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Perceived longevity of mRNA technology increases support for Covid-19 vaccines

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ABSTRACT

Among the reasons for Covid-19 mRNA vaccine hesitancy are the vaccines' relative newness and, consequentially, concerns about their risks and safety. In this research, we address these reasons by manipulating the perceived longevity of the technology underlying mRNA Covid-19 vaccines (i.e., how long participants think these technologies have been in existence). An internet sample of American adults ($N = 433$) was shown one of the two versions of a timeline of medical events with 'creation of mRNA vaccines' placed to its left or right. The placement of mRNA vaccine creation on the left-end of the timeline resulted in Covid-19 mRNA vaccines being judged as older and - when participants' vaccination status was accounted for - better. Participants' vaccine status did not moderate the impact of longevity on vaccine support. Implications and limitations are discussed.

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Longevity bias; COVID-19; persuasion; vaccine hesitancy

On 17 May 2022, the United States hit a grim milestone of 1,000,000 deaths due to the SARS CoV-2 virus. Worldwide, the number of deaths has surpassed 6 million. Even though safe and effective vaccines are widely available, many have remained hesitant – and even hostile – to the idea of taking them. For the sake of personal and public health, it is important to find ways that encourage openness to efficacious medical treatments, including vaccines.

Several approaches have been taken to overcome Covid-19 vaccine hesitancy including persuasive communication, incentives, and mandates. Regarding persuasive communication and incentives, results have been mixed (Acharya & Dhakal, 2021; James et al., 2021; Kachurka et al., 2021; Walkey et al., 2021). In the present research, we describe a novel means by which Covid-19 vaccine support might be increased. Specifically, we focus on the framing of Covid-19 vaccine technology as relatively old vs. new, to test whether changes in perceptions of vaccine longevity might increase their support.

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Perceived longevity, goodness, and rightness

As an extension of the observation that people conflate existence with what is good, right, and ought to be (Eidelman et al., 2009; Hume, 2020/1888), Eidelman and colleagues posited that longer time in existence of an entity increases perceptions of its goodness and rightness (Eidelman & Crandall, 2014; Eidelman et al., 2010). Following the attributional principle of augmentation (Kelley, 1971) and quasi-evolutionary logic undergirding notions of ‘survival of the fittest,’ these researchers argued that people intuitively enhance the goodness and value of entities that withstand the tests of time; entities that exist for longer should be perceived as ‘better.’ Eidelman and Crandall (2014) referred to this process as a longevity bias.

Accumulating evidence supports these claims. Preference for an institutional requirement, the beauty of art and nature, and the taste of a piece of chocolate all increased when participants were led to believe these entities (or the company that produced it, in the case of chocolate) were longer standing (Eidelman et al., 2010). In another study, participants reported less social distance from a religion described as older vs. newer, an effect driven by changes in perceptions of the religion’s legitimacy due to longevity (Warner & Kiddoo, 2014). Food crops described as older are more willing to be eaten, and judged as more natural, beneficial, and morally good, compared to their more recent, but otherwise identical, counterparts (Inbar et al., 2020), and longer-standing consumer products are perceived as having better quality, an effect that is enhanced when participants believe there is more competition in the marketplace (Pecot & Merchant, 2022).

Even negative stimuli benefit from longer time in existence. Interrogation techniques commonly described as torture were judged as more effective, and people were more accepting of them, when framed as older (Crandall et al., 2009). Inequitable social arrangements (e.g., the Indian Caste system) were rated as more legitimate when described as longer standing (Blanchar & Eidelman, 2013). Even a bitter, bad-tasting beverage was rated as better-tasting when the company said to have produced it was described as older (Eidelman et al., 2009, Study 5). Taking an individual differences approach, Blanchar and Eidelman (2021) found that greater endorsement of the assumptions underlying longevity bias predicted more intrinsic explanations for social inequality, the perception of this inequality as more justifiable, and reduced moral outrage over its occurrence.

Harnessing longevity bias to promote vaccine acceptance

Perhaps most germane to the present research, there is evidence that longevity bias is also applicable in the context of medicine. Eidelman and colleagues asked participants to read a brief but (less the time in existence manipulation) accurate description of acupuncture, finding that participants considered this medical practice to be better and more worthy of use when described as older (Eidelman et al., 2010, Study 2). Similarly, Jie (2020) found that participants, including a sample of physicians, preferred older drugs (launched one year ago) over drugs launched more recently (one week ago; see Suri et al., 2013, for a related finding). Participants reported believing that the older drugs were safer and more efficacious.

Safety and side effects are significant concerns when deciding whether to receive medical treatment (e.g., Berry et al., 2002). Not surprisingly, these same concerns are central to Covid-19 vaccine hesitancy (e.g., Machingaidze & Wiysonge, 2021; Solis Arce et al., 2021; Thunstrom et al., 2021). In fact, surveys of Americans indicate that, whereas those slow to take a Covid-19 mRNA vaccine initially adopted a ‘wait and see’ approach, vaccine hesitant individuals commonly cited a belief that the vaccines were ‘too new, unknown, [or] not tested enough’ (Aparna, 2021). Both the speed of Covid-19 vaccine development and the vaccines’ comparatively brief time in existence seem to provide reasons for resisting these vaccines, but also open the door to a strategy to lower this resistance. If older treatments are seen as better (i.e., have greater efficacy and safety), framing mRNA vaccine technology – first tested in mice in the 1990s – as comparatively older should increase support for Covid-19 vaccines that use this technology. Moreover, because longevity bias has been found to operate for negative and positive stimuli alike (Blanchar & Eidelman, 2013; Crandall et al., 2009; Eidelman et al., 2009, Study 5), a pattern of longer time in existence as better might hold among those weary of receiving the vaccine (i.e., the unvaccinated).

The present research

Using an internet sample of Americans, we manipulated the perceived longevity of Covid-19 mRNA technology by way of a dateless but still accurate timeline. Several medical advancements through history were displayed on this timeline that reflected the correct order of their occurrence, with the development of mRNA vaccine technology placed at the far left (furthest from present day) or on the right (adjacent to present day). We predicted that participants would perceive the technology behind Covid-19 mRNA vaccines as older when placed on the left of the timeline, and that this manipulation would also lead participants to perceive Covid-19 mRNA vaccines as better. We also included participants’ vaccination status as an additional factor. We predicted a main effect for vaccination status such that those already vaccinated would perceive Covid-19 mRNA vaccines more favorably but made no firm predictions about whether vaccination status would moderate a longevity bias. Predictions, sample size, and analyses were preregistered on the Open Science Framework.

Method

Participants and design

The participants were 433 Amazon Mechanical Turk workers ($M_{age} = 35.68$, $SD = 11.68$) who were paid \$0.35 in exchange for completion of a brief survey. The majority (60.83%) were women, with 36.1% reporting their gender as male, 1.6% nonbinary, and 1.2% transgender. Most (80.65%) reported their race as White/Caucasian, with 9.45% reporting their race as Black/African American, 4.61% Asian, 4.61% Multiracial, and 0.69% Native American. Whereas 341 participants reported being partially or fully vaccinated against Covid-19, 93 reported that they were not vaccinated. All were randomly assigned to one of the two timeline conditions, described below.

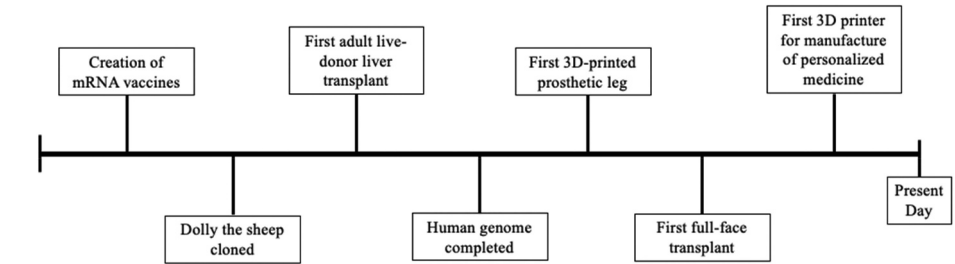
Procedure and materials

Data collection took place from October through December 2021. Ethical approval was obtained for all protocols from the University of Arkansas’s institutional review board (IRB protocols: 1802104798 and 2009288452). Participants self-selected for an online study about ‘current social issues’ that was posted on the Amazon Mechanical Turk platform. After providing informed consent, participants were given some background information about messenger RNA (mRNA) vaccines to read. This information described how mRNA vaccines work, in general and regarding Covid-19 in particular (see supplemental materials for all text and measures).

Participants then saw one of the two dateless timelines on which medical events through history were arranged so that the creation of mRNA vaccines appeared relatively old or new. In the *old* condition, ‘Creation of mRNA vaccines’ was placed on the far left of the timeline, with six other medical events (e.g., *Dolly the sheep cloned*, *first adult live-donor liver transplant*, *first 3-D printed prosthetic leg*) to the right with ‘Present Day’ capping the end. In the *new* condition, ‘Creation of mRNA vaccines’ was adjacent to ‘Present Day,’ with five medical events (e.g., *invention of the microscope*, *germ theory of disease proposed*, *first successful heart-valve surgery*) to its left (see, Figure 1(a,b), respectively). The order of events in both conditions was accurate but the space between each event was not to scale. Underscoring this manipulation, a sentence at the top of the page read: As can be seen in the timeline, the technology behind mRNA vaccines has been around for a long time/is relatively new (in the old vs. new condition, respectively).

Participants then responded to six statements that gauged their support for Covid-19 mRNA vaccines. These statements were: ‘Covid-19 mRNA vaccines are good,’ ‘Covid-19

a Old Timeline – Manipulation Stimuli



b New Timeline – Manipulation Stimuli

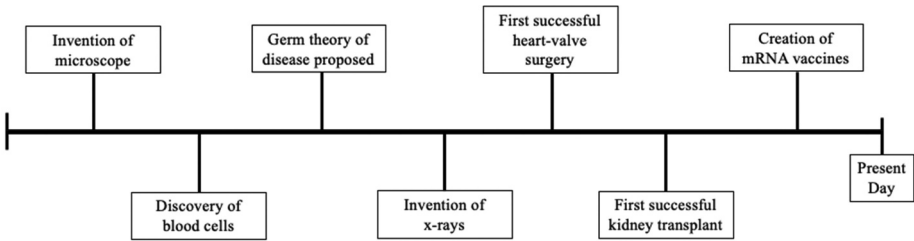


Figure 1. (a) Old timeline – manipulation stimuli, (b) new timeline – manipulation stimuli.

mRNA vaccines are safe,’ ‘Covid-19 mRNA vaccines are effective,’ ‘It’s a good thing that we have Covid-19 mRNA vaccines available for use,’ ‘It is reasonable to have concerns about Covid-19 mRNA vaccines’ (reverse-scored), and ‘People should get the Covid-19 mRNA vaccine if they haven’t already.’ All responses were made on 7-point Likert-type scales (1 = *strongly disagree*, 7 = *strongly agree*) and combined to form a *Covid-19 Vaccine Support* index ($\alpha = .94$), with higher numbers indicating more support for Covid-19 mRNA vaccines.

Participants were then asked how long they thought the technology behind Covid-19 mRNA vaccines had been around (1 = *not long at all*, 7 = *a long time*) as a check on our time in existence manipulation. They also answered demographic questions, including their vaccination status (fully vaccinated, partially vaccinated, or not vaccinated). For the analyses reported below, and following our preregistration plan, participants who had received one or two shots of any of the three Covid-19 vaccines available at the time of data collection were considered *vaccinated*, whereas those who had not received any shot were considered *not vaccinated*.

Before the study ended, participants were asked to recall at least one event on the timeline they were shown (as an indirect attention check) and then were invited to respond to some open-ended questions about the purpose of the study and whether they had any comments. Participants were then thanked, debriefed, and paid for their time.

Results

Sample size and data exclusions

Our preregistration plan indicated a desired sample size of at least 400 participants. This plan also reported our intention to exclude participants who missed an attention check (“This is an attention check, please indicate Strongly Agree as your response”) and/or could not recall at least one event on the timeline they were shown. Slots were posted in batches, and as participants were excluded, additional slots were posted to compensate for those lost.¹ Ultimately, 537 times were posted, 104 were excluded, leaving a final sample of 433 participants, as reported above.

Manipulation check

To confirm the effectiveness of our timeline manipulation, responses to the manipulation check were submitted to an independent samples *t*-test with timeline condition as the between-subjects factor. This analysis yielded a significant effect of condition, $t(429) = 18.55$, $p < .001$, $d = 1.79$.² Consistent with predictions, participants reported that the technology behind Covid-19 mRNA vaccines had been around longer in the *old* condition ($M = 5.65$, $SE = .107$) compared to the new condition ($M = 2.75$, $SE = .114$).

Support for Covid-19 mRNA vaccines

Our initial test of time in existence of mRNA vaccine technology on Covid-19 vaccine support was a *t*-test, which yielded a non-significant effect, $t(431) = 0.870$, $p = .385$, $d = 0.084$.

Following our pre-registration plan, we then computed a two-way ANOVA with time in existence and vaccination status as between-subjects variables to test whether they impacted support for Covid-19 mRNA vaccines independently and interactively. This analysis resulted in the predicted main effect of timeline condition, $F(1, 429) = 5.30$, $p = .022$, $\eta_p^2 = .012$. Participants reported more support for Covid-19 mRNA vaccines in the *old* condition ($M = 4.47$, $SE = .087$) than in the *new* condition ($M = 4.18$, $SE = .093$).

A main effect also emerged for vaccination status, $F(1, 429) = 342.61$, $p < .001$, $\eta_p^2 = .444$. Not surprisingly, participants who indicated being vaccinated reported more support for Covid-19 mRNA vaccines than those who indicated that they were not yet vaccinated ($M_s = 5.50$ and 3.14 , $SE_s = .059$ and $.113$, among vaccinated and non-vaccinated participants, respectively). There was no interaction between timeline condition and vaccination status, $F(1, 429) = 1.24$, $p = .267$, $\eta_p^2 = .003$; overall, both vaccinated ($M_s = 5.78$ and 5.42 , $SE_s = .084$ and $.082$) and non-vaccinated participants ($M_s = 3.36$ and 2.93 , $SE_s = .152$ and $.167$) reported more support for Covid-19 mRNA vaccines in the *old* versus *new* condition, respectively.

Discussion

Accounting for participants' vaccination status, Covid-19 mRNA vaccines received more support – they were judged as better, safer, and more as something people ought to take – when the technology undergirding their development was perceived as having longer existence. Vaccination status strongly predicted Covid-19 mRNA vaccine support but did not moderate the effect of timeline condition, indicating that this effect held regardless of whether participants had received a Covid-19 vaccine by the time of data collection.

Others have found that forms of status quo bias may be relevant in medical contexts. People seem to prefer well-established medical treatments (Eidelman et al., 2010; Jie, 2020), even when newer treatments are described as superior (Suri et al., 2013). Medical experts also show this bias (Jie, 2020), and in one study physicians showed a *stronger* bias to prefer the status quo compared to their non-expert counterparts (Camilleri & Sah, 2021). To our knowledge, our research is the first to show that a bias for the status quo – in this case what is longer standing – can be harnessed to increase support for vaccines.

Typical approaches to persuasion try to increase the positive qualities of an alternative. In the context of Covid-19 vaccines, this approach has been tried, and met with mixed success (e.g., James et al., 2021). A more effective approach may be to focus on lowering resistance (Knowles & Linn, 2004; Knowles & Riner, 2007). Common reasons people give for Covid-19 vaccine hesitancy include concerns about safety and side effects (e.g., Machingaidze & Wiysonge, 2021; Solis Arce et al., 2021; Thunstrom et al., 2021) but also the newness or novelty of the vaccines themselves (Aparna, 2021), concerns that are reinforced by perceptions of the speed of Covid-19 vaccine development and its comparatively brief time in existence. Our longevity manipulation addressed these concerns and, it seems the corresponding reasons for Covid-19 vaccine hesitancy that ultimately increased the attractiveness of these vaccines.

Limitations

We found an upward shift in people's attitudes toward Covid-19 vaccines due to our longevity manipulation but have no evidence that this change in opinion would correspond to changes in relevant behavior. It is well known among researchers that attitudes do not always predict behavior (e.g., Ajzen & Fishbein, 2005; Wicker, 1969), and that several factors determine the strength of this correspondence or lack thereof (Davidson & Jaccard, 1979; Kraus, 1995; Wallace et al., 2005). Whether people would be more likely to receive the Covid-19 vaccine due to manipulations of perceived longevity and corresponding changes in vaccine attitudes remains an open question.

It is important to note the small effect size observed for our longevity manipulation on Covid-19 vaccine support. At the same time, it is also important to point out that a simple and minimal timeline manipulation still had an effect, despite our focus on the general creation of mRNA vaccine technology (rather than Covid-19 vaccines specifically) as well as the politics and misinformation that have swirled around the pandemic and Covid-19 vaccines (e.g., Conway et al., 2021). Moreover, and as suggested by the large main effect of vaccination status we observed, participants already held firm attitudes toward Covid-19 vaccines which should make increasing their support difficult. Collectively, these circumstances provide context for interpreting the small effect size of our timeline manipulation on support for Covid-19 vaccines. Effects created by a modest manipulation and on a measure seemingly resistant to influence are just the conditions that have been argued to make a small effect meaningful (Prentice & Miller, 1992).

The generalizability of our findings is constrained by the participants used in this research – a non-representative sample of Americans recruited over the Internet. Nevertheless, studies recruiting panels from this online platform frequently yield results comparable with those obtained via representative samples like the American National Election Studies (e.g., Clifford et al., 2015). Data were also collected well into the pandemic, but far from its end, raising the possibility that the effectiveness of our manipulation might depend on timing, as well as other particulars unique to the situation during which our data were collected. Whether our findings extend to other samples in other contexts must be left to future research to determine.

Boundary conditions

Individual differences have been found to moderate longevity bias (Shockley et al., 2016), and people vary in their tendency to infer goodness from assumptions about time in existence and the competition it invites (Blanchard & Eidelman, 2021). These and other individual differences may moderate the impact of longevity on the perceived goodness of and support for Covid-19 vaccines. Moreover, as time unfolds and more of the hesitant get the vaccine, those left who are unvaccinated may be particularly strong in their resistance, and unaffected by frames of mRNA technology as relatively old.

We acknowledge that longer time in existence may not always signal 'better.' Everyday experience tells us that people often want the latest technology or the most advanced medical treatment. Reconciling this point with past research (e.g., Jie, 2020; Suri et al., 2013) as well as our findings presented above, we suspect that it is not what's 'new' that people want but instead what is 'new and improved' (see, Eidelman et al.,

2010), a preference that would capitalize on the safety and security that status quo entities (including older and established medical treatments) seem to provide (e.g., Jie, 2020). Still, what's already established may grow stale, and people may become bored, leaving room for the possibility of a 'newer is better' effect in the context of vaccines or otherwise.

A note on ethics

Are framing effects, including the framing of vaccines as longer standing, ethical? We note, first, that manipulations of longevity via use of a timeline require no deception. All judgment is comparative (Biernat & Eidelman, 2007), and whether a day is hot or a medical practice old depends on the standard of comparison invoked. Who determines these standards and to what end are of course harder issues to settle, ethically speaking. When framing effects 'nudge' people toward what they themselves want (e.g., health or happiness), the ethics seem clear enough (e.g., Swindell et al., 2010; Thaler & Sunstein, 2009). When what people want is different, ambiguous, or inconsistent, the ethical status of framing effects is less clear. Though we hesitate to make any strong moral proclamations, we suggest that it should be easier to justify persuasive nudges in the context of public health than financial profit or personal power, two contexts in which marketers and politicians regularly (and with little controversy) attempt to persuade the public.

Conclusions

As the Covid-19 pandemic carries forward, people continue to get sick, suffer, and even die, outcomes that disproportionately affect those who are not yet vaccinated. Strategies to increase acceptance and support of Covid-19 vaccines are therefore needed. Because all judgment is comparative, a simple and (as suggested by our research) effective strategy may be to frame the technology underlying Covid-19 vaccines as relatively old.

Notes

1. To make exclusions, the attention check and timeline recall data were reviewed on an ongoing basis. No other data were observed prior to the completion of data collection.
2. Because Shapiro-Wilk's test of normality was significant, $p < .001$, we computed a non-parametric Mann-Whitney test. This analysis also revealed a significant effect of condition on the manipulation check ($Mdn = 6$ vs. 2), $U = 40689.00$, $p < .001$.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data that support the findings of this study are openly available in Open Science Framework (OSF) at <http://doi.org/10.17605/OSF.IO/X8JNY>, reference number 95ZCB.

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