State mask mandates and psychological reactance theory: The role of political partisanship and COVID-19 risk in mask adoption and resistance

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ARTICLE INFO	ABSTRACT
	Rationale: Psychological reactance theory was applied to examine the implications of state-level mask mandates in the United States during the COVID-19 pandemic. We evaluated the role of political partisanship and COVID-19 risk on changes in self-reported mask wearing before and after the imposition and removal of state mask mandates. *Method:* Secondary data from several sources were aggregated about self-reported mask wearing behavior, state mandates, COVID-19 infection rates, and state-level political partisanship. Difference-in-differences tests were performed using logistic regression to evaluate whether change in mask wearing behavior following the imposition or removal of a mandate was greater in states based on state-level political partisanship and COVID-19 infection rates. *Results:* Although mask adoption generally increased following mandates, the amount of increase was smaller in more Republican states compared to more Democratic states. Mask wearing generally decreased following the removal of mandates, with greater decreases when COVID-19 infection rates were lower. *Conclusion:* The results collectively offer insights about the nuanced role of contextual factors in the adoption and resistance to masks following state mask mandates. Partisanship was important in responses to the imposition of state mask mandates and COVID-19 risk played a critical role in responses to mandate removal.

One of the many societal changes initiated by the SARS-CoV-2 (COVID-19) pandemic has been the use of masks as a prevention strategy among the public in the United States. Starting in 2020, 38 states adopted mandates requiring the use of a mask covering one's nose and mouth in public spaces. The goal of such mandates was to mitigate the primary mechanism for spreading the COVID-19 virus and stem the pandemic. Public responses to masks and state mandates, however, were and remain divided. Observational and survey research indicate that, although large numbers of people adopted masks, others criticized or were unwilling to perform this health behavior (Haischer et al., 2020; Knotek et al., 2020; Rains et al., 2022). Efforts to understand resistance to mask mandates identified concern about personal freedom as an important factor (Taylor and Asmundson, 2021; Vargas and Sanchez, 2020). By mandating the use of masks in public spaces, state-level mandates restricted the public's autonomy to choose whether or not to wear a mask.

In this project, we endeavor to extend the body of research examining the implications of mask use and mask mandates as a prevention strategy during the pandemic. We use psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981) to evaluate changes in mask wearing following the imposition and removal of state mandates across the United States. Psychological reactance theory explains responses to freedom threats, including threats posed by a governmental mandate (Clee and Wicklund, 1980; Irmak et al., 2020). We consider factors associated with mask use adoption and resistance following the enactment and withdrawal of mandates. Although we generally expect mask adoption rates to increase following the imposition of mandates and decrease following their removal (Haischer et al., 2020; Knotek et al., 2020), we also expect the amount of change to differ among states based on COVID-19 risk as well as political partisanship. We test these possibilities using several public data sources, including 16 waves of a national survey from the beginning of the pandemic in April 2020 and ending in January 2022 (Lazer et al., 2022). The results of our project help to explain public responses to state mandates, offer insights about

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psychological reactance theory, and inform governmental efforts at disease prevention.

1. Mask mandates and restrictions to personal freedom

Between April and December 2020, 38 states in the United States enacted mandates requiring the use of face masks in public spaces to prevent the spread of COVID-19. Early research examining the effects of such mandates suggested substantial compliance among the public. An observational study in Wisconsin consisting of almost 10,000 shoppers showed that masked wearing increased from 40% to more than 90% after the imposition of a state or store mandate (Haischer et al., 2020). This pattern aligns with results from survey research (Knotek et al., 2020) and studies of mask-related discourse on social media (Pascual-Ferrá et al., 2021) indicating that masks tended to be viewed positively and widely used. In one analysis, tweets expressing pro-mask anger directed at others for failing to wear a mask significantly increased in 18 states following the imposition of mandates (Rains et al., 2022).

Despite relatively high levels of compliance overall, mask mandates represented a source of controversy that sparked resistance among some segments of the public. One survey showed that only 10% of respondents reported not wearing a face covering the last time they shopped. Most of that group, however, indicated being unwilling to wear a mask even if it was offered for free by the store (Knotek et al., 2020). A similar trend was observed in social media discourse about masks. During the second half of 2020, messages on Twitter containing anti-mask hashtags were much less common but more likely to include toxic (e.g., disrespectful, insulting) language compared to messages with pro-mask hashtags (Pascual-Ferrá et al., 2021). One explanation for some negative reactions to masks and mask mandates offered by scholars involves the role of personal freedom and a threat to established freedoms (i.e., not wearing a mask; Dillard et al., 2021; Rains et al., 2022; Scheid et al., 2020). Vargas and Sanchez (2020), for example, reported that the most prevalent reason people were resistant to mask wearing involved the belief in the "right as an American not to wear a mask." In another study, "feeling forced to wear a facemask" was shown to be the central belief in anti-mask attitudes (Taylor and Asmundson, 2021, p. 6).

Psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981) offers a framework to understand resistance to freedom threats and elimination of an established freedom. This theory is founded on the notion that people value personal freedom (Brehm, 1966). Anything that serves to limit a freedom is considered a freedom threat. For many, mask mandates represented a threat to their established freedom to not wear a mask (Dillard et al., 2021; Rains et al., 2022; Scheid et al., 2020). When an individual's freedom is threatened or lost, they experience a motivational state called reactance that then leads individuals to restore their freedom. Although restoration may take several forms (Quick and Stephenson, 2007), one primary mechanism is direct restoration in which people enact the behavior associated with the restricted freedom (i.e., boomerang effect).

Several scholars have argued that mask mandates could serve as a freedom threat and create reactance (Rains et al., 2022; Scheid et al., 2020). Through requiring mask wearing, state-level mask mandates limit the public's freedom to choose whether or not to wear a mask. Mandates usurp the public's autonomy to make decisions about their personal health—a freedom that Americans have increasingly come to perceive under their direct control (Reiser, 1985). In this way, mandates have the potential to create psychological reactance. Indeed, Brehm and Brehm (1981) describe the "passage of restrictive laws" as an example of a freedom threat (p. 4). Other researchers have similarly argued (Clee and Wickland, 1980) and shown (Irmak et al., 2020) that governmental mandates that restrict the public's freedom may create reactance. We apply psychological reactance theory to explain changes in mask wearing behavior following the imposition and removal of state mandates. We consider when and why state mandates were more and less successful in promoting mask use.

1.1. The imposition of state-level mask mandates

Although state-level mask mandates were intended to promote increased mask wearing, their effects were heterogenous. Mask wearing (Haischer et al., 2020) and pro-mask discourse on social media (Rains et al., 2022) generally increased following the imposition of mandates, but some researchers reported resistance (Knotek et al., 2020; Vargas and Sanchez, 2020). Psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981) offers a framework to understand such varying responses to mask mandates. The imposition of a mandate represents a freedom threat by limiting the public's autonomy to decide whether or not to wear a mask (Scheid et al., 2020). The magnitude of reactance experienced among the general public, however, should be contingent upon the importance of the threatened freedom (Brehm, 1966; Brehm and Brehm, 1981). The importance of any freedom depends on the degree to which it satisfies a need. In the context of mask wearing during the COVID-19 pandemic, two factors may have shaped freedom importance and can explain varying responses to mask mandates.

One factor likely to influence the importance of freedom related to mask wearing involves political partisanship. Scholars have argued that the conceptualization of freedom in psychological reactance theory and among political theorists follows a similar form (Dillard et al., 2021). This notion of personal freedom is particularly salient among Republicans who adopt a conservative political ideology and is common within conservative media rhetoric (Dillard et al., 2021). Researchers have reported positive associations between conservative ideology and perceived freedom threat or reactance (Chinn and Hart, 2021; Dillard et al., 2018) as well as conservative ideology and trait reactance (Chan and Lin, 2022). Scholars have also demonstrated that Republicans tend to be more sensitive to freedom threats stemming from governmental mandates than are Democrats. Irmak et al. (2020) showed that, following the imposition of a state mandate in California banning mobile phone use while driving, drivers in Republican leaning counties were more likely to increase this behavior compared to drivers in counties that were more Democratic. Researchers studying the COVID-19 pandemic further demonstrated that conservatives were more likely than liberals to hold anti-mask attitudes (Mallinas et al., 2021) as well as more likely to perceive a freedom threat and experience reactance in response to a campaign promoting mask wearing (Dillard et al., 2021). Other scholars found that political partisanship mediated the relationship between trait reactance and mask wearing behavior (Young et al., 2022).

Research examining political partisanship and reactance suggests that Republicans should be more sensitive than Democrats to state-level mask mandates. Because conservative ideology includes a greater concern with personal freedom (Dillard et al., 2021), Republicans should be more likely than Democrats to find state mandates freedom threatening and experience reactance (Irmak et al., 2020). In testing this and the remaining predictions, we follow prior research and focus on state-level differences in the prevalence of Republicans and Democrats (Irmak et al., 2020). We expect states with more Republicans be more likely to resist state mask mandates relative to states with more Democrats. Consistent with other research on mandates (Haischer et al., 2020; Knotek et al., 2020), we assume that mask wearing generally increased following mandates. Accordingly, our predictions focus on differences in the amount of change in mask wearing from before to after a mandate. The increase in mask wearing following the imposition of a state mandate should be smaller in more Republican states compared to more Democratic states.

H1. State political partisanship moderates the effect of state mandate imposition on mask wearing such that the increase in mask wearing following the adoption of a mandate will be smaller in more Republican states.

The risk posed by COVID-19 is a second factor that could influence public responses to state-level mask mandates. Risk generally involves

one's susceptibility to a health threat and the severity of the threat (Rimal and Real, 2003). Given the potentially deadly nature of COVID-19, we evaluate risk in terms of susceptibility and, more specifically, infection rates in a state at a particular point in time. As infection rates increase, the importance of one's autonomy related to mask wearing should generally decrease. Scholars have shown that mortality salience can mitigate perceptions of freedom threat (Bessarabova and Massey, 2020). The potential for death effectively outweighs concerns about personal freedom. In another study, researchers demonstrated that fear of the danger posed by COVID-19 was positively associated with pro-mask attitudes and negatively associated with anti-mask attitudes (Mallinas et al., 2021). These studies collectively indicate that the importance of autonomy related to mask wearing and resistance to mandates should be strongest when the risk posed by COVID-19 is low. As with the previous prediction, we evaluate the consequences of COVID-19 risk at the state level and in terms of the relative amount of increase in mask wearing following the imposition of a state mandate. The increase in mask wearing following a mandate will be smaller in states with lower COVID-19 infection rates than states with higher infection rates.

H2. COVID-19 risk moderates the effect of state mandate imposition on mask wearing such that the increase in mask wearing following the adoption of a mandate will be smaller as state COVID-19 infection rates decrease.

The risk posed by COVID-19 and political ideology may also interact to shape responses to state-level mask mandates. Among Republicans who are generally more concerned with personal freedom, relatively low COVID-19 infection rates may make state mandates seem especially intrusive and unwarranted. The importance of mask-related freedom should be strongest in this condition. Mandates should generate the greatest level of reactance in more Republican states when infection rates are low and result in lower levels of mask adoption compared to more Democratic states and states with higher rates of COVID-19.

H3. COVID-19 risk and political partisanship jointly impact the effect of state mandate imposition on mask wearing such that the smallest increase in mask wearing following the adoption of a mandate will be in more Republican states with relatively low COVID-19 infection rates.

1.2. The removal of state-level mask mandates

Beyond explaining the imposition of state mask mandates, psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981) can yield insights about responses following mandate removal. From the lens of this theory, the removal of mandates represents the restoration of a freedom. Removing a mask mandate restores the public's autonomy to make their own health decisions related to mask wearing in public. Freedom restoration has received attention from scholars studying reactance (Bessarabova et al., 2017; Miller et al., 2007; Quick and Stephenson, 2007; Richards et al., 2022). It has typically been examined in the form of a second message accompanying a freedom threat that serves to reestablish an audience's freedom by reminding individuals that they ultimately have autonomy over their decisions or actions (Miller et al., 2007). Whether placed before (Richards et al., 2022) or after (Bessarabova et al., 2017; Miller et al., 2007) a freedom threat, such restoration messages have been shown to reduce reactance within the context of print messages (for a discussion, see Quick et al., 2015).

In the context of mask mandates, the removal of a mandate should decrease mask wearing among the public in the same way that imposing a mandate generally increased this behavior (Haischer et al., 2020). Following psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981), however, the relative amount of decline in mask wearing should be greater when the freedom associated with mask wearing is more salient. Because Republicans are more sensitive to institutional mandates than Democrats (Irmak et al., 2020)—including COVID-19 restrictions (Dillard et al., 2021)—we expect a greater reduction in

mask wearing in Republican states relative to more Democratic states. Lower levels of COVID-19 risk should similarly make the freedom threat of mandates more salient and result in a larger reduction in mask wearing compared to states where the risk is greater. Finally, as with the imposition of state mandates, political ideology and COVID-19 risk should interact with the greatest decline in mask wearing following the removal of state mandates appearing in Republican states when COVID-19 risk is relatively low.

H4. State political partisanship moderates the effect of state mandate removal on mask wearing such that the decrease in mask wearing following the removal of a mandate will be greater in more Republican states.

H5. COVID-19 risk moderates the effect of state mandate removal on mask wearing such that the decrease in mask wearing following the removal of a mandate will be greater as state COVID-19 infection rates decrease.

H6. COVID-19 risk and political partisanship jointly impact the effect of state mandate removal on mask wearing such that the largest decrease in mask wearing following the removal of a mandate will be in more Republican states with relatively low COVID-19 infection rates.

2. Method

The hypotheses for this project were tested by aggregating publicly available data about mask wearing behavior, state mandates, COVID-19 infection rates, and state-level political partisanship from several different sources. Because this project consisted entirely of secondary data, it was exempt from Institutional Review Board review at the University of Arizona. Descriptive information for all study variables across each state in the sample can be found in Table 1.

2.1. Data

Survey data from the COVID States Project (Lazer et al., 2022) were aggregated to identify mask wearing behavior. Starting in April 2020, researchers at the COVID States Project began fielding rolling surveys to evaluate self-reported health behavior and perceptions regarding the pandemic among the public in the United States. The surveys were conducted by a professional survey firm and involved representative samples from each of the 50 states based on race, age, and gender. The data were weighted to match the United States population. The non-probability sampling approach adopted in the COVID States Project has been validated (Radford et al., 2021). The COVID States Project is led by academic researchers and funded by the National Science Foundation and other agencies; all information about the data used in this project was derived from the project website (https://www.covidstates.org/).

The data for this study consisted of 16 waves starting in April 2020 and concluding during January 2022. The first three waves were fielded during two-week periods, and the remaining waves were conducted over four-week periods. That total sample size across all waves was 347,596, with a mean of 21,725 respondents (SD = 2393) per wave. Participants in each wave were asked to indicate how closely they followed a series of health recommendations during the previous week (e.g., avoiding crowded places, hand washing frequently, mask wearing, etc.). Most relevant to this project, participants were asked to report about "wearing a face mask when outside of your home." Although participants were originally given four response options, responses were transformed into a dichotomous variable in the publicly available data shared by the COVID States Project. This variable indicated whether respondents did or did not follow mask wearing recommendations "very closely." Across all states and waves, 66.90% (SD = 10.70%) of respondents self-reported following *mask wearing* recommendations very closely outside of their home.

Table 1

Descriptive Data for States Before and After Mandates were Imposed and Rescinded.

State	Partisan.	Mandate start	Before mandate imposed					After mandate imposed				
			Survey waves	New infections		Mask wearing		Survey waves	New infections		Mask wearing	
				M	SD	M	SD		M	SD	M	SD
AL	−.25	7/16/2020	4	.08	.05	.53	.05	3	.22	.03	.73	.02
AR	−.28	7/20/2020	4	.07	.07	.46	.06	3	.25	.06	.70	.03
CA	.29	6/18/2020	3	.05	.01	.74	.02	3	.16	.07	.80	.01
CO	.13	7/17/2020	4	.06	.02	.61	.04	3	.12	.10	.72	.04
CT	.20	4/17/2020						4	.08	.06	.81	.02
DE	.19	January 5, 2020	1	.18		.61		4	.12	.05	.85	.03
IA	−.08	11/17/2020	3	.28	.13	.62	.08	2	.32	.20	.76	.01
IL	.17	January 5, 2020	1	.15		.52		4	.12	.06	.72	.05
IN	−.16	7/27/2020	3	.07	.02	.55	.01	3	.19	.10	.69	.01
KS	−.15	March 7, 2020	4	.06	.02	.48	.01	3	.18	.03	.70	.03
KY	−.26	October 7, 2020	4	.04	.00	.52	.07	3	.19	.08	.71	.01
LA	−.19	7/13/2020	4	.10	.03	.55	.07	3	.14	.04	.73	.02
MA	.33	June 5, 2020	1	.31		.65		3	.07	.06	.80	.01
MD	.33	4/18/2020						4	.12	.04	.81	.03
ME	.09	January 5, 2020	1	.02		.46		4	.02	.01	.64	.04
MI	.03	4/26/2020						4	.05	.02	.71	.04
MN	.07	7/25/2020	3	.09	.03	.46	.02	3	.19	.11	.71	.02
MS	−.17	May 8, 2020	4	.17	.13	.63	.08	2	.21	.07	.74	.00
MT	−.16	7/15/2020	4	.01	.01	.32	.02	3	.29	.28	.69	.05
NC	−.01	6/26/2020	3	.05	.02	.51	.07	3	.15	.03	.77	.02
ND	−.33	11/14/2020	3	.54	.40	.54	.05	1	.31		.71	
NH	.07	11/20/2020	2	.05	.03	.71	.06	2	.39	.23	.81	.05
NJ	.16	October 4, 2020						4	.17	.13	.79	.01
NM	.11	5/15/2020	1	.06		.42		4	.08	.04	.73	.09
NV	.02	6/25/2020	3	.04	.00	.61	.07	3	.22	.11	.83	.02
NY	.23	4/15/2020						4	.13	.12	.79	.03
OH	−.08	7/23/2020	4	.05	.01	.54	.07	3	.12	.06	.72	.02
OR	.16	January 7, 2020	4	.02	.02	.50	.03	3	.06	.01	.73	.00
PA	.01	4/17/2020						4	.06	.02	.76	.01
RI	.21	4/20/2020						4	.12	.08	.80	.04
TX	−.06	March 7, 2020	4	.06	.06	.63	.04	3	.24	.08	.80	.02
UT	−.20	September 11, 2020	3	.25	.16	.70	.05	1	.79		.77	
VA	.10	5/29/2020	2	.08	.02	.56	.03	3	.10	.03	.75	.04
VT	.35	January 8, 2020	4	.01	.00	.66	.04	3	.01	.01	.81	.02
WA	.19	6/26/2020	3	.03	.00	.50	.06	3	.08	.03	.78	.02
WI	.01	January 8, 2020	4	.08	.04	.50	.06	3	.35	.28	.67	.03
WV	−.39	July 7, 2020	4	.02	.00	.52	.03	3	.08	.02	.70	.01
WY	−.43	September 12, 2020	3	.59	.54	.51	.10	2	.30	.23	.61	.04

State	Partisan.	Mandate end	Before mandate rescinded					After mandate rescinded				
			Survey waves	New infections		Mask wearing		Survey waves	New infections		Mask wearing	
				M	SD	M	SD		M	SD	M	*SD*
AL	−.25	September 4, 2021	1	.21		.83		1	.03		.48	
AR	−.28	3/30/2021	2	.54	.40	.74	.01	2	.08	.04	.55	.18
CA	.29	January 3, 2022	1	2.03		.73						
CO	.13	5/14/2021	2	.24	.05	.76	.02	1	.08		.40	
CT	.20	2/28/2022	1	1.76		.73						
DE	.19	5/21/2021	2	.32	.00	.83	.03	1	.03		.54	
IA	−.08	July 2, 2021	2	.77	.44	.71	.09	1	.14		.69	
IL	.17	November 6, 2021	1	.23		.77		1	.28		.64	
IN	−.16	June 4, 2021	1	.17		.77		1	.04		.43	
KS	−.15	January 4, 2021	2	.46	.36	.75	.03	1	.04		.36	
KY	−.26	November 6, 2021	1	.12		.77		1	.86		.55	
LA	−.19	4/28/2021	1	.18		.76		1	.08		.48	
MA	.33	5/29/2021	1	.24		.82		1	.01		.45	
MD	.33	5/15/2021	2	.17	.02	.85	.08	1	.01		.60	
ME	.09	5/24/2021	2	.19	.09	.83	.03	1	.02		.36	
MI	.03	6/22/2021	1	.60		.74		1	.27		.46	
MN	.07	5/14/2021	2	.23	.13	.69	.05	1	.02		.31	
MS	−.17	9/30/2020	3	.26	.10	.74	.00	3	.45	.24	.75	.08
MT	−.16	December 2, 2021	2	.68	.35	.72	.00	1	.13		.60	
NC	−.01	5/14/2021	2	.24	.09	.78	.06	1	.03		.50	
ND	−.33	1/18/2021	3	.93	.59	.67	.06	2	.14	.06	.55	.06
NH	.07	4/16/2021	1	.24		.77		1	.02		.41	
NJ	.16	5/28/2021	1	.30		.83		1	.02		.61	
NM	.11	2/17/2022	2	1.09	.66	.68	.00					
NV	.02	October 2, 2022	2	.85	.93	.68	.08					
NY	.23	October 2, 2022	2	1.39	1.54	.69	.14					
OH	−.08	February 6, 2021	1	.15		.77		1	.02		.46	
OR	.16	6/30/2021	1	.16		.71		1	.44		.64	

(continued on next page)

Table 1 (*continued*)

State	Partisan.	Mandate end	Before mandate rescinded					After mandate rescinded				
			Survey waves	New infections		Mask wearing		Survey waves	New infections		Mask wearing	
				M	SD	M	SD		M	SD	M	*SD*
PA	.01	6/28/2021	1	.31		.76		1	.32		.51	
RI	.21	June 7, 2021	1	.31		.79		1	.29		.43	
TX	−.06	October 3, 2021	2	.49	.30	.81	.00	1	.11		.74	
UT	−.20	October 4, 2021	1	.25		.80		1	.10		.32	
VA	.10	5/15/2021	2	.22	.09	.81	.02	1	.02		.58	
VT	.35	6/14/2021	1	.18		.80		1	.28		.48	
WA	.19	December 3, 2022	1	1.51		.75						
WI	.01	3/31/2021	2	.31	.24	.73	.00	2	.07	.08	.53	.27
WV	−.39	6/20/2021	1	.21		.74		1	.91		.47	
WY	−.43	3/16/2021	2	.30	.23	.61	.04	1	.10		.47	

Note. Partisan. = state-level political partisanship; negative values indicate more Republicans and positive values indicate more Democrats. New infections are reported per 1 k and have not been transformed.

The start and end dates of state-level mask mandates for each the 38 states that imposed a mandate were acquired from Ballotpedia.org (Ballotpedia, 2022). States imposed mandates for as little as 56 days and up to 682 days, with a mean of 344.40 days (*SD* = 164.96). In a small number of cases, states (*n* = 5) discontinued their mandate only to reinstate it later. In these instances, we focused on the behavior of state residents during the initial mandate period.

COVID-19 risk was evaluated using state-level new infection rates during the time a COVID States Project survey was fielded. The Center for System Science and Engineering at Johns Hopkins University (Dong et al., 2020) consolidated infection rate data from state health departments for each state in the United States throughout the pandemic. We used these data to first determine the mean number of new COVID-19 cases in every state during the time period each COVID States Project survey was conducted. These values were then divided by population for each state, and then further divided by 1000. The final values for this variable reflected the mean daily COVID-19 *new infection rate* per 1000 residents for each state and survey period (*M* = 0.32, *SD* = 0.42). Because this variable was positively skewed (skew = 3.28), it was log transformed (skew = −0.66). The transformed variable was used in conducting all subsequent analyses.

State-level *political partisanship* was determined using the results from the 2020 United States presidential election (MIT Election Data and Science Lab, 2020). The proportion of votes garnered by Joe Biden and Donald Trump in each state were identified. A difference score was then created by subtracting the proportion of votes received by Biden from the proportion received by Trump. Positive values indicate that Biden received a greater proportion of the votes in a state and negative values indicate that Trump won a greater proportion (*M* = −.02, *SD* = 0.21); scores approaching zero indicate a relatively equal proportion of votes won by both Biden and Trump in a state. The use of presidential voting patterns to determine state-level political partisanship has been adopted in previous research exploring the implications of governmental mandates (Irmak et al., 2020).

2.2. Procedure for data analysis

Difference-in-differences tests were used to evaluate the hypotheses (Dimick and Ryan, 2014). This approach makes it possible to determine the effects of interventions and has been previously applied to examine responses to governmental mandates (Irmak et al., 2020). It involves using regression to estimate whether change in an outcome variable from before to after an intervention is different between groups. In this case, we evaluated whether change in mask wearing behavior following the imposition or removal of a mandate was greater in states based on state-level political partisanship and COVID-19 new infection rates.

The analyses were conducted using logistic regression. Our outcome variable was dichotomous, distinguishing people who did (assigned a

value of 1) or did not (assigned a value of 0) closely follow mask wearing recommendations outside of their home during the previous week. In order to standardize the amount of time before and after mask mandates, we limited the data to surveys conducted during 12-week periods (i.e., 84 days) surrounding the imposition and removal of mandates. For our analyses focusing on the imposition of mandates, we limited the data to survey waves from each state that terminated during the 84 days before or began during the 84 days after the mandate was imposed. This process was repeated for surveys conducted during the 84 days before and after a mandate was rescinded. This approach allowed us to ensure that the observation period was similar across each state. Data from survey waves conducted before the imposition/removal of a state mandate were assigned value of 0 and data from waves after the imposition/removal of a state mandate were assigned a value of 1.

The analyses proceeded as follows: a model was first tested including the variable representing whether the data were collected before or after the imposition of the mask mandate, state political partisanship, and new COVID-19 infections for each state. A second model was then tested with the previous variables and all two-way interaction terms included. A third and final model was evaluated in which the three-way interaction was added to the variables included in the previous model. This process was then repeated to evaluate the removal of state mask mandates. There were no missing data in the dataset constructed for this project. The analyses were conducted using R. The ggeffects (Lüdecke, 2018) and sjPlot (Lüdecke, 2021) packages were used to estimate predicted values from the models and build the tables, and the ggplot package (Wickham, 2016) was used to construct the figure. Data and syntax to replicate the analyses can be found on the Open Science Project webpage dedicated to this project: https://osf.io/yb2fz/

3. Results

3.1. Preliminary analyses

The analyses reported in Table 2 showed that mandates were associated with increased self-reported mask wearing. The odds of mask wearing were 1.98 times as likely after the imposition of state mandates. As anticipated, mask wearing was also greater in more Democratic states and when COVID-19 new infection rates increased. As reported in Table 3, mask wearing significantly decreased following the removal of mandates. The odds of mask wearing were lower (0.45 times as likely) after a mandate was rescinded. Mask wearing was again more likely in states that were more Democratic and as infection rates increased.

3.2. Imposition of state mandates

The first three hypotheses included predictions about the degree to which changes in mask wearing following state-level mask mandates

Table 2

Difference-in-differences logistic regression model predicting mask wearing following the imposition of state mandates.

	Model 1			Model 3			Model 3		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
(Intercept)	1.99	1.89–2.10	<0.001	2.00	1.87–2.14	<0.001	1.98	1.85–2.13	<0.001
New infection rate	1.15	1.13–1.17	<0.001	1.16	1.13–1.18	<0.001	1.15	1.13–1.18	<0.001
Mandate imposed (0 = before; 1 = after)	1.98	1.92–2.04	<0.001	1.83	1.67–2.01	<0.001	1.85	1.68–2.03	<0.001
Political ideology	2.63	2.43–2.85	<0.001	1.55	1.21–1.98	<0.001	1.44	1.09–1.91	0.010
New infection rate × Mandate imposed				0.97	0.93–1.00	0.064	0.97	0.93–1.00	0.057
New infection rate × Political partisanship				0.86	0.80–0.93	<0.001	0.84	0.77–0.92	<0.001
Mandate imposed × Political partisanship				1.33	1.12–1.58	0.001	1.64	1.09–2.48	0.018
New infection rate × Mandate imposed × Political partisanship							1.10	0.93–1.29	0.274

Notes. N = 89,078. *OR* = odds ratio. *95% CI* = 95% confidence interval. The outcome variable for the analyses was mask wearing. Larger values for political partisanship indicate states with more Democrats.

Table 3

Difference-in-differences logistic regression model predicting mask wearing following the removal of state mandates.

	Model 1			Model 2			Model 3		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	P
(Intercept)	3.24	3.13–3.36	<0.001	2.69	2.58–2.80	<0.001	2.66	2.54–2.77	<0.001
New infection rate	1.10	1.07–1.12	<0.001	0.90	0.87–0.93	<0.001	0.89	0.86–0.92	<0.001
Mandate rescinded (0 = before; 1 = after)	0.45	0.43–0.48	<0.001	0.72	0.66–0.79	<0.001	0.73	0.66–0.79	<0.001
Political partisanship	1.30	1.17–1.44	<0.001	1.58	1.35–1.86	<0.001	1.80	1.48–2.18	<0.001
New infection rate × Mandate rescinded				1.37	1.31–1.43	<0.001	1.38	1.32–1.44	<0.001
New infection rate × Political partisanship				0.93	0.84–1.02	0.137	1.07	0.92–1.25	0.375
Mandate rescinded × Political partisanship				0.73	0.56–0.95	0.020	0.51	0.34–0.76	0.001
New infection rate × Mandate rescinded × Political partisanship							0.79	0.65–0.96	0.020

Notes. N = 41,916. *OR* = odds ratio. *95% CI* = 95% confidence interval. The outcome variable for the analyses was mask wearing. Larger values for political partisanship indicate states with more Democrats.

differed based on state political partisanship (H1), risk of COVID-19 infection (H2), and the interaction between political partisanship and infection risk (H3). It is important to reiterate that these analyses are not concerned with demonstrating increased mask wearing following a mandate, but examine differences in mask wearing changes based on political partisanship and COVID-19 infection rates. The results from the difference-in-differences models can be found in Table 2. The results related to H1 and H2 appear in Model 2, and the results for H3 appear in Model 3.

There was a statistically significant interaction between the introduction of state mask mandates and political partisanship on self-reported mask wearing. This interaction was decomposed by examining the odds ratios reflecting change in mask wearing before and after mandates in Republican states where Trump received 20% more votes than Biden and Democratic states in which Biden received 20% more votes than Trump. These values were selected because they reflect solidly Republican and Democratic states. Although the odds of mask wearing after the imposition of mandates increased in both types of states, the odds of mask wearing were 1.89 times as likely after mandates in Republican states and 2.12 times as likely in Democratic states. Consistent with H1, the imposition of mandates led to a smaller increase in mask wearing in more Republican states than more Democratic states.

The *p*-value for the interaction reflecting differences in mask wearing following a mandate based on COVID-19 infection rates did not reach the conventional criterion for statistical significance (*p* = .06). H2 was not supported. The results were also inconsistent with H3. The three-way interaction between COVID-19 new infection rates, political partisanship, and mask mandates was not statistically significant. H3 was not supported.

3.3. Removal of state mask mandates

The final three hypotheses focused on mask wearing before and after mandates were rescinded. We predicted differences in the decline in mask wearing following the removal of mandates based on state political

partisanship (H4), risk of COVID-19 infection (H5), and the interaction between partisanship and risk (H6). The results related to H3 and H4 appear in Model 2 from Table 3, and the results for H3 appear in Model 3 from Table 3.

The two-way interactions between the removal of a mandate and both state political partisanship and COVID-19 new infection rates were both statistically significant. These two-way interactions, however, were qualified by a significant three way-interaction addressed in H6 (see Table 3, Model 3). Fig. 1 was constructed to decompose the three-way interaction. The probability of self-reported mask wearing before and after the removal of mandates were plotted in Republican states (i.e., Trump won by 20%) and Democratic states (i.e., Biden won by 20%) when case rates were at the mean (0.20 cases per 1 k residents) as well as one standard deviation below (0.06 cases per 1 k) and above (0.68 cases per 1 k) the log-transformed mean.

The results reported in Fig. 1 supported H5. Larger reductions in mask wearing were observed after the removal of mandates as COVID-19 infection rates decreased. As can be seen in the figure, decreases in the probability of self-reported mask wearing following the removal of mandates were greatest when COVID-19 infection rates were relatively low. As predicted in H6, the largest reduction in the probability of mask wearing occurred among Republican states when infection rates were low. The reduction in mask wearing among Republicans, however, was only slightly larger than among Democrats. Moreover, when COVID-19 new infection rates were high, this trend was reversed and Democratic states demonstrated a greater reduction in mask wearing. This pattern runs counter to H4 and is further considered in the discussion.

3.4. Robustness check

A robustness check was performed to determine whether the same findings hold when the time interval around the imposition or rescindment of mandates was adjusted. We re-conducted the analyses reported in Tables 2 and 3, limiting the data to surveys fielded six weeks before and after mandates were imposed and removed. We then re-conducted
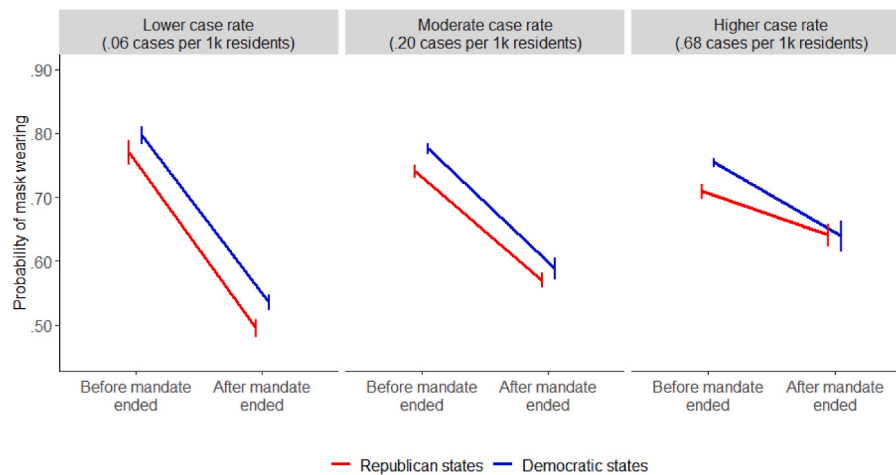
Note. The figure reports the predicted probability of mask wearing at different levels of infection rates among states with majorities of Republican or Democratic voters before and after the removal of mask mandates.

Fig. 1. Mask wearing following the removal of mandates in republican and democratic states at lower, moderate, and higher COVID-19 infection rates.

the analyses a second time with the data limited to surveys fielded six months before and after the imposition and removal mandates. The results from both sets of analyses followed the trends reported in this manuscript. Tables detailing the results can be found on the Open Science Foundation webpage dedicated to this project. The robustness check showed that the trends reported in this manuscript appeared as little as six weeks before and after mandates were imposed and removed and persisted up to six months before and after mandates.

4. Discussion

We used psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981) in this project to examine the implications of state mask mandates on self-reported mask wearing. Our results indicate that, although mask wearing generally increased following the imposition of mandates and decreased following their removal, there were differences in the amount of change based on state-level political partisanship and COVID-19 risk. The patterns in the results suggested that partisanship was particularly important in responses to the imposition of state mask mandates and COVID-19 risk played a critical role in responses to mandate removal. We consider these findings and their implications for psychological reactance theory and governmental efforts to promote public health in the following paragraphs.

4.1. The imposition and removal of state mandates

The results of this study indicate that self-reported mask wearing generally increased from the three months before to after a mandate in the 38 states that imposed a mask mandate. This pattern was observed after controlling for state-level political partisanship and COVID-19 risk evaluated in terms of new infection rates. The relative amount of increase, however, was contingent upon political partisanship. As states became more Republican, they exhibited a smaller increase in mask wearing following the imposition of mandates. There were no differences in responses to mandate imposition based on COVID-19 risk.

Self-reported mask wearing generally declined in the three months following the removal of mandates. As with the imposition of state mask mandates, responses to their removal were contingent. The decrease in mask wearing following the removal of mandates was generally smaller as COVID-19 infection rates increased. When COVID-19 infection risk was low, Republican states exhibited a slightly larger reduction in mask

wearing relative to more Democratic states. Contrary to our expectations, this trend was reversed when COVID-19 infection rates were relatively high and Republican states exhibited a smaller reduction than Democratic states in mask wearing.

4.2. Implications for psychological reactance theory

The findings from this project have several implications for psychological reactance theory (Brehm, 1966; Brehm and Brehm, 1981). At the most general level, the results demonstrate that responses to freedom threats are contingent upon the importance of a threatened freedom. In this case, responses to the imposition and removal of state mask mandates were contingent upon political partisanship and COVID-19 risk. The results further indicate that the effects of freedom importance can vary in nuanced ways based on the nature of a freedom threat. Across both sets of analyses we conducted, it appears that political partisanship generally played a more important role in responses to the imposition of mandates and COVID-19 risk was more salient in responses to mandate removal.

The importance of political partisanship in responses to the imposition of mandates is consistent with prior research (Irmak et al., 2020). People in more Republican states were less likely to adopt masks following the imposition of state mandates than people in more Democratic states. This trend extended to mandate removal, but only when COVID-19 risk was low. This pattern of results indicates that political partisanship could function to shape the importance of a freedom that has been threatened by a governmental mandate. The emphasis on liberty and personal autonomy in conservative ideology related to many—though certainly not all (e.g., abortion)—health issues may have led Republicans to be less likely to follow mask requirements. These results collectively inform psychological reactance theory by highlighting the role of political partisanship in making particular freedoms more or less important and subsequent threats to freedoms more or less salient. In the case of governmental mandates, it seems plausible that liberal ideology might similarly make freedoms related to other issues (e.g., abortion) salient and lead governmental restrictions via mandates to cause reactance. Examining this possibility is a valuable direction for future research.

The findings related to mandate removal also contribute to scholarship on psychological reactance theory. This project represents a rare test of the outcomes associated with restoring a freedom that had been

restricted over an extended period of time. Prior research examining freedom restoration has typically involved restoration messages delivered shortly before or after a freedom threat (Bessarabova et al., 2017; Miller et al., 2007; Richards et al., 2022). The results of this study show that restoring a freedom was associated with less mask wearing. They further illustrate the importance of health risk in responses to freedom restoration. The findings are consistent with recent research examining mortality salience (Bessarabova and Massey, 2020) and suggest that the risk posed by a COVID-19 infection offset the desire to restore one's freedom related to mask wearing. Although mask wearing declined following the removal of mandates, this trend was less pronounced when COVID-19 infection rates were relatively high. In addition to documenting the consequences associated with restoring a freedom, the results show that the desire to enact the restricted behavior is somewhat offset by a salient health risk.

In considering the implications of this project for psychological reactance theory, it is important to note one trend in the results related to mandate removal that did not conform with our predictions. When COVID-19 infection rates were relatively high, the reduction in mask wearing following the removal of mandates was greater in Democratic states than Republican states. Although we expected the difference to be small, we hypothesized that Republican states would have a greater reduction in mask wearing following mandate removal when COVID-19 risk was relatively high. One possible explanation for this unexpected pattern is that, in being more dismissive of governmental mandates, it may be that Republicans also dismissed their removal when COVID-19 infection rates were high. This could stem from conservative ideology encompassing autonomy over one's health decisions along with concerns about governmental intrusion and credibility related to health policy. Another possibility is that people in Democratic states might have experienced greater levels of pandemic fatigue that led them to be more sensitive to the removal of mandate restrictions. A final possibility involves community level vaccination rates. Higher vaccination rates in Democratic areas compared to Republican areas (Ye, 2021) may have led people in Democratic states to feel more comfortable reducing their mask wearing following the removal of mask mandates and be more sensitive to the freedom threat associated with mandates. Further examining the nuanced ways in which health risk and political partisanship intersect to shape responses to freedom restoration are a valuable direction for future scholarship.

4.3. Implications for health promotion

The findings from this project also inform governmental efforts aimed at promoting public health. Although using the legal system to encourage health behavior is a drastic step, mandates were generally effective in fostering increased mask wearing. There was, however, a notable divide based on political partisanship. Not only was there a smaller increase in mask wearing in conservative states following mandate imposition, but conservative states also had lower overall levels of mask wearing prior to and following the imposition of mandates. The results of this study highlight the inherit political nature of public health at both the state and federal level and underscore the limitations of politicizing public health behaviors. Additionally, it is a reminder that health policy cannot be based on science or expertise alone, but instead requires the consideration of values and democratic deliberation (Humphreys and Piot, 2012). Despite the potential of masks to reduce disease regardless of the political partisanship of the wearer, they were less likely to be adopted by one ideological group. In this way, political partisanship functioned as an important determinant of mask wearing during the COVID-19 pandemic.

The analyses examining mandate removal contribute further evidence documenting the utility of mandates in promoting mask wearing. The significant reduction in mask wearing following the removal of mandates (regardless of political party affiliation) signals that they were a central factor driving mask use. The results also underscore the

importance of the broader context in which mandates are removed. When the rate of COVID-19 infection was relatively high, the removal of a mandate resulted in the smallest decrease in mask wearing. This pattern offers some evidence that segments of the public saw value in masks as a prevention strategy and were motivated to wear them regardless of whether the behavior was mandated. As the future trajectory of this pandemic remains unclear, this analysis can serve as a contribution to the existing knowledge about the level of general adherence to mask wearing with and without mandates.

4.4. Limitations

The results of this study should be considered in light of a few limitations. One limitation involves our approach to measuring political partisanship. Our arguments regarding the implications of membership in the Republican Party for responses to mask mandates are grounded in conservative ideology. Our measure, however, focuses on voting patterns and does not directly tap ideology. Nonetheless, we believe it is reasonable to expect that states where more people voted Republican in a presidential election are likely to have more citizens who identify as conservatives. Future research examining the connection between mask wearing behavior, conservative ideology, and political partisanship would be valuable.

A second set of limitations stems from our use of data from the COVID States Project about mask wearing. Although the data shared by this group made it possible to examine mask wearing behavior in all 50 states over an extended period of time, there were several limitations. The structure of the data supplied by the COVID States Projects did not allow for the calculation of effect sizes associated with the models we tested. Additionally, mask wearing was originally measured as a continuous variable that was transformed to a dichotomous variable in the data made publicly available by the group. Similarly, the data did not capture objective mask wearing behavior but instead relied on self-reports of this behavior. Self-reporting is subject to under or over-reporting of certain behaviors and, in this particular study, made it impossible to distinguish between quality of masks. Future research evaluating more objective measures of mask wearing (e.g., mask sales) would be valuable as would efforts to examine governmental freedom threats and restoration addressing other health behaviors. A final limitation is that the difference-in-differences analysis (Dimick and Ryan, 2014) approach we adopted in this project did not involve including a random intercept for each state in our models.

5. Conclusion

The adoption of state-level mandates requiring mask wearing has been a defining feature of governmental responses to the COVID-19 pandemic in the United States. In this project, we leveraged psychological reactance theory to consider the implications of mask mandates for mask wearing. Our results underscore the role of freedom importance as determined by political partisanship and COVID-19 risk in explaining responses to mandates. Although self-reported mask wearing generally increased following mandates, we documented trends consistent with resistance in more Republican states. The decline in mask wearing following the removal of mandates varied based on COVID-19 infection rates. It is our hope that gaining insights about these nuanced responses to mask mandates will leave us better prepared to respond effectively to future threats to public health.

Data availability

A link to the data and script for analyses has been supplied in the article.

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