

# Letter to the Editor: Assessing Behavioral Economic-Based Approaches to Address COVID-19 Vaccine Hesitancy

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**A**LTHOUGH CONFIDENCE in coronavirus disease-2019 (COVID-19) vaccines is increasing, vaccine hesitancy remains prevalent; a May 2021 poll reported that 22% of Americans “probably or definitely will not” get vaccinated (AP-NORC Center for Public Affairs Research, 2021; Coustasse et al., 2021). While receiving vaccinations may be rational, human behavior is influenced by social, cognitive, and emotional factors. The study of these factors is encompassed by behavioral economics; application of principles, such as anchors, framing, and probability biases, can help health care professionals positively influence patients' decisions and increase vaccination coverage (Davis & Feldman, 2014). We assessed the impact of various behavioral economic concepts on perspectives on the COVID-19 vaccine.

## METHODS

Institutional review board approval was obtained. Subjects 18 years and older from the United States were recruited using Amazon Mechanical Turk (MTurk), an online crowdsourcing platform used extensively in social science research (Buhrmester et al., 2011). Subjects were randomly assigned 1 of 7 narratives, which provided information about COVID-19 vaccination using behavioral

economic concepts such as framing, tailored messaging, and engagement (see Supplemental Table 1, available at: <http://links.lww.com/JACM/A103>). Patients completed prenarrative and postnarrative questionnaires.

Survey response durations of 90 seconds or less were excluded from analysis ( $n = 57$ ). For participants who responded of “neutral” or “not willing/comfortable” to receive the COVID-19 vaccine at baseline, prenarrative and postnarrative responses were compared. Fisher’s exact tests were performed to test for statistical significance.

## RESULTS

Demographic data for responses ( $n = 306$ ) were analyzed (Table 1). Most participants had received a vaccination in the past (90.5%), were comfortable or willing to receive a flu shot in the past (61.1%), and “strongly” or “slightly willing/comfortable” receiving a COVID-19 vaccine (59.1%); 16.3% of participants had already received a COVID-19 vaccine (Table 2).

Demographic data for 118 unvaccinated participants with a baseline response of “neutral” or “not willing/comfortable” receiving the COVID-19 vaccination were compared to all participants. Participants ages 18 to 30 years had the highest percentage of participants “neutral/not willing/comfortable” receiving the vaccination (37/78, 47%). American Indian or Alaska Native (2/2, 100%), Native Hawaiian or other Pacific Islander (1/1, 100%), and Black or African American (16/32, 50%) participants, or those who practiced other religions (7/13, 53.9%) or Christianity (79/170, 46.5%) were less likely to be willing to receive the vaccination. A majority of participants who completed less than a high school degree (2/2, 100%) or “other” (eg, associate’s degrees and vocational school) (15/23, 65.2%) were “neutral/not willing/comfortable” receiving the vaccination. Participants from the Midwest had the highest vaccine hesitancy (27/55, 49.1%) of all regions. Hesitancy to receive the COVID-19 vaccine occurred with participants who had received vaccinations

in the past (104/277, 37.6%) and were willing/comfortable receiving an annual flu shot (40/187, 21.4%).

Most participants had no change in their comfort or concern between their prenarrative and postnarrative responses (Table 3). There were no statistically significant differences between the narratives and changes in willingness/comfort receiving the COVID-19 vaccine ( $P > .05$ ).

Concerns about the safety of the COVID-19 vaccine for the relatable narrative (narrative C) differed from the unrelatable narrative (narrative D) ( $P < .05$ ); the relatable narrative resulted in 3 participants (18%) becoming more concerned regarding safety, while the unrelatable narrative resulted in 4 participants (29%) becoming less concerned. More participants were less concerned about the immediate and short-term adverse effects after reading an expert opinion with engagement than expert opinion alone (25% vs 0%;  $P < .05$ ). No other narratives for questions 2 to 6 yielded statistically significantly different response distributions ( $P > .05$ ).

## DISCUSSION

Human behavior is complex and influenced by factors outside one’s immediate awareness. Behavioral economics acknowledges people have limited attention and willpower and tend to make irrational decisions that lead to suboptimal outcomes (Soofi et al., 2020). While behavioral economics are well-established in economics and politics, its use is nascent in medicine (Davis & Feldman, 2014). Behavioral economics may be useful in educating the public about COVID-19 vaccination (Soofi et al., 2020).

We employed framing, anchoring, and addressing probability biases to present subjects with scientific information and a table with statistics. Framing was applied to illustrate the safety of the COVID vaccine and the size of its clinical trial. By stating adverse effects were controlled by an over-the-counter medication, we created an anchor to highlight the mildness of the side effects. We

**Table 1.** Demographic Data for Vaccine Hesitancy Survey Respondents

<b>Demographic</b>	<b>All Participants (%)</b>	<b>Unvaccinated or Unwilling to Be Vaccinated (%)</b>	<b>Percentage of Unwilling/All</b>
<b>Gender</b>			
Male	107 (35.0)	41 (34.8)	38.3%
Female	198 (64.7)	76 (64.4)	38.4%
Other	1 (0.327)	1 (0.847)	100%
<b>Age</b>			
18-30	78 (25.5)	37 (31.4)	47.4%
31-40	101 (33.0)	41 (34.8)	40.6%
41-50	55 (18.0)	13 (11.0)	23.6%
51-60	39 (12.8)	16 (13.6)	41.0%
61-70	26 (8.50)	8 (6.78)	30.8%
71-80	7 (2.29)	3 (2.54)	42.9%
<b>Race</b>			
White	213 (69.6)	84 (71.2)	39.4%
Black or African American	32 (10.5)	16 (13.6)	50.0%
Asian	35 (11.4)	9 (7.63)	25.7%
Hispanic or Latino	20 (6.54)	6 (5.08)	30.0%
American Indian or Alaska Native	2 (0.654)	2 (1.69)	100%
Native Hawaiian or other Pacific Islander	1 (0.327)	1 (0.847)	100%
Other	3 (0.980)	0 (0)	0%
<b>Religion</b>			
Buddhism	9 (2.94)	2 (1.69)	22.2%
Christian	170 (55.6)	79 (67.0)	46.5%
Folk religion	3 (0.980)	1 (0.847)	33.3%
Hindu	6 (1.96)	1 (0.847)	16.7%
Jewish	7 (2.29)	0 (0)	0%
Muslim	3 (0.980)	1 (0.847)	33.3%
Other	13 (4.25)	7 (5.93)	53.9%
I am not religious	95 (31.1)	27 (22.9)	28.4%
<b>Education</b>			
Master's degree (eg, MA, MS, and MEd)	47 (15.4)	13 (11.0)	27.7%
Bachelor's degree (eg, BA and BS)	131 (42.8)	44 (37.3)	33.6%
High school degree or equivalent	91 (29.7)	40 (33.0)	44.0%
Doctorate (eg, PhD and EdD)	12 (3.92)	4 (3.39)	33.3%
Less than a high school diploma	2 (0.654)	2 (1.69)	100%
Other	23 (7.52)	15 (12.7)	65.2%
<b>Region</b>			
Midwest	55 (18.0)	27 (22.9)	49.1%
Northeast	67 (21.9)	24 (20.3)	35.8%
Southeast	91 (29.7)	34 (28.8)	37.4%
Southwest	33 (11.0)	13 (11.0)	39.4%
West	60 (19.6)	20 (17.0)	33.3%

addressed probability biases by illustrating the size of the clinical trial and framing the efficacy appropriately. These did not statistically significantly reduce concerns regarding the vaccine.

Tailored messaging can influence health behavior (Kreuter et al., 2000; Noar et al., 2007). However, most participants in our study had no change in their comfort or concerns with the COVID-19 vaccination, regardless of the

**Table 2.** Baseline Questions Regarding Participants’ Perspective on Vaccines

Question	Response	Participants (%)	Unvaccinated or Unwilling to be Vaccinated (%)	Percentage of Unwilling/All
Have you received a vaccine in the past?	Yes	277 (90.5)	104 (88.1)	37.6%
	Maybe	3 (0.980)	1 (0.847)	33.3%
	No	26 (8.50)	13 (11.0)	50.0%
Have you received the COVID-19 vaccine	Yes	50 (16.3)	0 (0)	0%
	No	256 (83.7)	0 (0)	0%
Looking back, how willing/comfortable were you to receive a flu shot in the past	Strongly <i>not</i> willing/comfortable	44 (14.4)	35 (29.7)	79.6%
	Slightly <i>not</i> willing/comfortable	41 (13.4)	24 (20.3)	58.5%
	Neutral	34 (11.1)	19 (16.1)	55.9%
	Slightly willing/comfortable	65 (21.2)	20 (17.0)	30.8%
	Strongly willing/comfortable	122 (39.9)	20 (17.0)	16.4%
How willing/comfortable are you to receive a COVID-19 vaccine? (prenarrative)	Strongly <i>not</i> willing/comfortable	59 (19.3)	58 (49.2)	98.3%
	Slightly <i>not</i> willing/comfortable	43 (14.0)	40 (33.9)	93.0%
	Neutral	23 (7.52)	20 (17.0)	87.0%
	Slightly willing/comfortable	50 (16.3)	0 (0)	0%
	Strongly willing/comfortable	131 (42.8)	0 (0)	0%

narrative. Participants were less concerned about short-term adverse effects ( $P = .27$ ), effectiveness ( $P = .61$ ), and getting infected ( $P = .24$ ) after reading the unrelatable narrative than reading the relatable narrative, but the differences were small and not statistically significantly different.

Engaging patients in their care creates a sense of personal investment and can drive behavior (Davis & Feldman, 2014). However, expert opinion with participant engagement did not statistically significantly reduce concerns about the safety, long-term and short-term side effects of the vaccine compared to expert opinion alone.

The last narrative assessed the impact of framing, as it pertains to an aversion to “unnatural” interventions. COVID-19 vaccines were framed as a way to produce antibodies

that are “naturally” created after an infection. It had the largest percentage of participants report increased comfortable/willing to receive the COVID-19 vaccine.

Although a majority of participants had no change between their pre- and postnarrative responses, the demographic data in this study may help inform future interventional efforts. For example, Black participants were less likely to be willing to receive the vaccine than other races. The Black population has a historical lack of trust in the health care system, and may benefit from tailored messaging (Thompson et al., 2021).

Web-based surveys have limitations. Our narratives were communicated solely through text, and face-to-face conversations may afford an additional layer of interaction. While we were not able to monitor participants’ attention levels or effort, we excluded

**Table 3.** Number and Percentage of Participants With Changes in Question Responses Based on Narratives

Question	Narrative	A (%)	B (%)	C (%)	D (%)	E (%)	F (%)	G (%)
1. How willing/comfortable are you to receive a COVID-19 vaccine?	No change	15 (83)	17 (77)	12 (71)	9 (64)	16 (84)	9 (75)	11 (69)
	More comfortable/willing	3 (17)	3 (14)	5 (29)	4 (29)	3 (16)	2 (17)	5 (31)
	Less comfortable/willing	0 (0)	2 (9)	0 (0)	1 (7)	0 (0)	1 (8)	0 (0)
2. Are you concerned about the safety of the COVID-19 vaccine?	No change	12 (67)	19 (86)	14 (82)	10 (71)	16 (84)	8 (67)	12 (75)
	More concerned	1 (6)	1 (5)	3 (18)	0 (0)	1 (5)	1 (8)	2 (13)
	Less concerned	5 (28)	2 (9)	0 (0)	4 (29)	2 (11)	3 (25)	2 (13)
3. Are you concerned about immediate or short-term adverse effects of the COVID-19 vaccine?	No change	15 (83)	20 (91)	14 (82)	11 (79)	18 (95)	8 (67)	14 (88)
	More concerned	0 (0)	0 (0)	2 (12)	0 (0)	1 (5)	1 (8)	1 (6)
	Less concerned	3 (17)	2 (9)	1 (6)	3 (21)	0 (0)	3 (25)	1 (6)
4. Are you concerned about unknown long-term effects of the COVID-19 vaccine?	No change	16 (89)	19 (86)	13 (76)	12 (86)	16 (84)	10 (83)	12 (75)
	More concerned	0 (0)	1 (5)	2 (12)	1 (7)	1 (5)	0 (0)	1 (6)
	Less concerned	2 (11)	2 (9)	2 (12)	1 (7)	2 (11)	2 (17)	3 (19)
5. Are you concerned about the effectiveness of the COVID-19 vaccine?	No change	13 (72)	15 (68)	11 (65)	7 (50)	14 (74)	11 (92)	12 (75)
	More concerned	2 (11)	1 (5)	3 (18)	2 (14)	1 (5)	1 (8)	2 (13)
	Less concerned	3 (17)	6 (27)	3 (18)	5 (36)	4 (21)	0 (0)	2 (13)
6. Are you concerned about getting COVID-19 from the vaccine?	No change	15 (83)	18 (82)	13 (76)	9 (64)	12 (63)	9 (75)	13 (81)
	More concerned	3 (17)	2 (9)	3 (18)	1 (7)	2 (11)	2 (17)	1 (6)
	Less concerned	0 (0)	2 (9)	1 (6)	4 (29)	5 (26)	1 (8)	2 (13)

responses with durations 90 seconds or less to attenuate the potential impacts of data collected from unengaged participants. Our small sample size may have hindered our ability to detect statistically significant differences.

While concerns regarding immediate and short-term adverse effects may be assuaged by behavioral economic interventions, identifying effective methods of improving willingness/comfort in receiving the COVID-19 vaccine remains a challenge.

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