



# How do COVID-19 vaccine mandates affect attitudes toward the vaccine and participation in mandate-affected activities? Evidence from the United States

S.E. Kreps, D.L. Kriner<sup>1</sup>

Cornell University, Department of Government, White Hall, Ithaca, NY 14853, United States



## ARTICLE INFO

Article history:  
Available online 2 March 2022

Keywords:  
COVID-19  
Vaccine  
Mandate  
Survey experiment

## ABSTRACT

The spread of COVID-19 has prompted many governments, schools, and companies to institute vaccine mandates. Proponents suggest that mandates will enhance public health and increase vaccination rates. Critics suggest that evidence of mandates' effectiveness is unclear and warn that mandates risk increasing societal inequalities if unvaccinated minority groups opt out of educational, commercial, and social activities where mandates are required. We conduct an original survey experiment on a nationally representative sample of 1,245 Americans to examine the efficacy and effect of COVID-19 mandates. Our findings suggest that mandates are unlikely to change vaccination behavior overall. Further, they may increase the likelihood that sizable percentages of the population opt out of activities where vaccines are mandated. We conclude that mandates that do go into effect should be accompanied by persuasive communications targeted to specific information needs and identities.

© 2022 Elsevier Ltd. All rights reserved.

## 1. Introduction

In the early 19th century, England produced the first vaccine in history, protecting individuals against smallpox, one of the most significant causes of death in Europe. The government first made vaccinations free, but facing continued reluctance, later made them mandatory [1]. More than two centuries later, governments faced a public health crisis in the form of COVID-19 and many began implementing an array of mandates to boost vaccination rates. These mandates have prompted fierce debate. Some critics worry that mandates may further entrench anti-vaccine sentiment and exacerbate inequities if economically disadvantaged groups opt out of daycares, schools, or employment rather than vaccinate [2]. If so, then the expanded use of incentives to vaccinate may be a more effective policy route [3]. Empirically, past studies have found mixed evidence of mandates' efficacy and effects [4–6]. For example, while childcare/kindergarten vaccine mandates against Hepatitis A appear to have significantly increased vaccination [6], vaccination rates actually declined after the implementation of New York City's measles vaccine mandate [7], and studies of Australian childhood vaccine mandates showed no statistical change in public behavior post-intervention [8].

Empirical study of public reaction to COVID-19 mandates is limited [9], an important oversight given the prevalence of mandates enacted around the world. Dozens of countries have implemented vaccine mandates either for particular jobs (e.g., home care staff in England, France, and Greece, teachers in New Zealand) or for all adults (e.g., Austria, Indonesia, Turkmenistan) [10]. Although mandates are a global phenomenon [11], a distinguishing feature of vaccine mandates in the United States is that the federal government lacks clear constitutional authority to mandate vaccination outside of specific circumstances, such as for the armed forces [12]. Even President Biden's more limited plan to mandate vaccinations for large employers drawing on statutory authority to protect workplace safety was struck down by the U.S. Supreme Court. As a result, most vaccine mandates in the United States are imposed either at the state or local level or by private entities for their employees. Given this unique context, we seek to understand reactions toward such mandates. This study employs an original survey instrument and embedded experiment on a nationally representative sample of 1,245 adult Americans to understand how COVID-19 vaccine mandates affect attitudes toward vaccination and willingness to engage in a range of social and economic activities.

## 2. Methods

To examine the potential effect of two vaccine regulatory instruments—mandates and incentives [13]—on Americans'

<sup>1</sup> Address: 209 White Hall, Ithaca, NY 14853, United States.  
E-mail address: [kriner@cornell.edu](mailto:kriner@cornell.edu) (D.L. Kriner)

attitudes and behaviors with respect to the COVID-19 vaccine, we conducted a survey online and via telephone from July 15 to 19, 2021 through the National Opinion Research Center (NORC), a non-partisan research institution at the University of Chicago. Our sample was recruited from the probability-based AmeriSpeak panel, which is representative of the US adult population, and was part of an omnibus survey with questions from the Centers for Disease Control and Prevention (CDC) [14]. NORC's national sample frame provides coverage of approximately 97% of US households. Sample demographics are summarized in Table 1. Cornell University's Institutional Review Board approved all protocols.

Respondents were randomly assigned to one of four experimental groups. Those in the control group received no information. Subjects in the three treatment groups all received the same initial prompt informing them that the Food and Drug Administration was likely to grant full approval to the Pfizer and Moderna COVID-19 vaccines later in the year. Those in the *approval-only treatment* group were also told only that after full approval some employers and schools hope to see an increase in community vaccination rates. Comparing attitudes across this treatment and the control group (which received no information about the likelihood of the vaccines receiving full FDA approval in the near future) affords an estimate of the effect of full FDA approval on vaccine confidence, although neither offers an additional policy intervention to actively push vaccination. The final two treatment groups explore the effect of incentives and mandates on individual attitudes. Respondents assigned to the *incentive treatment* were told that after full approval, some schools and employers plan to offer financial and scholarship lotteries to increase vaccination rates. Respondents assigned to the *mandate treatment* were told that after full approval, some schools and employers plan to mandate vaccination. Our treatment focused specifically on schools and employers because they have been at the forefront of vaccine mandates in the United States and the federal government's legal authority to issue broad mandates is much more limited than in most other countries. We structured our dependent variables as follows. Since we included our questions in the same nationally representative survey in which the CDC posed questions about vaccination status and intentions prior to our experimental manipulations, we used an alternative measure to gauge attitudes about vaccination. We used a three-item Vaccine Confidence Index—gauging perceptions of vaccine safety, importance, and effectiveness—shown to be a valuable indicator of vaccination intent and behavior given that confidence is a pre-cursor to willingness to vaccinate [15,16]. Each question was measured on a seven-point likert scale. Because the three measures are highly correlated, we created an additive index. Additional analyses assessing each question individually or an alternate index constructed via factor analysis are presented in SI Fig. 1.

To assess the effects of the approval, incentive, and mandate treatments on vaccine confidence, we estimated ordinary least squares regressions including indicator variables for assignment to each experimental treatment (with the control being the omitted baseline category). The models also control for a range of demographic factors shown by past research to be associated with vaccine confidence, including political partisanship, gender, age, race/ethnicity, and educational attainment [17–19].

Finally, we asked all respondents whether a COVID-19 vaccine mandate would make them more or less likely to visit, participate, or attend: school, work, church, restaurants, movie theaters, or sporting events. Respondents answered on a seven-point scale from “much less” to “much more” likely. To ease visual comparisons, we collapse this to three categories, “less likely”, “more likely,” or “neither more nor less likely.”

**Table 1**  
Survey Sample Demographics.

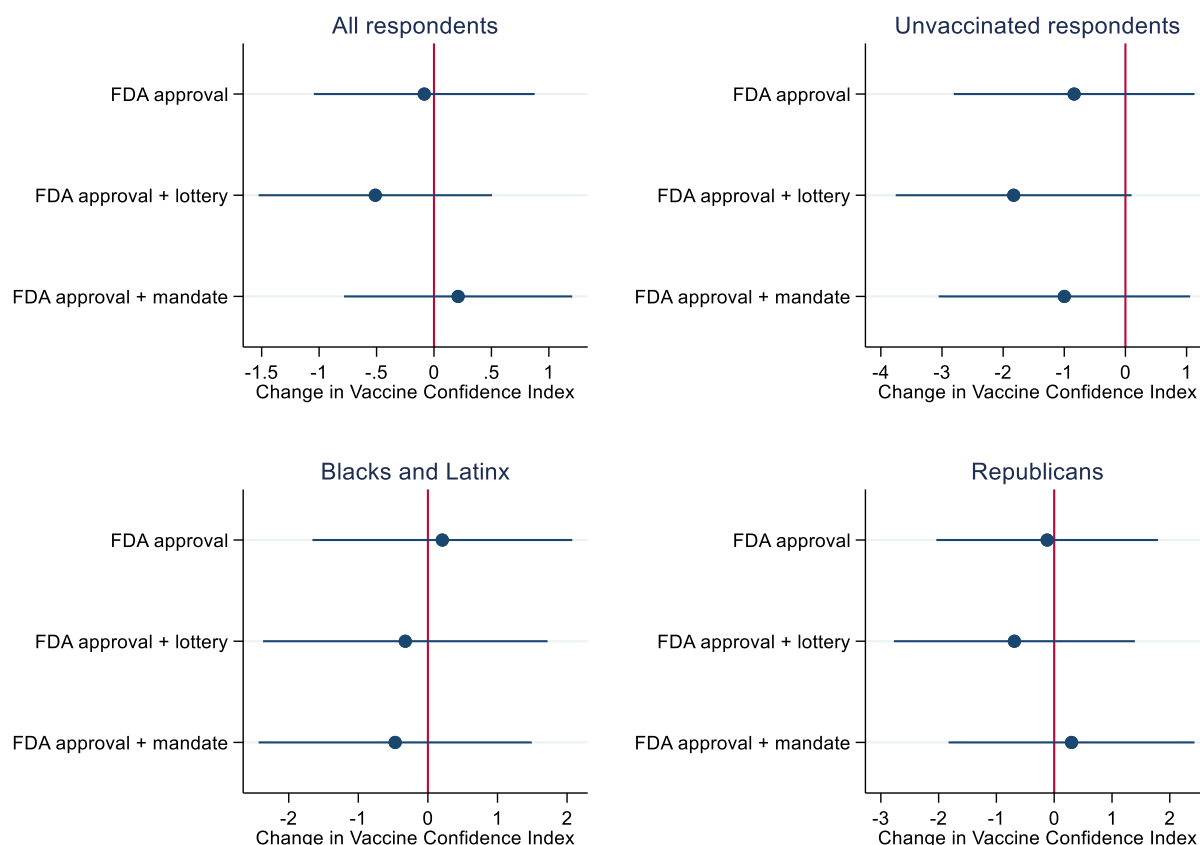
	N	Percentage
<b>Age</b>		
18–29	160	(13%)
30–44	397	(32%)
45–59	298	(24%)
>= 60	390	(32%)
<b>Gender</b>		
Male	644	(52%)
Female	601	(48%)
<b>Race/Ethnicity</b>		
White	836	(67%)
Black	147	(12%)
Latino	171	(14%)
Asian	34	(4%)
Other	57	(5%)
<b>Education</b>		
Less than High School	46	(4%)
High School / GED	219	(18%)
Some College	523	(42%)
4-Year College Degree	260	(21%)
Graduate School	197	(16%)
<b>Income</b>		
< \$30,000	300	(24%)
\$30,000 to \$59,999	333	(27%)
\$60,000 to \$99,999	331	(27%)
>= \$100,000	281	(23%)
<b>Political Partisanship</b>		
Democrat (includes leaners)	621	(50%)
Republican (includes leaners)	449	(36%)
Independent	175	(14%)
<b>Vaccination Status</b>		
Vaccinated (at least one dose)	900	(72%)
Not vaccinated	345	(28%)
<b>Vaccination Intention (Unvaccinated Only)</b>		
Definitely get a vaccine	7	(2%)
Probably get a vaccine	29	(8%)
Not sure about getting a vaccine	65	(19%)
Probably not get a vaccine	88	(26%)
Definitely not get a vaccine	154	(45%)

### 3. Results

#### 3.1. Experimental effects on attitudes toward the COVID-19 vaccine

Fig. 1 assesses the impact of the FDA approval, incentives, and mandate treatments on public vaccine confidence. As shown in the top panel of Fig. 1, none of the treatments significantly increased or decreased public confidence in the COVID-19 vaccines among all respondents. Learning that full FDA approval of the vaccines was expected within the year did little to boost confidence in the vaccines. Being informed that some employers and schools were considering mandating vaccination after full FDA approval did not have a corrosive effect on vaccine confidence. Similarly, incentive programs had no effect on vaccine confidence.

We then investigated heterogeneous treatment effects, focusing on those not yet vaccinated against COVID-19. The upper right panel of Fig. 1 estimates treatment effects for the 27% of our sample that reported not yet having received at least one dose of a vaccine. None of the treatments significantly increased or decreased vaccine confidence among the unvaccinated. Similarly, the bottom two panels show that none of the treatments significantly affected vaccine confidence among Black and Latinx respondents or among Republicans, demographic groups associated with lower COVID-19 vaccination rates [20–23].



**Fig. 1.** Effects of Mandate and Incentive Treatments on Vaccine Confidence. *Note:* Results obtained from OLS regressions including standard demographic controls reported in Supplemental Information. I-bars present 95% confidence intervals around each estimated treatment effect.

### 3.2. Self-reported effects of vaccine mandates on social and economic activities

Fig. 2 presents the self-reported effects of a vaccine mandate on respondent's likelihood of engaging in a range of social and economic activities. The upper left panel presents results for all respondents. For four out of the six activities examined, the modal answer was that a vaccine mandate would have little influence on the likelihood of engaging in a given activity. However, the percentage saying a mandate would make them more likely to engage in an activity was, on average, almost double the percentage saying a mandate would make them less likely to engage in an activity. The percentage of respondents saying a vaccine mandate would make them more likely to engage in an activity ranged from a low of 31.5% for attending church to a high of 48.0% for eating in a restaurant. A smaller, but substantively meaningful percentage of respondents replied that a vaccine mandate would make them less likely to engage in each activity. This effect ranged from 16.6% who said a mandate would make them less likely to report for work to a high of 22.3% who said a mandate would make them less likely to go to a movie theater.

Among those currently unvaccinated (top right quadrant), the pattern was sharply reversed. Approximately 10% said that a mandate would make them more likely to engage in each of the six activities, while between 35.0% (work) and 46.1% (sporting event) said a mandate would make them less likely to engage in the given activity.

Among demographic groups with lower levels of vaccination, more Republicans reported that mandates would make them less likely rather than more likely to participate in a range of activities

(bottom left panel). For example, the percentage of Republicans saying that a vaccine mandate would make them less likely to eat out in a restaurant was 30.1% compared to 27.6% who said that the mandate made them more likely to eat out. By contrast, 66.9% of Democrats said a mandate would make them more likely to eat out versus just 11.2% who said a mandate would make them less likely to do so (SI Fig. 2). Between 19% and 29% of Black and Latinx respondents answered that a mandate would make them less likely to engage in each of the six activities examined. However, between 35% and 48% said a mandate would actually increase their participation.

Finally, to investigate more directly whether mandates could plausibly incentivize vaccination, Fig. 3 summarizes responses among unvaccinated respondents by subgroup. Across subgroups, most unvaccinated respondents said that a mandate would either make them less likely or have no effect on their likelihood of participating in a range of economic and social activities. However, a significant share of unvaccinated Black and Latinx respondents – between 13.5% (attending sporting events) and 23.5% (eating out in a restaurant) – said that a mandate would make them more likely to engage in an activity. This suggests that mandates might encourage at least some Black and Latinx Americans to get vaccinated to return to normal life. By contrast among unvaccinated Republicans, the percentage saying a mandate would make them more likely to engage in an activity was very low, ranging from 4.5% (attend school) to 7.6% (eat out in a restaurant). Many more unvaccinated Democrats and Independents said that a mandate would make them more likely to engage in activities; however, in each case more than three quarters said a mandate would either have no effect or make them less likely to participate.

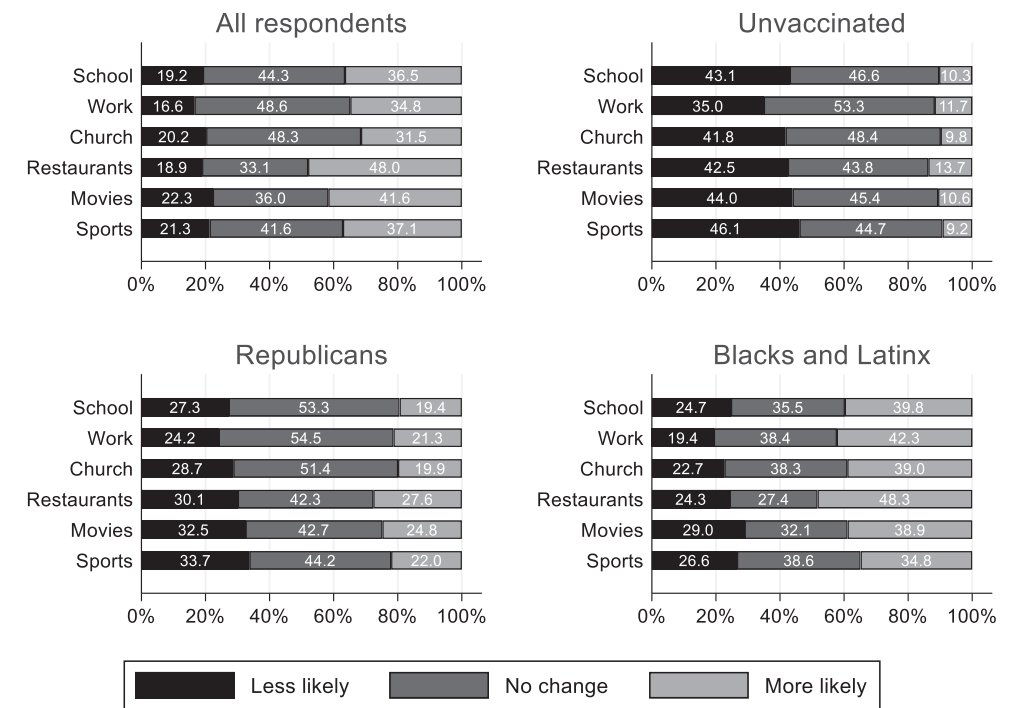


Fig. 2. Self-Reported Effect of Mandates on Behavior among All Respondents and Groups of Interest.

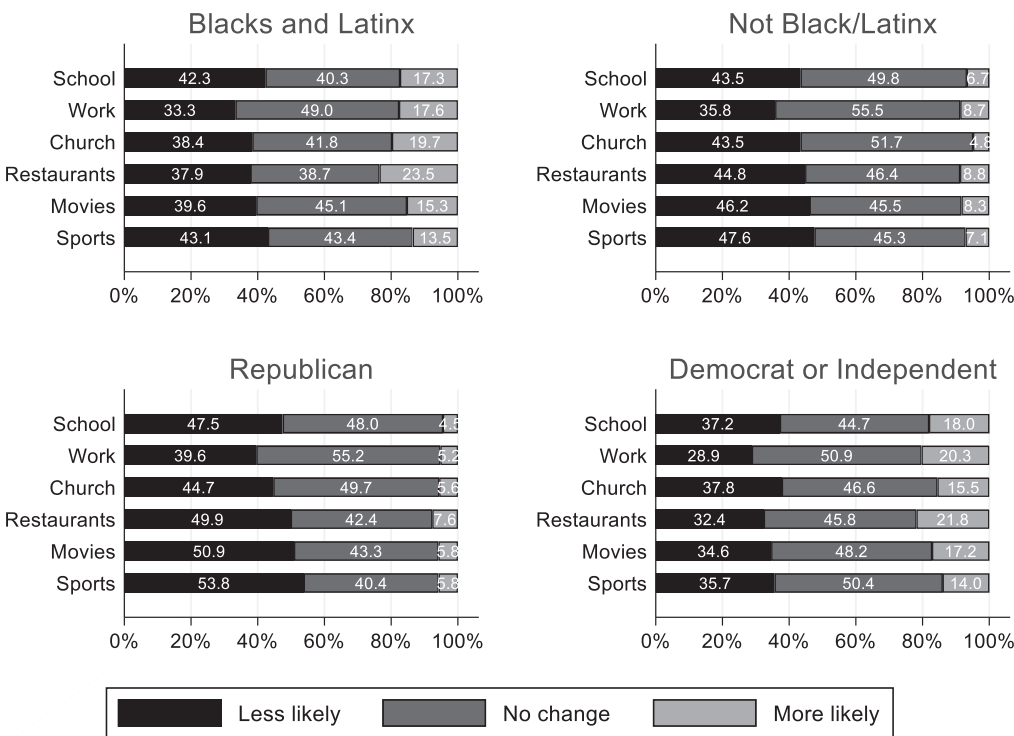


Fig. 3. Self-Reported Effect of Mandates on Behavior among Subgroups of Unvaccinated Respondents.

4. Discussion

Our experiment yielded several findings. First, we found little evidence that either vaccine mandates or incentives offered by schools and private enterprise would significantly improve or erode public confidence in the COVID-19 vaccines. Of course, school mandates, in particular, may be effective in targeted popu-

lations, as university COVID-19 mandates have been in the United States [24]. However, the impact on the broader population may be limited. Second, the experimental treatment informing respondents that the COVID-19 vaccines are likely to receive full FDA approval also did little to bolster vaccine confidence. Previous research suggests that the emergency use authorization may have depressed public

acceptance in the early stages of the vaccination campaign, an intuitive finding given that full authorization requires more systematic safety and efficacy data that should elicit higher degrees of trust [17,25,26]. However, our results suggest that at this advanced stage of the campaign, full FDA approval would not produce a surge of voluntary vaccinations. Indeed, observational evidence suggests that vaccine uptake did not experience a sustained surge after full FDA approval and that a range of other factors contribute to individual vaccination behaviors [27].

Finally, we found that vaccine mandates would likely affect participation in economic and social activities, but that these anticipated effects vary dramatically across subgroups of the population. For example, while significant percentages of vaccinated Americans and Democrats said that a vaccine mandate would make them more likely to re-engage in various aspects of pre-pandemic social and economic life, many fewer unvaccinated Americans and Republicans said the same. Instead, many Republicans (between one in four and one in three across categories) said that a vaccine mandate would make them less likely to engage in a range of activities where vaccination was required. Reported likely reactions to vaccine mandates among Black and Latinx respondents were mixed, but for all six activities the percentage of Black and Latinx respondents who said the mandate would make them more likely to engage exceeded the percentage who said a mandate would make them less likely to participate in the activity. Unvaccinated Black and Latinx respondents were significantly more likely than other unvaccinated subjects to say that a mandate would increase their likelihood of engaging in a range of activities. This suggests that mandates may help vaccination rates for some Americans of color; however, a strong majority of unvaccinated Black and Latinx subjects said that mandates would not affect their likelihood of engaging in a range of activities or even make them less likely to do so. These findings are consistent with prior research that showed more Republicans and Blacks viewed certain mandates as unacceptable than acceptable [9], although our research more directly looked at the possible backlash against mandates—specifically, the decision to opt out of economic and social activities.

A limitation of our analysis is that we can only examine self-reported attitudes and behaviors. Moreover, a single survey necessarily offers a snapshot in time; our survey was fielded before the surge of Delta-variant cases in the latter part of the 2021 summer and Omicron at the end of 2021, which prompted a new wave of proposed and actual vaccine mandates across Europe and in the United States to encourage more vaccinations and require them in many public spaces. As the medical and political situations evolve, so too may public attitudes and behaviors. We recommend follow-on study to understand changes in attitudes toward the vaccine and behaviors with respect to activities that have required COVID-19 vaccines. Fielding a comparable study outside the United States would also offer a useful comparative perspective. Governments imposing mandates should understand the particularities of the society's behavioral landscape and use the findings of analogous studies to inform meaningful interventions. For example, our research suggests that mandates that do go into effect in the US should be accompanied by persuasive communications targeted to specific information needs and identities; however other countries' or regions' mandates or interactions with specific populations might look altogether different and warrant different types of communications.

## CRediT authorship contribution statement

**S.E.Kreps:** Conceptualization, Formal analysis, Writing original draft and review and editing. **D.L.Kriner:** Conceptualization, Data

curation, Formal analysis, Writing original draft and review and editing.

## Data availability

All data and replication files are publicly available on the Harvard Dataverse at: <https://doi.org/10.7910/DVN/TEOGIO>.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2022.02.083>.

## References

- [1] Durbach N. *Bodily Matters: The Anti-Vaccination Movement in England, 1853–1907*. Duke University Press; 2005.
- [2] Omer SB, Betsch C, Leask J. Mandate vaccination with care. *Nature* 2019;571(7766):469–72.
- [3] Gostin LO, Shaw J, Salmon DA. Mandatory SARS-CoV-2 Vaccinations in K-12 Schools, Colleges/Universities, and Businesses. *JAMA - J Am Med Assoc* 2021;326(1):25. <https://doi.org/10.1001/jama.2021.9342>.
- [4] Abrevaya J, Mulligan K. Effectiveness of state-level vaccination mandates: Evidence from the varicella vaccine. *J Health Econ* 2011;30:966–76.
- [5] Stead M, Critchlow N, Eadie D, Sullivan F, Gravenhorst K, Dobbie F. Mandatory policies for influenza vaccination: Views of managers and healthcare workers in England. *Vaccine* 2019;37(1):69–75.
- [6] Lawler EC. Effectiveness of vaccination recommendations versus mandates: Evidence from the hepatitis A vaccine. *J Health Econ* 2017;52:45–62.
- [7] Cantor JD. Mandatory Measles Vaccination in New York City – Reflections on a Bold Experiment. *N Engl J Med* 2019;381(2):101–3.
- [8] Attwell K, Seth R, Beard F, Hendry A, Lawrence D. Financial Interventions to Increase Vaccine Coverage. *Pediatrics* 2020;146.
- [9] Largent EA, Persad G, Sengenito S, Glickman A, Boyle C, Emanuel EJ. US Public Attitudes Toward COVID-19 Vaccine Mandates. *JAMA Network Open* 2020;3(12):e2033324. <https://doi.org/10.1001/jamanetworkopen.2020.33324>.
- [10] Reuters. Factbox: Countries making COVID-19 vaccines mandatory. Reuters; 2021.
- [11] Gravagna K, Becker A, Valeris-Chacin R, Mohammed I, Tambe S, Awan FA, et al. Global assessment of national mandatory vaccination policies and consequences of non-compliance. *Vaccine* 2020;38(49):7865–73.
- [12] Mohiuddin F, Mohiuddin H. To Force or Not To Force: Analyzing The Implications of the Executive Employer Vaccine Mandate. *Houst Law Rev* 2021;12:25–49.
- [13] Attwell K, Rizzi M, McKenzie L, Carlson SJ, Roberts L, Tomkinson S, et al. COVID-19 vaccine Mandates: An Australian attitudinal study. *Vaccine* 2021.
- [14] Dennis JM. Technical overview of the AmeriSpeak panel: NORC's probability-based household panel, vol. 728; 2019. [https://scholar.google.com/scholar?hl=en&as\\_sdt=0%2C33&q=Technical+Overview+of+the+AmeriSpeak+Panel+NORC's+Probability-Based+Household+Panel.+&btnG=](https://scholar.google.com/scholar?hl=en&as_sdt=0%2C33&q=Technical+Overview+of+the+AmeriSpeak+Panel+NORC's+Probability-Based+Household+Panel.+&btnG=).
- [15] de Figueiredo A, Simas C, Karafillakis E, Paterson P, Larson HJ. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *Lancet* 2020;396(10255):898–908.
- [16] Larson HJ, de Figueiredo A, Xiaohong Z, Schulz WS, Verger P, Johnston IG, et al. The State of Vaccine Confidence 2016: Global Insights Through a 67-Country Survey. *EBioMedicine* 2016;12:295–301.
- [17] Kreps S, Prasad S, Brownstein JS, Hsuen Y, Garibaldi BT, Zhang B, et al. Factors Associated With US Adults' Likelihood of Accepting COVID-19 Vaccination. *JAMA Netw open* 2020;3(10):e2025594. <https://doi.org/10.1001/jamanetworkopen.2020.25594>.
- [18] Lin C, Tu P, Beitsch LM. Confidence and receptivity for covid-19 vaccines: A rapid systematic review. *Vaccines* 2021;9:1–32.
- [19] Motta M. Can a COVID-19 vaccine live up to Americans' expectations? A conjoint analysis of how vaccine characteristics influence vaccination intentions. *Soc Sci Med* 2021;272:113642. <https://doi.org/10.1016/j.socscimed.2020.113642>.
- [20] Troiano G, Nardi A. Vaccine hesitancy in the era of COVID-19. *Public Health* 2021;194:245–51.
- [21] Fridman A, Gershon R, Gneezy A. COVID-19 and vaccine hesitancy: A longitudinal study. *PLoS One* 2021;16:e0250123.
- [22] Razai MS, Osama T, McKechnie DGJ, Majeed A. Covid-19 vaccine hesitancy among ethnic minority groups. *BMJ* 2021;372.

- [23] Kreps SE, Kriner DL. Factors influencing Covid-19 vaccine acceptance across subgroups in the United States: Evidence from a conjoint experiment. *Vaccine* 2021;39(24):3250–8. <https://doi.org/10.1016/j.vaccine.2021.04.044>.
- [24] Thorp HH. Colleges need vaccine mandates. *Science* 2021;373(6553).
- [25] Guidry JPD et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am J Infect Control* 2021;49:137–42.
- [26] Gostin LO, Salmon DA, Larson HJ. Mandating COVID-19 Vaccines. *JAMA - J Am Med Assoc* 2021;325(6):532. <https://doi.org/10.1001/jama.2020.26553>.
- [27] Cohen E. Full FDA approval of Pfizer's Covid-19 vaccine had only a modest impact on uptake. Here's what mattered more - CNN. CNN.com; 2021. <https://www.cnn.com/2021/10/04/health/pfizer-covid-19-vaccine-approval-bump/index.html>.