariates. For unvaccinated participants, we also estimated the log odds of clicking through to the Vaccine Finder service. We performed all analyses in R version 4.0.3 and used a significance level of 0.05.

Results

Respondent characteristics

Descriptive statistics for the overall sample are reported in Table 2, and statistics by vaccination status are available in the Supplement. Following our preregistration, we

excluded 2 respondents who failed an attention check. The rate of failure did not vary across conditions, and adding these 2 respondents back into the sample did not affect any of our findings (data not shown). Our final sample comprised 1194 respondents (45.5% female; median age range 30-39 years old; 22.5% unvaccinated against COVID-19). 43.8% of respondents identified as Democrats, 42.0% identified as Independents, and 14.2% identified as Republicans. Vaccination rates significantly differed by political affiliation; 10.3% of Democrats in the sample were unvaccinated, compared to 29.9% of Independents and 38.5% of Republicans ($p < .001$ by chi-square test). Unvaccinated respondents were strongly vaccine-hesitant; 51.3% indicated that they “definitely would not” and 21.6% indicated that they “probably would not” get a COVID-19 vaccine. Of those respondents who were employed full-time or part-time (70.8%), 31.8% had an employer mandate announced or in place, 64.7% did not, and 3.6% were unsure. 94.4% of respondents with an employer mandate in place had received at least one dose of a COVID-19 vaccine.

Table 2

Respondent characteristics

| Covariates | | Percentage of Sample |
|-------------------------|----------------------------------|----------------------|
| Age range | 18-39 | 57.5 % |
| | 40+ | 42.5 % |
| Gender | Male | 53.6 % |
| | Female | 45.5 % |
| | Other | 0.6 % |
| | Prefer not to answer | 0.3 % |
| Race / ethnicity | White | 74.1 % |
| | American Indian / Alaskan Native | 0.1 % |

| | | |
|------------------------------------|---------------------------------|--------|
| | Asian | 7.0 % |
| | Black / African American | 7.6 % |
| | Hispanic / Latino | 4.1 % |
| | Other | 0.2 % |
| | Prefer not to answer | 0.7 % |
| | Two or more races | 6.3 % |
| Political affiliation | Independent | 42.0 % |
| | Democrat | 43.8 % |
| | Republican | 14.2 % |
| COVID-19 vaccination status | Vaccinated | 77.5 % |
| | Unvaccinated | 22.5 % |
| Mandate status | Not employed full- or part-time | 29.1 % |
| | No mandate announced | 45.8 % |
| | Unsure | 2.5 % |
| | Mandate announced / in place | 22.5 % |
| N | | 1194 |

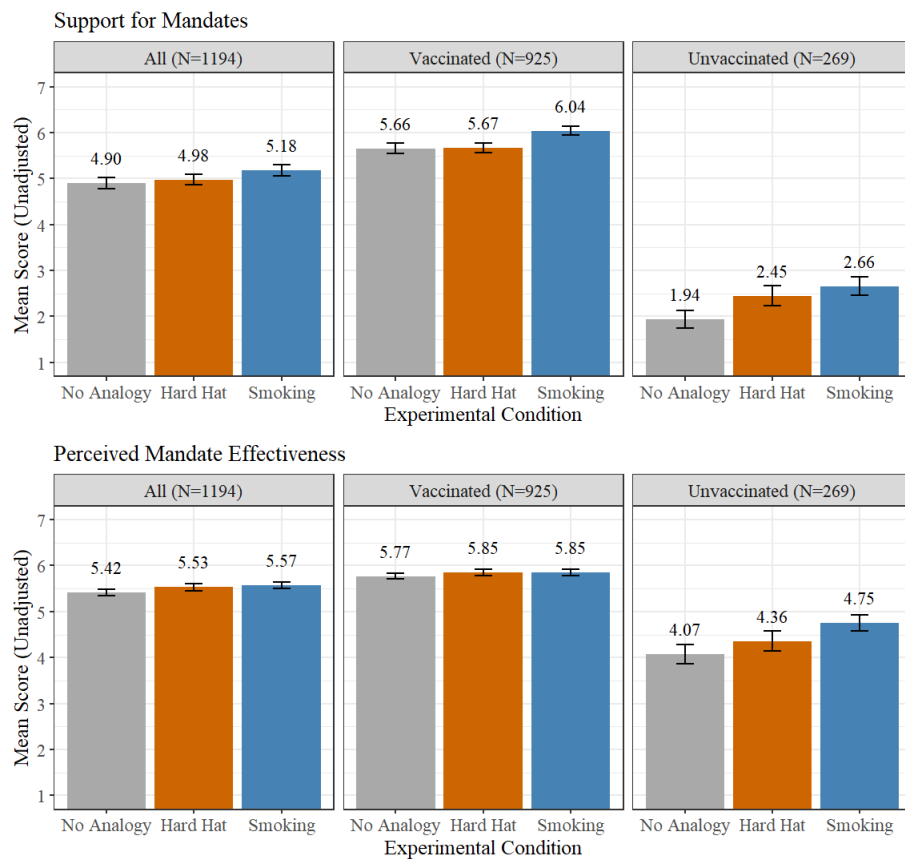
Effects of analogy-based messages on attitudes toward workplace COVID-19 vaccination mandates

On a 7-point scale, mean support for COVID-19 vaccination mandates was directionally higher in both the smoking (5.2) and hard hat (5.0) analogies, compared to the no analogy condition (4.9; $p = .183$ by Kruskal-Wallis test) (Figure 1 and Supplement). Mean perceived effectiveness of mandates was also directionally higher in the analogy conditions (smoking = 5.6; hard hat = 5.5; no analogy = 5.4; $p = .230$ by Kruskal-Wallis test). In our preregistered multivariable OLS analysis (controlling for demographic factors including political affiliation and vaccination status, which are strong predictors of attitudes towards mandates), the

smoking analogy led to a significant increase in support for mandates and perceived effectiveness of mandates, compared to no analogy (Table 3). As a robustness check, we also estimated logistic regression models (available in the Supplement). The smoking analogy led to a significant 62.2% increase in the likelihood of supporting mandates (adjusted odds ratio (AOR) = 1.62; 95% confidence interval (CI) = [1.08, 2.45]), though it had no significant effect on the likelihood of perceiving them as effective (AOR = 1.29; 95% CI = [0.85, 1.96]).

Figure 1

Support for and perceived effectiveness of workplace COVID-19 vaccination mandates by vaccination status and experimental condition



Notes: Authors' own analysis. Mean scores and standard errors are displayed without adjusting for demographic covariates.

Table 3

Regression coefficients (and P-values) for effects of analogy-based messages on attitudes toward workplace COVID-19 vaccination mandates

| | | Support for Mandates | | Perceived Effectiveness of Mandates | |
|--|---------------------------------------|---------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Covariates | | Base Model b (P-value) | Interaction Model b (P-value) | Base Model b (P-value) | Interaction Model b (P-value) |
| Condition | No analogy (ref.) | | | | |
| | Hard hat analogy | 0.02 (.861) | -0.06 (.664) | 0.08 (.373) | 0.05 (.624) |
| | Smoking analogy | 0.41 *** (<.001) | 0.37 ** (.008) | 0.20 * (.037) | 0.07 (.510) |
| COVID-19 vaccination status | Vaccinated (ref.) | | | | |
| | Unvaccinated | -2.95 *** (<.001) | -3.15 *** (<.001) | -1.25 *** (<.001) | -1.50 *** (<.001) |
| Condition x COVID-19 vaccination status | Hard hat analogy x Unvaccinated | | 0.38 (.200) | | 0.16 (.488) |
| | Smoking analogy x Unvaccinated | | 0.20 (.487) | | 0.54 * (.015) |
| Intercept | | 5.12 *** (<.001) | 5.17 *** (<.001) | 5.57 *** (<.001) | 5.62 *** (<.001) |
| Age range | 18-39 (ref.) | | | | |
| | 40+ | -0.10 (.367) | -0.10 (.329) | 0.04 (.663) | 0.03 (.742) |
| Gender | Male (ref.) | | | | |
| | Female | -0.04 (.720) | -0.04 (.732) | -0.09 (.242) | -0.10 (.215) |
| | Other | 0.27 (.679) | 0.28 (.662) | 0.07 (.882) | 0.06 (.903) |
| | Prefer not to answer | 0.24 (.812) | 0.24 (.812) | 1.60 * (.037) | 1.51 (.050) |
| Race / ethnicity | White (ref.) | | | | |

| | | | | | |
|----------------------------------|-----------------------|-----------|-----------|-----------|----------|
| | American | 1.92 | 1.87 | -0.48 | -0.53 |
| | Indian / | (.262) | (.275) | (.714) | (.684) |
| | Alaskan Native | | | | |
| | Asian | 0.34 | 0.35 | 0.10 | 0.09 |
| | | (.086) | (.081) | (.513) | (.533) |
| | Black / African | 0.10 | 0.10 | 0.11 | 0.11 |
| | American | (.610) | (.615) | (.461) | (.437) |
| | Hispanic / | 0.38 | 0.38 | 0.24 | 0.23 |
| | Latino | (.139) | (.139) | (.217) | (.223) |
| | Other | 2.34 | 2.34 | 0.40 | 0.53 |
| | | (.054) | (.054) | (.668) | (.569) |
| | Prefer not to | -0.20 | -0.19 | -0.59 | -0.57 |
| | answer | (.078) | (.797) | (.278) | (.299) |
| | Two or more | 0.30 | 0.30 | 0.18 | 0.19 |
| | racess | (.150) | (.150) | (.263) | (.234) |
| Political affiliation | Independent (ref.) | | | | |
| | Democrat | 1.25 *** | 1.24 *** | 0.41 *** | 0.41 *** |
| | | (<.001) | (<.001) | (<.001) | (<.001) |
| | Republican | -1.01 *** | -1.01 *** | -0.42 *** | -0.41 ** |
| | | (<.001) | (<.001) | (<.001) | (.001) |
| N | | 1194 | 1194 | 1194 | 1194 |
| Adjusted R² | | .42 | .48 | .20 | .20 |

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test).

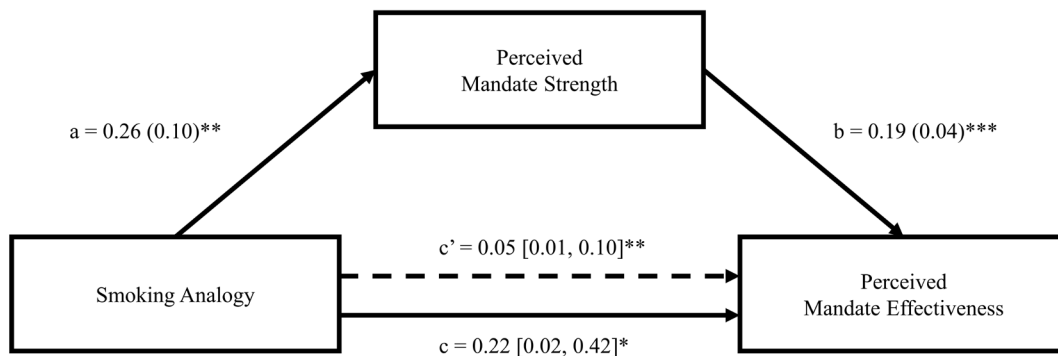
Vaccination status was the only significant moderator among our four preregistered interaction analyses; compared to the control condition, the smoking analogy increased perceived effectiveness 0.54 points more for unvaccinated respondents than for vaccinated respondents (Table 3). The interaction effect did not hold in the logistic regression we estimated as a robustness check, however (AOR = 1.33; 95% CI = [0.57, 3.09]). In another OLS model that included only participants who reported being unvaccinated (n=269), the smoking analogy did not significantly affect vaccination intent (b = 0.16; p = .359). Only 10.8% of unvaccinated respondents clicked the Vaccine Finder link, and the smoking

analogy did not significantly affect the log-odds of clicking (AOR = 0.85, 95% CI = [0.32, 2.25]).

Only one of the three preregistered mediators explained the relationship between either of the analogy messages and the perceived effectiveness of mandates (Figure 1). The perceived strength of mandate enforcement mediated 23.3% (95% CI = [5.78%, 95.0%]; $p < .001$) of the effect of the smoking analogy on perceived effectiveness. That is, the smoking analogy increased perceived strength of mandate enforcement ($a = 0.26$; $SE = 0.10$; $p = .009$), and perceived strength was associated with perceived effectiveness ($b = 0.19$; $SE = 0.04$; $p < .001$). The total effect ($c = 0.22$; 95% CI = [0.02, 0.42]; $p = .036$) and indirect mediation effect ($c' = 0.05$; 95% CI = [0.01, 0.10]; $p = .006$) were also both significant. Perceived strength of mandate enforcement and perceived mandate effectiveness were only weakly correlated ($r = 0.27$; $p < .001$), suggesting that the two measures captured distinct constructs.

Figure 2

Path model: Effect of smoking analogy on perceived effectiveness of workplace COVID-19 vaccination mandates, via perceived strength of mandate enforcement



Notes: Authors' own analysis. a = effect (SE) of independent variable on mediator; b = effect (SE) of mediator on dependent variable; c = total effect (95% CI) of independent variable on dependent variable; c' = indirect mediation effect (95% CI); * significant at $p < .05$; ** significant at $p < .01$; *** significant at $p < .001$.

Finally, fewer respondents who were exposed to either analogy, compared to no analogy, clicked the link to read a news report about the mandate announcement (smoking = 31.0%; hard hat = 33.9%; no analogy = 38.2%). This difference was only significant for the smoking analogy (26.1% decrease in the likelihood of clicking; AOR = 0.74; 95% CI = [0.55, < 1.00]; regression available in the Supplement).

Discussion and Conclusion

Analogies are frequently used to help explain COVID-19 mitigation efforts, but little is known about their impact on public opinion. Our study demonstrated that attitudes toward workplace COVID-19 vaccination mandates can be influenced by analogies to other workplace safety rules. Although presenting mandates as analogous to hard hat policies did not result in any attitudinal changes relative to using no analogy, presenting them as analogous to workplace smoking restrictions increased both support for mandates and the perception that they would effectively increase employees' likelihood of getting vaccinated. In addition to changing attitudes, the smoking analogy also decreased click-through rates to a news report about the federal mandate announcement, indicating that analogies can affect behaviors as well as attitudes. If we consider information-seeking to be motivated by the desire to reduce uncertainty (Kuhlthau, 1993), it is possible that the smoking analogy fulfilled this desire for some.

In accordance with nationally representative polls conducted in late September 2021 (Johnson & Fingerhut, 2021), we found a strong partisan split in support for workplace COVID-19 vaccination mandates. We also found similar rates (about one-third) of full-time or part-time workers who reported being subject to a mandate. While political affiliation and workplace mandate status were strongly associated with mandate support and perceived effectiveness, the smoking analogy increased support and perceived effectiveness equally across all groups, as well as all gender and racial categories. This is notable in light of the potential for analogies to have differential effects, or even backfire, among different groups (Galesic & Garcia-Retamero, 2013).

Critically, the smoking analogy increased perceived mandate effectiveness more for unvaccinated (vs. vaccinated) respondents. This may suggest that the analogy is more impactful for those who stand to benefit most, or it may reflect a ceiling on opinion toward mandates among the vaccinated. Given the dearth of effective messaging interventions for changing COVID-19 vaccination attitudes, especially later in the vaccine rollout timeline (Rabb, Bowers, Wilson, & Yokum, 2021), the smoking analogy should be considered for use in public health messages. Its particular effect on unvaccinated individuals should also be explored more thoroughly.

Although we originally predicted that the hard hat analogy would be more effective than the smoking analogy because the former is based on personal benefits rather than collective benefits, our results showed that the smoking analogy was more effective. Audience characteristics may explain the hard hat analogy's failure to influence attitudes. Hard hat requirements are specific to work environments such as construction sites, so

participants may have had less personal experience with them than with smoking bans, which may have been more salient to respondents due to their ubiquity in most workplaces.

Our results suggest that the effect of the smoking analogy on perceived effectiveness was mediated by the perceived strength of enforcement, but not by estimated proportions of employers who would offer a COVID-19 testing option or of employees who would leave or lose their jobs. Of the three potential mediators we investigated, strength of enforcement is most directly associated with the smoking analogy; smoke-free workplace rules are strictly enforced and have been shown to lead to reduced cigarette consumption (Bauer, Hyland, Li, Steger, & Cummings, 2005). The analogy thus likely prompted respondents to think about these factors in relation to employer mandates for COVID-19 vaccination. It is less plausible that respondents thought about workplaces that offered alternatives to full smoking bans or employees who would resign if they had to give up smoking at work.

Another feature of the analogies (albeit one that our survey did not explicitly measure) was the extent to which they communicated a social norm. Smoke-free workplaces have become widely accepted following regulations that established them as the norm (Osypuk & Acevedo-Garcia, 2010), and perceived norms have been found to shape COVID-19 related attitudes in contexts such as vaccination (Palm et al., 2021) and mask usage (Carbon, 2021). Similar analogies to norms such as wearing seatbelts (Giubilini & Savulescu, 2019) and paying taxes (Giubilini, 2020) have also been used to justify the ethics of vaccination mandates. In the taxation analogy, a key argument was that tax evasion, like vaccine refusal, involves individuals failing to make their fair contribution to the collective good and increasing harm to others. We framed our smoking analogy in terms of collective protection and framed our hard hat analogy, which was not empirically persuasive, in terms

of individual protection. However, one study of attitudes toward flu vaccines found that collectivist framing was more effective than individualist framing in messages that were also loss-framed, and equally effective in messages that were also gain-framed (Yu & Shen, 2013). In these terms, our smoking analogy used a collectivist gain frame. Future studies should investigate the role of alternative frames and assess whether unvaccinated and vaccinated individuals respond differently to them.

Our study has some important limitations. The study population is a convenience sample of Amazon Mechanical Turk workers, who are not representative of the US population. Our intervention referred specifically to the federal government's employer mandate announcement; it is not known whether the analogies may have operated differently if other mandates had been referenced. Our results may have further been sensitive to the specific wording of our two analogies and to the timing of the study relative to mandates being in the news cycle; indeed, a replication study with a slightly different design fielded in October 2022 did not support our original findings. However, the timing of the study was also a strength, as we were able to rigorously assess the effects of analogies at the moment when they were relevant and persuasive. Another strength was adding a rigorous evaluation of analogies to the growing literature on this topic. Finally, as our control message did not vary from our experimental message conditions in terms of invoking the federal mandate, our results are likely to be robust to the shifting mandate policy environment.

In our randomized survey experiment, depicting workplace COVID-19 vaccination mandates as analogous to workplace smoking bans increased support for and perceived effectiveness of mandates; depicting them as analogous to construction site hard hat

requirements did not affect attitudes. Our results suggest that a simple message that presents vaccine mandates as similar to familiar, successful, and popular workplace regulations can shift public opinion about mandates. Critically, among the unvaccinated, the analogy to smoking bans can also increase perceived effectiveness of such mandates. At this moment in the COVID-19 vaccine roll-out and in anticipation of a regular booster vaccine schedule, securing public support for workplace mandates is an important policy goal to ensure effective implementation and minimize associated job losses or resignations.

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