

## A behavioral economics perspective on the COVID-19 vaccine amid public mistrust

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### ABSTRACT

The COVID-19 vaccine development, testing, and approval processes have moved forward with unprecedented speed in 2020. Although several vaccine candidates have shown promising results in clinical trials, resulting in expedited approval for public use from the U.S. Food and Drug Administration, recent polls suggest that Americans strongly distrust the vaccine and its approval process. This mistrust stems from both the unusual speed of vaccine development and reports about side effects. This article applies insights from behavioral economics to consider how the general public may make decisions around whether or not to receive a future COVID-19 vaccine in a context of frequent side effects and preexisting mistrust.

Three common cognitive biases shown to influence human decision-making under a behavioral economics framework are considered: confirmation bias, negativity bias, and optimism bias. Applying a behavioral economics framework to COVID-19 vaccine decision-making can elucidate potential barriers to vaccine uptake and points of intervention for clinicians and public health professionals.

### Keywords

Behavioral economics, Cognitive bias, COVID-19, Vaccine

### INTRODUCTION

While rapid COVID-19 vaccine development is an unprecedented and potentially life-saving feat of science, it is also a major disruption to what Americans expect for the development and rollout of a new vaccine [1]. Polls show that only 51% of Americans would be willing to get a COVID-19 vaccine or are undecided as of December 2020 [2]. Major reasons for this unwillingness are worries about possible side effects (59% of poll respondents) and a lack of trust in the government to ensure the vaccines' safety and effectiveness (55% of poll respondents) [2]. There is also widespread concern that the newly approved Pfizer/BioNTech COVID-19 vaccine is too new, prompting people to express a desire to wait and see how it works for other people before getting it themselves (53% of poll respondents) [2,3].

These continued fears over the integrity of vaccine approval are understandable. Given the urgent need to slow transmission of the SARS-CoV-2, the U.S. Food and Drug Administration (FDA) has considered potential COVID-19 vaccine candidates for

### Implications

**Practice:** When discussing the COVID-19 vaccine with patients, clinicians should explore and address cognitive biases and use a shared decision-making process.

**Policy:** Policymakers should consider the consequences of a rushed, mistrusted COVID-19 vaccine in terms of potential vaccine uptake and public education.

**Research:** Future research should explore individual and population interventions that target cognitive biases to promote COVID-19 vaccine update.

### Lay Summary

Several COVID-19 vaccines are being rapidly developed in response to the 2020 coronavirus pandemic. Studies show that the vaccines are safe and provide some protection against COVID-19. In an emergency situation like a pandemic, vaccine makers can apply for an emergency approval from the government to distribute the vaccine. Several companies plan to do this. However, polls show that Americans are worried about the speed of vaccine development and approval. They are also worried about vaccine side effects. Worries like these may lead people to decide not to get the COVID-19 vaccine. If enough people decide they do not want the vaccine, it will be difficult to slow down the pandemic. Behavioral economics is the study of human decision-making. This article discusses how behavioral economics can be used to understand how people may intuitively think about the decision to get a COVID-19 vaccine. Humans can sometimes have errors in judgment (called "cognitive biases"). By identifying these errors as they relate to the COVID-19 vaccine, we can prepare health care providers and health officials to help people make fully informed decisions about the vaccine.

emergency authorization, a temporary approval that is quicker and requires less data on safety and efficacy than a full approval. On December 11, 2020, the FDA released the first emergency use authorization for a

messenger RNA (mRNA) based COVID-19 vaccine from Pfizer/BioNTech, which showed 95% efficacy in preventing COVID-19 [4–6]. Emergency use authorization of a second mRNA vaccine from Moderna, which demonstrated similar efficacy, was released just a week later on December 18, 2020 [7,8]. The development-to-authorization timeline may have given the appearance of an expedited process, but the FDA remains committed to stringent standards for emergency use authorization [9].

Public acceptance of a vaccine may be further threatened by a more insidious problem with the FDA's general strategy of evaluating a vaccine for public use: an undervaluation of how vaccine side effects may be perceived. Under the FDA's current process of vaccine approval, licensure is granted by an expert reviewer panel, made up of medical officers, biostatisticians, and other scientists from a variety of professions, who conduct a risk/benefit assessment based on data from multi-phase clinical trials [9]. This evaluation of risks is based on balancing the efficacy of the vaccine with its safety. Although all side effects are considered in determining vaccine safety during clinical trials, there is an emphasis on whether the vaccine is associated with any serious adverse events that pose a significant threat to patient health (e.g., anaphylaxis and hospitalization). Relatively innocuous and transient side effects, such as fatigue, body aches, and low-grade fever, which are normal signs of vaccine reactogenicity, do not generally preclude vaccine approval. The vaccine is then released to the public who, it stands to reason, should rest assured that the benefits of this vaccine outweigh whatever harms they might anticipate.

There is a problem in this line of thinking in that it fails to account for the complex cognitive, social, and affective processes that guide our decisions. As humans, we do not always act in our own best interest, even when we have strong evidence about what decisions are best for us. Behavioral economist Richard Thaler and legal scholar Cass Sunstein proposed the idea of “Econs” and “Humans” to illustrate this idea [10]. Econs are perfectly analytical and deliberative beings, who always make the most “rational” choice from a set of alternatives (i.e., the choice that provides them the greatest subjective utility or benefit) [11,12]. Humans, by contrast, can sometimes be emotional, reflexive, and short sighted—traits that can lead them to make “less-than-rational” decisions. Under the assumption that we live in a world of Econs, we would expect the public to evaluate whether to get a vaccine in the same way as the FDA's expert review panel: through a straightforward and dispassionate comparison of risks and benefits. We live in a world of Humans, however, and we must consider how *Humans*, not Econs, will view a COVID-19 vaccine.

Humans are already prone to mistrusting vaccines and believing misinformation. In the USA, vaccine

hesitancy has been observed among both high- and low-income populations, across political parties, and across racial/ethnic groups [13]. Common reasons for this mistrust are suspicion about the increased number of vaccines required for children over time, increased exposure to conspiracy theories, and antivaccination ideas via social media, mistrust in the government and government health officials, and incorrectly believing that vaccines do not protect against disease or even cause disease [13–16]. Although a majority of Americans vaccinate their children, vaccination is more challenging among adults. During the 2018–2019 flu season, only 45% of American adults received the influenza vaccine despite strong efforts over time to make the vaccine inexpensive and easily accessible [15]. There is both skepticism about the safety and efficacy of vaccines and underestimation of risk for serious illness or death from vaccine-preventable diseases like influenza and, now, COVID-19 [17].

Critically, a realistic examination of how Humans will view the new COVID-19 vaccines will entail greater recognition of the potentially powerful impact of side effects on decisions surrounding the COVID-19 vaccine. Data from the Phase 3 trial of the newly approved Pfizer/BioNTech vaccine, BNT162b2, indicate that there are high rates of systemic side effects, including fatigue (59%), headache (52%), chills (35%), muscle pain (37%), fever (16%), and joint pain (22%) [5]. Similar side effects have been observed for the second mRNA vaccine, mRNA-1273 [7]. Though the majority of these symptoms are expected, transient signals of reactogenicity, there were anecdotal reports of more concerning side effects, such as lymphadenopathy [5]. These side effects are temporary and do not pose a direct threat to human health (unlike a SARS-CoV-2 infection) and, so, from an Econ's perspective, should not play a major role in our decisions to vaccinate. Indeed, they are signs of reactogenicity and a positive signal that the vaccine is working as intended [18]. For Humans, on the other hand, such side effects could have undue influence on our decisions to refuse vaccination due to certain errors in judgment, known as cognitive biases. These biases may exacerbate—and be exacerbated by—the current climate of public mistrust and could have a harmful influence on vaccine uptake if not appropriately addressed through a more thorough consideration of how to communicate about vaccine side effects.

#### Cognitive biases affecting vaccine uptake

##### *Confirmation bias*

Humans tend to pay attention to the evidence in support of—and disregard evidence in conflict with—their prior beliefs, a phenomenon known as *confirmation bias* [19]. With regards to prior beliefs surrounding the new mRNA COVID-19 vaccines, a large proportion of the general public has reported

low confidence and negative perceptions of these vaccines given worries over the hastened process of development and approval [2]. Moreover, the majority of Americans do not view the pharmaceutical industry in a particularly favorable light [20] and, given the massive anticipated payoff for the pharmaceutical companies producing COVID-19 vaccines [21], people may be even more inclined to believe that such companies do not have the public's best interest in mind. For the many Americans who distrust the pharmaceutical industry and the new "fast-track" process of vaccine development, introducing a vaccine with frequent side effects may be seen as particularly salient evidence of the haphazard and delusory nature of vaccine development and approval. This may intensify prior negative beliefs concerning the vaccines, which persist even when individuals are presented with evidence to the contrary.

A vaccine with frequent side effects could also bolster the pervasive belief that vaccines can cause, rather than prevent, disease [23,24]. The risk that this could occur may be greater if these side effects mirror the symptoms of the disease. For the two mRNA-based vaccines from Pfizer/BioNTech and Moderna, the side effects of vaccines align almost perfectly with the most common symptoms of COVID-19: fatigue, chills, headache, fever, joint pain, and muscle pain [5,7]. Among those Americans who suspect or believe that vaccines cause disease, stories about these COVID-like symptoms among those who received the vaccine may be perceived as compelling evidence in alignment with their prior belief. Such "evidence" may serve to intensify the false belief that the COVID-19 vaccine causes COVID-19, while overshadowing any evidence of the vaccine's protective effects.

#### Negativity bias

Unfortunately, for those seeking to promote the COVID-19 vaccine to a highly skeptical American public, psychological research indicates that negative perceptions are often quite powerful and difficult to shake. Humans tend to pay more attention to negative information than positive information [25]. Our negative perceptions also tend to be "stickier," in that we are less likely to change our minds about something we perceive negatively than something we perceive positively, a phenomenon known as *negativity bias* in framing [25]. Positive perceptions are like Teflon and negative perceptions are like Velcro. Thus, introducing a vaccine with frequent and unpleasant side effects may induce negative perceptions that have an inordinate, Velcro-like "stickiness" and impact people's decisions to vaccinate, both now and in the future. These negative perceptions could extend beyond the single COVID-19 candidate, effectively tainting perceptions of other candidates.

#### Optimism bias

Evaluation of the risks and benefits of a COVID-19 vaccine is further complicated by the considerable uncertainty surrounding the outcomes of COVID-19. Many do not know if or when they will get the disease or how bad their symptoms could be if they were to be infected. In the case of COVID-19, symptoms are widely variable, and a substantial proportion of those infected (40%) experience mild or no symptoms [26]. Though the risks of COVID-19 may be quite high, on average, individuals may nonetheless exhibit *optimism bias*, a tendency to adopt an overly optimistic view about themselves and the likelihood of experiencing negative events [27,28]. Indeed, many Americans underestimate their susceptibility to SARS-CoV-2 infection and their body's ability to fight the virus [26]. Uncertainty regarding outcomes can then give people moral "wiggle room" to rationalize behavior that is in their own self-interest [29,30]. In the case of a COVID-19 vaccine with frequent and unpleasant side effects, people may be more apt to adopt a self-serving narrative to avoid vaccination (e.g., "I do not need to get the vaccine because I probably won't get COVID-19 and, even if I do, it probably won't be as bad as the vaccine side effects anyway"). Thus, optimism bias and the uncertainty surrounding COVID-19 can make it easy to justify not getting vaccinated, especially if one is not keen on getting vaccinated in the first place.

#### Countering cognitive biases

There are several strategies health care providers can consider to counter the above cognitive biases and promote the acceptance of COVID-19 vaccines [31].

##### *Avoid unprompted attempts to "debunk" the myth that vaccines cause disease*

Efforts to debunk vaccine efforts can sometimes backfire. For instance, in a study assessing the effects of messaging countering the myth that the flu vaccine causes the flu, Nyhan and Reifler found that, while the corrective information reduced belief in the myth, it also significantly reduced intent to vaccinate among those highly concerned about side effects [32]. Debunking a myth carries the risk that one could increase people's familiarity with this myth, which could lead them to recall it as if it were true [33].

##### *Emphasize the reason for vaccine side effects: reactogenicity*

Instead of redressing vaccine myths, health care providers should explain the role of vaccines in stimulating an immune response that protects people from infection [18]. The side effects associated with vaccines are a signal that our bodies are responding positively to the vaccine and learning to protect themselves from illness. Health care

providers should ensure that their explanation of reactogenicity is simple and compelling as this can make the explanation easier to adopt and recall in the face of misinformation [31].

#### *Stress the prosocial reasons for getting the vaccine*

People can transmit COVID-19 to others, regardless of whether they experience symptoms of the disease [34]. Framing vaccines as a means to protect others in one's family or community could compel people to vaccinate, even if they do not feel personally at risk of illness or death [35]. Moreover, framing decisions in terms of their impact on others may also reduce people's tendency to rationalize their refusal of the vaccine as individuals are less likely to make self-interested decisions when faced with uncertainty about the extent that their decision will negatively impact other people (e.g., "You could spread COVID-19 to your older family member/friend, and you don't know how badly it may affect them") [36].

#### *Build vaccination opportunities into health care such that people "opt out" rather than "opt in"*

People get vaccines both through *active seeking* and *passive acceptance* [31]. Evidence from pediatrics suggests that, when vaccines are offered routinely during well child care, there are fewer barriers to vaccine acceptance than when parents must actively ask for and seek out a vaccine [31]. We can adopt this strategy for COVID-19 vaccines by making it a routine practice to offer the opportunity for vaccination in multiple areas of health care (e.g., primary care, specialty care, pharmacy, and mental health).

### CONCLUSION

Given the current climate of uncertainty and public mistrust around newly authorized COVID-19 vaccines, we must reconsider how to factor vaccine side effects signaling vaccine reactogenicity into communication around the vaccine efficacy/safety balance and how to account for cognitive biases in promoting vaccine uptake in communities. Negative perceptions and vaccine myths are particularly intransigent in peoples' minds, and a vaccine with frequent, COVID<sup>like</sup> side effects may only serve to reinforce these perceptions and myths. Particularly unpleasant side effects could also foster a rationalization of vaccine refusal, especially amid uncertainty and overoptimism surrounding COVID-19 outcomes.

It is important to consider whether it is better to be proactive or reactive when it comes to combating vaccine hesitancy in this circumstance. In other words, should we continue with the current approval process and "clean up the mess" later or incorporate more public transparency and information-sharing about reactogenicity during the review process to avoid creating a "mess" in the first place? Increasing

uptake of vaccinations can be a challenging process, and releasing a vaccine with relatively frequent side effects could be a major barrier to COVID-19 vaccine uptake. In sum, simple risk/benefit assessments overlook the complex way that humans make decisions surrounding vaccines, and this oversight can have devastating consequences on vaccine acceptance. We must consider how Humans, not Econs, will view a COVID-19 vaccine and its side effects, especially in the current climate of uncertainty and public mistrust.

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#### Compliance with Ethical Standards

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