



Stony Brook University

Reactance to vaccine mandates

Vaccine mandates and emotions toward vaccines and public health officials on Twitter

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at COMPTExT 2023

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John Lamparski / NurPhoto / AP



Elon Musk 
@elonmusk



My pronouns are Prosecute/Fauci

5:58 AM · Dec 11, 2022

188.1K Retweets **35.4K** Quote Tweets **1.2M** Likes



Backlash against vaccine mandates?

Mandating vaccination is effective in increasing targeted vaccine uptake (Karaivanov et al. 2022), but

- It reduces self-reported willingness to be vaccinated in some respondents (Graeber, Schmidt-Petri, and Schröder 2021; Porat et al. 2021; Schmelz and Bowles 2022).
- It reduces the uptake of non-compulsory vaccines (Betsch and Böhm 2016).

In the U.S., during the pandemic,

- more Americans believe that harassing and threatening public health officials can be justified over time (Topazian et al. 2022).
- more than 30 states held back preventive health measures.
- the authority of state public health officials has been weakened by state legislatures in many states (Gostin and Wetter 2023).

Psychological reactance theory

Psychological reactance theory

- A motivational state aroused to regain a sense of freedom when *perceiving* a threat to freedom (Brehm 1966).

**WHAT IS
PSYCHOLOGICAL
REACTANCE**



Image/ Youtube channel @ProductivityGuy

Reactance Conditions

An individual believes that

1. they have freedom to make certain choices.
2. another actor intends to restrict their freedom of choice.

Consequences of reactance

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 - Considering the source of a threat to freedom to be less trustworthy, objective, and qualified (Smith 1977).
 - Engaging in aggressive behaviors, such as complaining and defaming the actor who uses coercion, as well as forming coalitions to combat a threat (Sittenthaler et al. 2015; McDermott 2017).

How vaccine mandates shape sentiments and emotions toward vaccines and public health officials on Twitter?

- Twitter plays a critical role in today's politics (Parmelee and Bichard 2012).
- Sentiments and emotions in tweets aggregated at the level of communities are consistent with self-reported survey (Pellert et al. 2022)

Hypotheses

Psychological reactance theory suggests that an individual who perceives vaccine mandates as a threat to freedom will tweet more negatively and angrily toward vaccines and public health officials.

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- Individual tweet: Tweets about vaccine mandates
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- Individual tweet: Tweets about vaccine mandates
 - are more likely to concern freedom than tweets not related to vaccine mandates.
 - are more negative and angry than the tweets not related to vaccine mandates.than non-mandate-related tweets.
- Aggregate level:
 - As vaccine mandates become more salient, tweets related to vaccines and public health officials will become more negative and angry.

Data

- 6,655,234 vaccine-related tweets from the U.S. between July 2021 and February 2022 by Twitter academic API track.
 - The location of the person who posted the tweet is identified
 1. a tweet's location tag (3.6%)
 2. a user profile's location (Beauchamp 2017)

Classify mandate-related tweets

- Use supervised learning methods to classify whether a tweet is about mandates.
- 3,499 random sample tweets were manually labeled as mandate-related or not to train a model.
 - Any type of vaccination policy that requires vaccination to avoid a restriction, such as vaccine requirements for work settings or activities imposed by government or private entities.
 - 884 mandate-related and 2615 non-mandate related

Classify mandate-related tweets

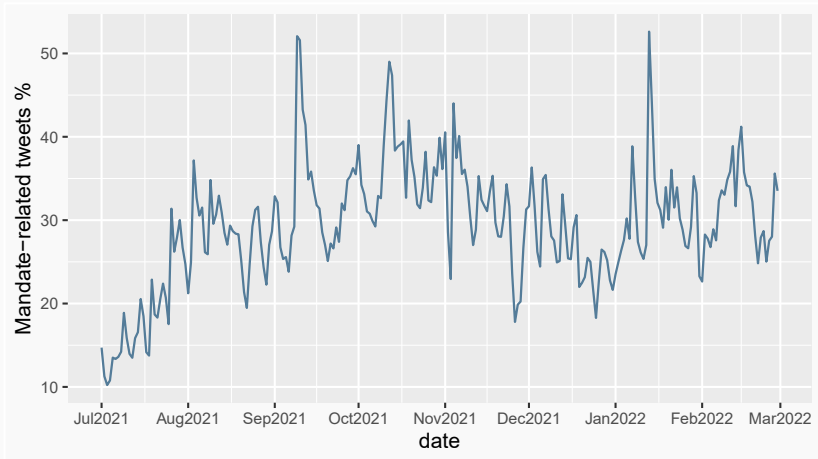
- BERTweet
 - Training set: 2449
 - Validation set: 524
 - Testing set: 526
- Naive Bayes, Logistic regression with elastic net regularization, and Support vector machine
 - Training set: 2973
 - Testing set: 526

Model performance

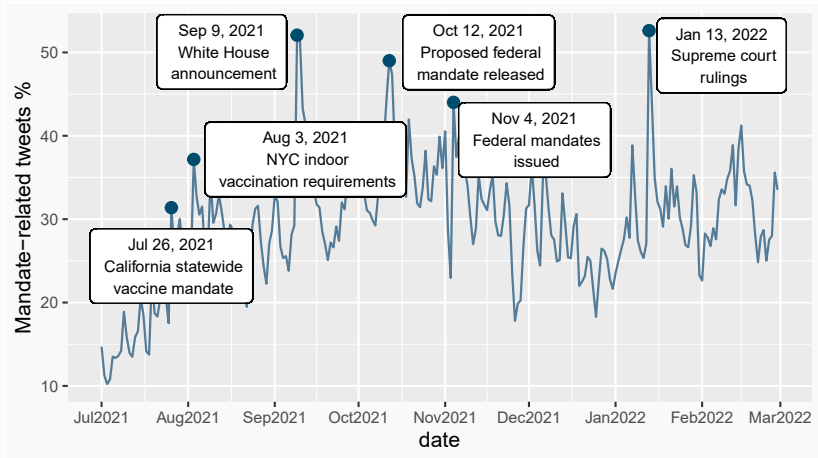
	Target f1	Accuracy
BERTweet	0.88	0.93
Naive Bayes	0.63	0.84
Logistic regression with elastic net	0.71	0.87
Support vector machine	0.8	0.91

- BERTweet identifies a total of 1,988,255 (29.87%) tweets related to mandates.

Daily trend of the percentage of mandate-related tweets



Daily trend of the percentage of mandate-related tweets



Other variables

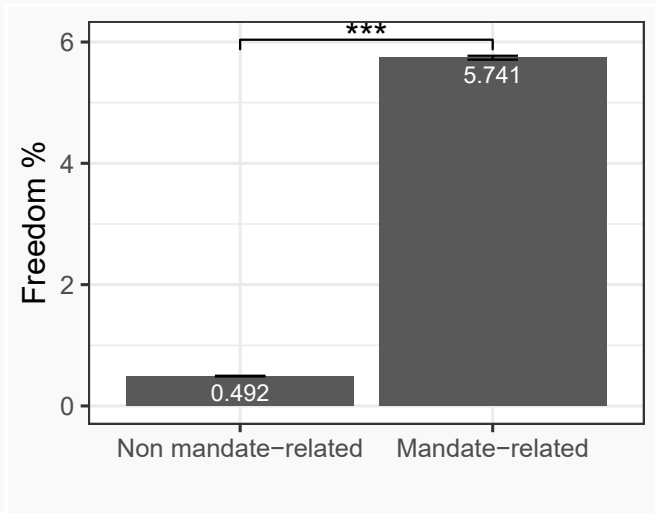
- Containing freedom words: 0 (No) or 1 (Yes)
 - Whether has the words *freedom, liberty, rights, choice*.
- Negative score: from 0 (not negative) to 1 (negative)
 - By the Valence Aware Dictionary and sEntiment Reasoner (VADER), a sentiment analysis tool that is specifically attuned to sentiments expressed in social media.
- Anger (0% to 100%):
 - The percentage of words related to anger from the National Research Council Canada (NRC) Word-Emotion Association Lexicon in a tweet.

Some example tweets

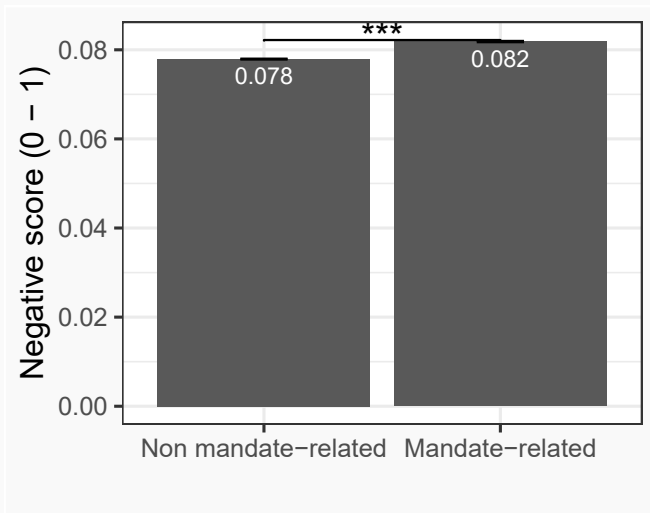
- "NYC requiring vaccination to do indoor things
..... 🙄 🙄 🙄 🙄 🙄 🙄 🙄 🙄 "
- Mandate-related, Negative score: 0.712 , Anger: 0
- "So Chris Rock got covid after being vaccinated but is telling us to get vaccinated? 🙄 🙄 🙄 🙄 "
- Non mandate-related, Negative score: 0.685 , Anger: 0
- "So nobody upset that you can't travel internationally without being vaccinated ? That's some bully/controlling/manipulating ass shit"
- Mandate-related, Negative score: 0.416, Anger: 15.8
- "AUTHORITARIAN TOTALITARIAN FASCIST BIDEN GOVT...STOP HIS INSANITY 🚫 🚫 🚫 🚫 🚫 🚫 Biden To Force Private Companies To Mandate Vaccinations, Weekly COVID Tests: Report <https://t.co/1oQhrAL8Zd>"
- Mandate-related, Negative score: 0.652, Anger: 30.77

Results

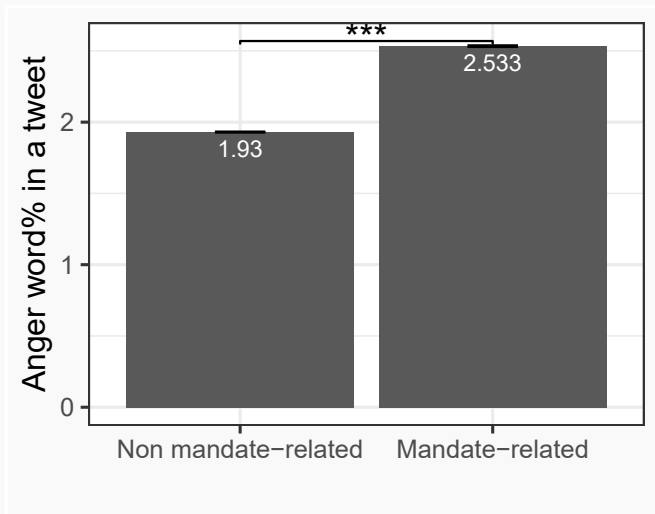
Were mandate-related tweets more likely to contain a freedom related word?



Were mandate-related tweets more negative on average?



Were mandate-related tweets angrier on average?



State-date level analysis

- When vaccination requirements is a salient issue in a particular state and date, whether tweets about vaccines and public health authorities are more negative and angrier.
 - Detect the salience of vaccine mandates by identifying where and when Twitter users tweeted about vaccination requirements (Beauchamp 2017).
 - 949,691 tweets about public health authorities with a state-level location between July 2021 and February 2022 by Twitter academic API track.

State-date level analysis

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 - 87% of the vaccine-related tweets can be located at the state level.

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- Other independent variables:
 - The log of the number of vaccine-related tweets per person, the log of the moving averages of new cases, deaths, and doses per person, the proportion of the fully vaccinated population in a state, and the weighted standard deviation across counties.

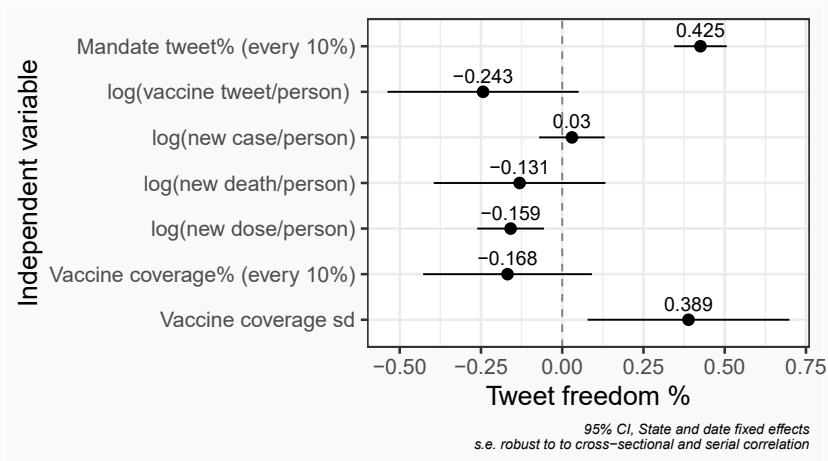
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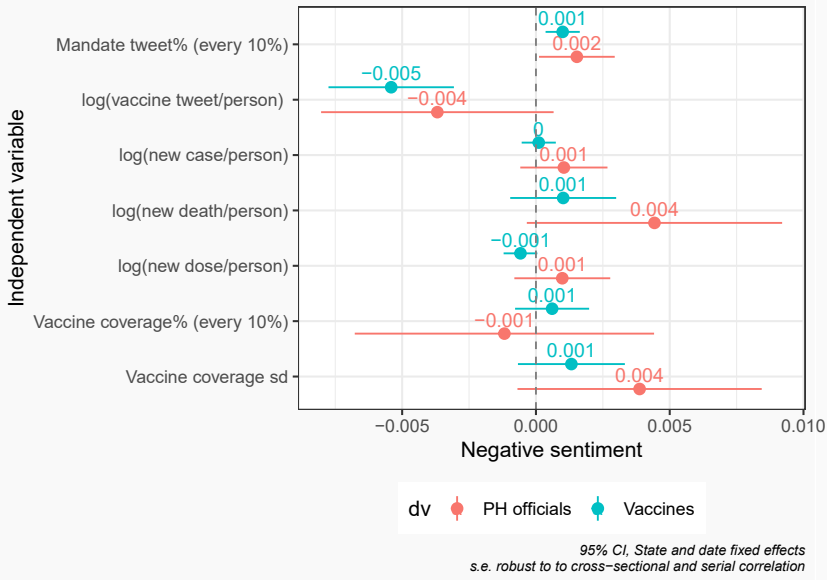
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- State and date fixed effects.

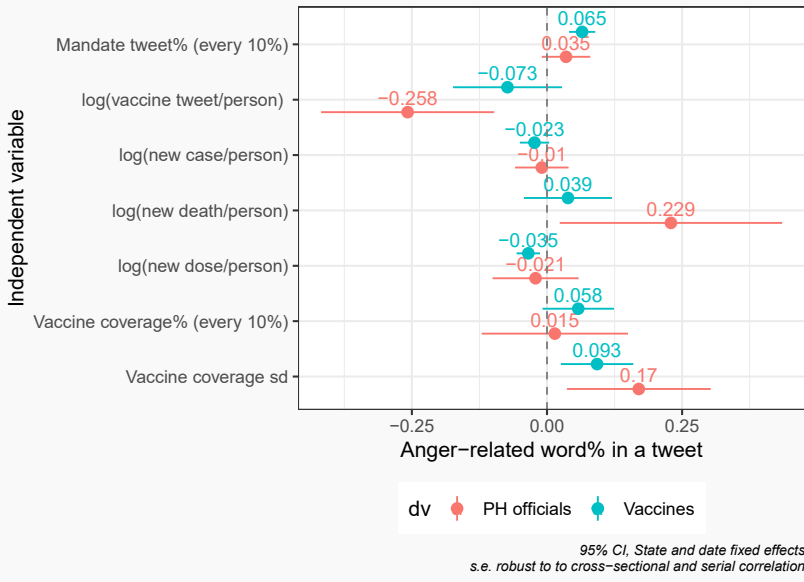
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- State and date fixed effects.
- Driscoll and Kraay (1998) panel Newey-West standard errors robust to cross-sectional and serial correlation.

Were vaccine-related tweets more likely to contain a freedom-related word when vaccine mandates were more salient?







Takeaways

- Mandate-related tweets
 - were more likely to mention a freedom-related word
 - were more negative and angrier on averagethen other vaccine-related tweets.
- When mandatory vaccination was a more salient issue in a state and date,
 - freedom-related words was more likely to be mentioned.
 - vaccine-related tweets were more negative and angrier on average.
 - tweets related to public health authorities were more negative on average, but were not angrier on average.

Thank you.

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Twitter: [@PeiHsunHsieh](https://twitter.com/PeiHsunHsieh)

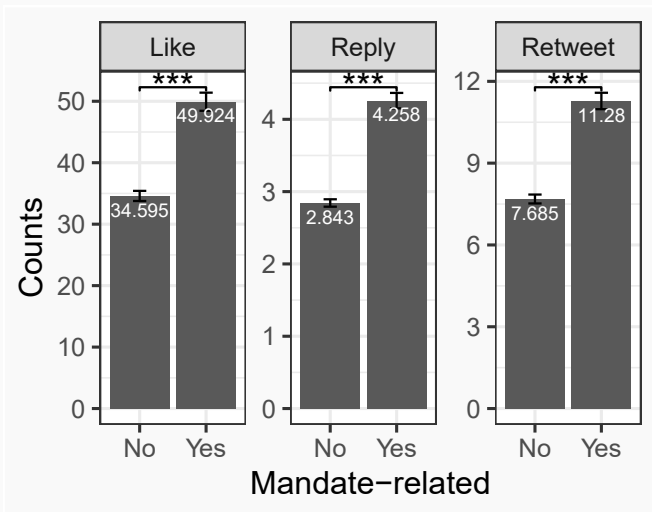
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Supplemental materials

Popularity



Keywords

- Vaccine-related: vaccine, vaccines, vaccinate, vaccinates, vaccinated, vaccinating, vaccination, vaccinations, vaccinemandate, vaccinemandates
- Public authority related: fauci, anthonyfauci, drfauci, fauci, anthonyfauci, drfauci, #FireFauci, #ArrestFauci, cdc, #cdc OR CDCgov OR "Centers for Disease Control"

Confusion matrix

True label \ Predicted label	Non mandate related	Mandate related
	Nonmandate related	69.2% \ 71.29% \ 72.24% \ 71.48%
Mandate related	2.85% \ 13.69% \ 11.60% \ 7.60%	23.95% \ 13.12% \ 15.21% \ 19.20%

Table 1: BerTweet/Naive Bayes/Logistic regression with elastic net/Support Vector Machine

	no mandat* in text	mandat* in text
Non mandate related	4661592 (99.87%)	6049 (0.13%)
Mandate related	1180493 (59.37%)	807762 (40.63%)

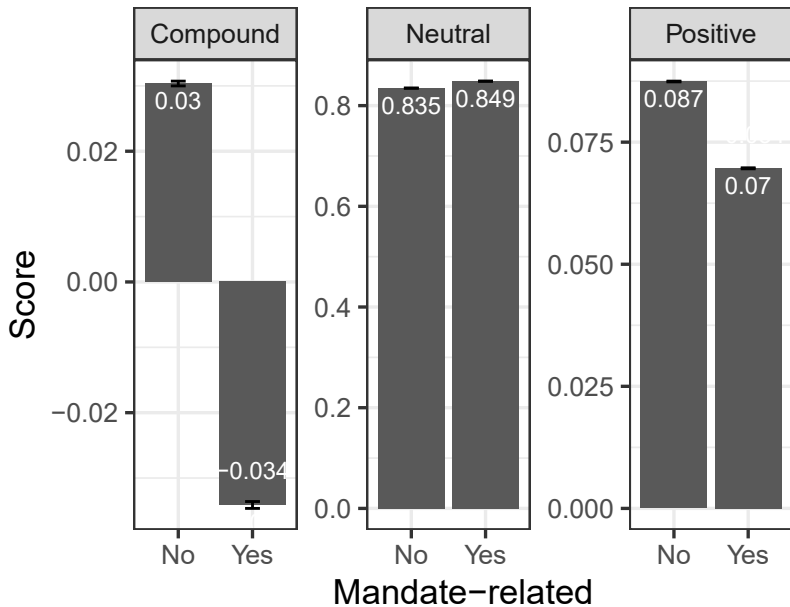
	Non verified	Verified
User N	949526 (96.173%)	37785 (3.827%)
Tweet N	5730380 (86.103%)	924854 (13.897%)

- Freedom-related
 - Yes: 137094 (2.060%), No: 6518893 (97.94%)
- Negative score
 - mean: 0.07909, median: 0.03600, sd: 0.102, Quartile: 0, 0.138
- Anger-related words%
 - mean: 2.11%, median: 0, sd: 3.71, Quartile: 0, 3.448

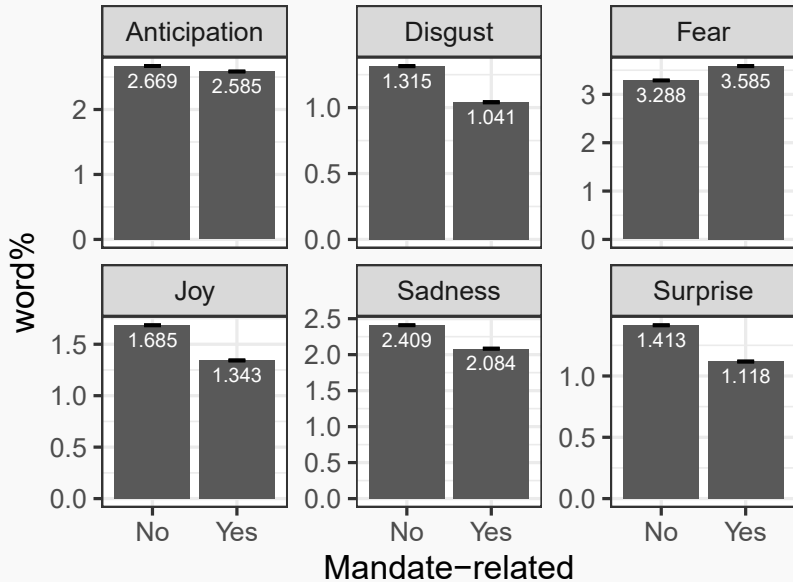
State-date level descriptive

- Mandate tweet%
 - mean: 28.35%, median: 27.96%, sd: 9.312, Quartile: 22.33%, 33.78%
- Negative score of vaccine-related tweet
 - mean: 0.07935, median: 0.07906, sd: 0.0144, Quartile: 0.0706, 0.0877
- Anger-related words% of vaccine-related tweet
 - mean: 2.138%, median: 2.088%, sd: 0.515, Quartile: 1.187%, 2.393%
- Negative score of public health authority related tweets
 - mean: 0.08645, median: 0.08397, sd: 0.0342, Quartile: 0.0665, 0.103
- Anger-related words% of public health authority related tweets
 - mean: 1.827%, median: 1.678%, sd: 1.100, Quartile: 1.211%, 2.265%

Sentiments



Emotions



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