Belief in misinformation and acceptance of COVID-19 vaccine boosters: A survey analysis

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A B S T R A C T

Objective: This study examines the impact of misinformation belief on the willingness of American adults to receive ongoing COVID-19 vaccine boosters.

Methods: A representative survey of 600 adults in the state of Florida was fielded in August of 2023. For this study, responses were analyzed for the 443 previously vaccinated respondents in that sample using both descriptive and inferential statistical methods.

Results: Among previously vaccinated individuals, belief in misinformation remained relatively high. 49% of respondents believe that COVID-19 vaccines contain a live strain of the virus, and roughly 40% believe that vaccines can cause you to "get sick" with COVID-19. Belief in misinformation was associated with a statistically significant decrease in the likelihood of receiving ongoing vaccine boosters, *ceteris paribus.*

Conclusion: While confidence in public health guidelines is the most compelling determinant of vaccine acceptance, misinformation continues to undermine vaccination efforts. Addressing common myths about COVID-19 vaccines may help to improve booster shot acceptance among previously vaccinated Americans.

Innovation: Throughout the COVID-19 pandemic, health professionals and public health agencies have been forced to innovate in real-time, as digital platforms have fueled the spread of viral misinformation. This study aims to inform these efforts by exploring and deepening our understanding of the impact that belief in misinformation has on vaccination behaviors.

1. Introduction

According to the Centers for Disease Control (CDC), nearly 8 in 10 American adults have received a primary series of COVID-19 vaccinations [1]. However, data simultaneously show high levels of belief in vaccine-related misinformation, even among those who have completed the primary inoculation series [2,3]. Despite concerted efforts on the part of public health experts to counter the spread of viral misinformation [4,5], recent survey data suggest that several false narratives about the constitution and efficacy of COVID-19 vaccines have persisted in spite of significant scientific evidence proving their effectiveness [3,6]. While health officials have emphasized the importance of ongoing vaccine boosters in maintaining immunity against SARS-CoV-2 infections [7] – and prior research has found trust in health information to be a critical determinant of booster shot acceptance [8,9] – it remains unclear if or to what extent belief in misinformation affects the willingness of previously vaccinated individuals to accept regular COVID-19 booster shots.

In this *Brief Communication* report, we examine how belief in misinformation impacts booster acceptance behaviors among American adults. Statistical analysis was conducted on survey responses from 443 previously vaccinated adults (drawn from an initial sample of 600). Respondents were asked to rate the accuracy of 11 separate statements about COVID-19 vaccines, with 8 of these statements including claims classified by the CDC as "false" [10]. Building on prior studies [8,9], we also controlled for several key factors known to influence vaccine hesitancy, including (a) trust in public health officials, (b) personal demographics, (c) educational attainment, and (d) political affiliation. The findings help us to better understand the impact of belief in misinformation on booster vaccination behaviors, while also highlighting the most pervasive misinformation themes in an effort to inform future public health communication efforts.

2. Methods

Initially, we surveyed 600 adults in the state of Florida using a sample purchased through an online panel vendor (Prodege MR). Respondents were identified using a stratified, quota sampling approach to ensure representativeness of the state's population based on age, gender, race/ethnicity, and political affiliation. Only those respondents who were previously vaccinated against COVID-19 are included in this study ($n = 443$). In keeping with prior research [8, 9], respondents were asked how likely they would be to receive "annual" COVID-19 booster shots "if they are recommended by public health officials": (a) "very likely", (b) "somewhat likely", (c) "not very likely", and (d) "not at all likely".

Additionally, respondents were asked to rate the accuracy of 11 statements about COVID-19 vaccines, 8 of which have been classified as "false" by the CDC (see Table 2 below). The misinformation themes included in this analysis were selected based on a review of guidance from the CDC [10], as well as the peer-reviewed medical literature [11,12]. Response options for each statement included (a) "definitely false", (b) "probably false", (c) "probably true", and (d) "definitely true". Responses for the 8 false statements were numerically coded (where "definitely false" = 0, through "definitely true" = 3) and summed, resulting in a continuous measure ranging from 0 to 24 ($x^- = 9.04$, $\sigma = 5.25$). A quality control question was included in this section of the survey to ensure response quality. While these measures are combined – for ease of analysis – into a continuous variable, they are not intended to represent a comprehensive accounting of all vaccine-related misinformation, nor are they intended to assess the broader question of what drives "belief in misinformation" as a theoretical concept.

To measure how belief in misinformation affects vaccination behavior, we fitted a binary logistic regression model, controlling for other known predictors of vaccine hesitancy. Given the focus of this analysis on booster shot acceptance – as well as the well-documented efficacy of SARS-CoV-2 vaccines [13] – the model measured the likelihood of a respondent being "very likely" to receive annual vaccine boosters (coded as 1). All other responses were coded as 0. Consistent with prior studies [8,9], respondents who said that they were only "somewhat likely" to receive annual booster shots were combined with those who indicated that they were unlikely to do so, as this suggests some degree of vaccine hesitancy, which could be influenced by belief in misinformation. Additional measures were included for (a) confidence in public health guidance, (b) political affiliation, (c) education, and (d) a vector of personal demographic characteristics (see Table 3 below).

3. Results

Among the survey respondents, 74.2% indicated that they had received at least one dose of a COVID-19 vaccine ($n = 443$). Among this group, 41.2% indicated that they would be "very likely" to receive regular COVID-19 booster shots if they were recommended by public health officials, while another 26.9% said that they would be "somewhat likely" to do the same. Conversely, 31.2% of previously vaccinated Americans indicated that they would be either "not very likely" or "not at all likely" to receive regular vaccine boosters, even if they were recommended by public health officials (Table 1).

Table 1
How likely would you be to receive regular COVID-19 booster shots (i.e., every year) if they are recommended by public health officials?

	Frequency	Percentage
Very Likely	186	41.8
Somewhat Likely	120	26.9
Not Very Likely	74	16.6
Not at All Likely	65	14.6

Question was only asked to those who have received at least one dose of a COVD-19 vaccine. (N = 445).

When asked to rate the accuracy of common claims about COVID-19 vaccines, respondents indicated significant levels of belief in several vaccine-related misinformation themes (Table 2). The most commonly believed misinformation themes pertained to the constitution of COVID-19 vaccines and the mechanisms through which they induce an immunological response to the SARS-CoV-2 virus. For example, 51.0% of respondents said that it was either "definitely" or "probably true" that getting sick with COVID-19 would result in stronger immunity than vaccination, while 49.0% expressed belief that COVID-19 vaccines "contain a live strain of the virus." Among the less commonly believed (but more conspiratorial) beliefs was the persistent myth that COVID-19 vaccines contain microchips (14.1%) and that COVID-19 vaccines alter the recipient's DNA (26.2%). A full summary of responses is contained in Table 2.

Table 3 summarizes the results of a logit regression model examining the effect of misinformation belief on the likelihood of accepting regular vaccine boosters, *ceteris paribus*. Belief in misinformation was associated with a statistically significant decrease in the likelihood of booster shot acceptance, where a 1 unit increase on the misinformation belief variable was associated with an 8% *decrease* in the likelihood of booster shot acceptance ($1/e^b = 1.083$). As such, a one standard deviation increase in misinformation belief ($\sigma = 5.25$) was associated with a 43% *decrease* in the likelihood that a respondent would accept regular vaccine boosters.

Consistent with prior studies [8,9], we also observed a very strong and significant relationship between booster shot acceptance and a respondent's trust in the COVID-19 guidance provided by public health agencies such as the CDC. Those who were "very confident" in the guidance provided by the CDC were 42.2 times *more* likely to indicate that they would accept regular vaccine boosters when compared to those who were "not at all confident" in public health guidance ($e^b = 42.23$). A smaller but statistically significant effect was also associated with age, wherein the likelihood of accepting vaccine boosters increased 1.024 for each one year increase in age. This is relatively unsurprising, as older Americans have been more susceptible to severe COVID-19 infections and more accepting of vaccines over the course of the pandemic [14].

Additionally, political affiliation was a significant predictor of booster shot acceptance, with previously vaccinated Republicans being

Table 2
Belief in Vaccine-Related Misinformation (as % of row total).

	Definitely False (0)	Probably False (1)	Probably True (2)	Definitely True (3)
Getting sick with COVID-19 builds better immunity than getting a vaccine.	19.3	29.7	34.5	16.5
COVID-19 vaccines are causing new variants of the virus to emerge.	21.2	37.3	29.8	11.7
COVID-19 vaccines alter your DNA.	39.7	34.2	20.2	6.0
COVID-19 vaccines contain a "live strain" of the virus.	28.0	23.0	36.7	12.3
COVID-19 vaccines contain microchips.	62.8	23.0	11.8	2.3
COVID-19 vaccines can cause infertility.	35.8	40.7	19.5	4.0
Vaccines can cause you to get sick with COVID-19.	31.7	26.7	29.8	11.8
Getting a COVID-19 vaccine will cause you to temporarily test "positive" for the virus.	19.2	38.7	34.2	8.0

Question was only asked to those who have received at least one dose of a COVD-19 vaccine. (N = 445).

Table 3
Logistic Regression: Likelihood of Booster Shot Hesitancy ($n = 455$).

	e^b	β	s.e.
Misinformation Belief (scale)	0.923**	−0.080	0.032
Confidence in public health guidance			
Not at all confident	–	–	–
Not very confident	0.553	−0.592	0.569
Somewhat confident	5.215**	1.651**	4.109
Very confident	42.229***	3.743***	34.316
Gender (Female)	1.130	0.123	0.295
Age	1.024**	0.024**	0.009
Hispanic (Yes)	0.602**	−0.507**	0.190
Race			
White	–	–	–
African American	0.626	−0.468	0.242
Other	0.684	−0.379	0.305
Four-year degree or higher	1.342	0.294	0.356
Political Affiliation			
Democrats	–	–	–
Independents	0.909	−0.096	0.321
Republicans	0.517*	−0.659*	0.200
Non-Voters	1.129	0.121	0.517
Constant	0.031**	−2.956**	0.034
-2LL	−194.511	–	–
Pseudo R^2	0.353	–	–

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$.

nearly two times *less* likely than Democrats to say that they would be "very likely" to receive regular vaccine boosters ($1/e^b = 1.93$). This is consistent with patterns of politicization observed throughout the COVID-19 pandemic, wherein Republican voters have exhibited greater vaccine hesitancy than their political counterparts [15,16]. Finally – consistent with the findings of prior research [17] – Hispanic respondents were 1.66 times ($1/e^b$) *less* likely to say that they would accept regular booster shots than their non-Hispanic counterparts.

4. Discussion

Despite hopes that public sentiments would eventually coalesce around a shared, scientific understanding on COVID-19 vaccines, misinformation surrounding the constitution and efficacy of COVID-19 vaccines continues to undermine vaccination efforts. While the most commonly believed myths about COVID-19 vaccines may not be pernicious or conspiratorial in nature, the evidence presented above suggests that overall belief in misinformation has a negative and statistically significant impact on American's vaccine behaviors, namely booster shot acceptance. Specifically, a one standard deviation increase in misinformation belief was associated with a 43% *decrease* in the likelihood of receiving regular COVID-19 vaccine boosters.

Consistent with previous research [8,9], our findings also suggest a strong association between trust in public health guidance and booster shot acceptance. Specifically, respondents who reported being "very confident" in the guidance provided by the CDC were 42.2 times more likely than respondents who were "not at all confident" to accept regular vaccine boosters. This finding is not surprising given that prior research has found a strong link between vaccine hesitancy and trust in government [18], including specifically trust in national public health officials [19]. With aggregate trust in government reaching historic lows [20], widespread belief in misinformation and subsequent vaccine hesitancy are consistent with our understanding of the current medical literature. In sum, this means that the implications of both general and specific health-related trust in government can impact the actions and behaviors of Americans, especially as it relates to vaccine adoption. Given this finding, it may be beneficial for federal agencies like the CDC to partner with local healthcare providers, public health agencies, and/or universities when releasing vaccine recommendations, as evidence has suggested that "localized" communication strategies may be more effective for building trust and overcoming vaccine hesitancy [21].

While politicized and conspiratorial misinformation remains problematic, the most commonly believed myths deal primarily with the constitution of COVID-19 vaccines and the underlying mechanisms through which they promote immunological responses. For instance, more than half of the survey respondents expressed a belief that getting sick with COVID-19 will build better immunity than a vaccine (51%), while 49% believed that COVID-19 vaccines contain a live strain of the virus, and roughly 40% believe that vaccines are causing new variants of the virus to emerge and that vaccines can cause you to "get sick" with COVID-19.

4.1. Innovation

The World Health Organization (WHO) noted in September 2020 that COVID-19 "is the first pandemic in history in which technology and social media are being used on a massive scale to keep people safe, informed, productive and connected" [22]. While social media have been shown to provide some important benefits, particularly for those actively infected with the SARS-CoV-2 virus [23], evidence also shows that platforms such as Facebook and Twitter have contributed to the politicization of COVID-19, as well as the viral spread of misinformation. As a result, health professionals have been forced to learn and innovate in real-time to combat the evolving challenges and threats associated with the digital *infodemic*. This study contributes to these necessary innovations by exploring and deepening our understanding of the impact that belief in misinformation has on vaccination behaviors.

5. Conclusion

Despite efforts on the part of public health officials to promote accurate and reliable information about SARS-CoV-2 vaccines, belief in misinformation remains widespread – even among previously vaccinated individuals – and negatively impacts individuals' willingness to receive regular vaccine boosters. Given the patterns of misinformation belief observed in this study, additional efforts are needed to address common myths about the make-up of COVID-19 vaccines and the mechanisms through which they promote an immunological response to the virus. Future research examining this relationship in a longitudinal context would help to deepen our understanding of this key relationship as misinformation evolves and continues to proliferate in digital spaces. Moreover, we opted in this case only to focus on respondents' levels of belief in false statements. However, including respondents' levels of belief in true/accurate statements about COVID-19 vaccines in future studies could help to deepen our understanding of this critical relationship.

CRediT authorship contribution statement

Stephen R. Neely: Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kaila Witkowski:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization.

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.

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