

Analyzing COVID-19 Vaccine Hesitancy in the United States and Possible Mitigations Through the Lens of Behavioral Economics

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ABSTRACT

During the current pandemic, vaccine hesitation is rapidly spreading through social media controversies. Despite the reassurance of medical professionals, heuristics from behavioral economics impose irrational thinking that leads to false interpretations of the news. This research paper analyzes the effect heuristics have on COVID-19 vaccination rates in the United States through a series of experiments and data analysis. Specifically, I will define confirmation bias, risk perception, availability bias, and status quo bias, and thoroughly discuss their relation to decision making. This paper also strives to explore framing and loss aversion among different age groups and provide refined, age-specific policies that the government can incorporate to increase vaccinations in America.

Introduction

COVID-19 has induced vast suffering to the world, infecting over 200,000,000 people and causing 5,000,000 deaths. Scientists rigorously worked to develop vaccines to combat this deadly virus, including the Pfizer-BioNTech and Moderna vaccines. Despite the introduction of these two FDA-approved vaccines, vaccination rates remain inadequate. According to the Centers for Disease Control and Prevention (CDC), only 61.2% of the United States population are fully vaccinated (CDC, 2021). What results in the substantial number of people unvaccinated in the United States? The standard response is that most people simply do not trust the vaccine and are waiting for the population to reach herd immunity. However, the problem is far more complex and abstract. Human psychology plays a major role in people's cognitive, social, and affective processes that direct people's decisions during vaccinations (Choi & Saleska, 2021).

Behavioral economics involves human psychology and its effect on economic-based decision-making. Much of what we know about this field of study comes from the works of Israeli psychologist Daniel Kahneman. In his book, *Thinking Fast and Slow*, he introduces two agents of thinking: System 1 and System 2. System 1 involves an automatic operating mechanism that operates quickly and intuitively. In contrast, System 2 involves the conscious mind making controlled, rational decisions in a narrow path. Kahneman asserts that System 1 develops first impressions, which frequently collide with later judgements. Humans tend to use heuristics (mental shortcuts) to cope with complex System 2 thinking, which may backfire and lead to irrational decisions. (Kahneman, 2011).

How does this coincide with COVID-19 vaccination rates in the United States? Vaccine skeptics use heuristics when evaluating the efficacy of the vaccine, resulting in biased and inaccurate conclusions. The healthcare market, which promotes vaccines in a uniform approach, fails to consider this intrinsic point. Vaccines are promoted the same regardless of age, which is irrational because different ages have different heuristic usability and risk tolerance. Studying behavioral economics provides insight into the biases that result in these implications. Possible exploitations of these biases can help unveil solutions to ensure higher vaccination trust among the population.

Context

This research paper analyzes the effect heuristics have on COVID-19 vaccination rates in the United States through a series of experiments and data analysis. Specifically, I will define the confirmation bias, availability bias, and status quo bias, and thoroughly discuss their relation to decision-making with vaccinations. This paper also strives to explore framing and loss aversion among different age groups and provide refined policies that the government can incorporate to increase vaccinations in America.

Confirmation Bias

The Context of Confirmation Bias

Confirmation bias is defined as “the seeking of evidence in ways that are partial to existing beliefs, expectations, or a hypothesis in hand” (Nickerson, 1998). This heuristic was first termed by psychologist Peter Wason, who formulated the 2-4-6 experiment. In this test, 29 participants were presented with three integers (2, 4, 6) and asked to write down a set of triples that conform to an unidentified rule. Subjects hypothesized that the integers must be even and the intervals must be equal, but the rule allowed for any ascending sequence. Consequently, Wason discovered that people tend to test positive examples of their irrational hypotheses. Rarely did one try to disprove their hypothesis, which led Wason to conclude that people tend to confirm their beliefs rather than test them.

In a subsequent experiment, Wason laid four cards with the faces labeled *E*, *K*, *4*, and *7*. Subjects were given a hypothesis: if a card has a vowel on one side, the same card has an even number on the other side. The question was to determine which card must be flipped to evaluate the rule’s facticity. The majority selected cards *E* or *4*, or both. There is a fair possibility that the card *E* could show an odd number, but there is no certainty that the card with *4* must be a vowel. However, there is a chance that flipping the card with *7* could result in an odd number, disproving the rule. Hence, *E* and *7* are the correct answers. Wason constructed the card showing *4* as the confirmation bias: subjects mainly focused on the letters and numbers mentioned in the hypothesis without thinking critically (Oxford Reference).

These experiments show how individuals struggle to solve a problem when it is presented in an abstract way. In both experiments, subjects adopted a positive test strategy, “a tendency to test cases that are expected to have the property of interest rather than those expected to lack that property” (Klayman, J. & Ha, 1987). In other words, people often tend to confirm their previous beliefs rather than find ways to contradict them.

Confirmation Bias and Social Media Polarization

Confirmation bias has spawned a plethora of social media induced polarization (SMIP), which jeopardizes society by igniting ‘digital wildfires’ (Modgil, Singh, & Gupta, 2021). Some of the prime examples of SMIP regarding the pandemic include downplaying the severity of COVID-19 and spreading misinformation about vaccines. The reason for this is confirmation bias allows like-minded individuals to network and form “polarized groups.” These groups involve “moving towards an extreme point in whatever direction is indicated by the members’ predeliberation tendency” (Alvernia University, 2018). This allows social media users to form “echo chambers” which put restraints on anyone’s views but their own. Conspiracies can spread rapidly through social media algorithms, encouraging extremist groups (Modgil, Singh, & Gupta, 2021). Regardless of reassurance from medical professionals and organizations, it is hard to break the initial psychological barrier that is formed by SMIP.

Consequently, the current media is struck by a partisan divide. Prior political ideologies impact the searches of users and their views on the severity of COVID-19. For example, viewers of Fox News, which is more conservative-leaning, show fewer intentions to vaccinate, while viewers of the liberal-leaning and New York Times show more trust in vaccines (Bell & Ruiz, 2021). In May of 2020, the National Bureau of Economic Research (NBER) challenged

confirmation bias with a survey experiment consisting of 4,000 respondents. Individuals were split into three different groups and asked to select two articles with differing tones. The first group did not see the sources of the articles (T1), the second group saw the sources after seeing the articles but before reporting their beliefs (T2), and the third group saw the sources from the beginning of the experiment (T3). The NBER selected a pessimistic article from Fox News and an optimistic article from New York Times to contradict the normal stances of the news sources. Surprisingly, the disclosure of the new source prior to the selection resulted in individuals ignoring the priors and choosing the source that aligned with their political standpoint (Faia, Fuster, Pezone, Zafar, 2021). This is direct evidence of confirmation bias—individuals favored the news source that supported their beliefs before even reading through the article. As a result, confirmation bias leads to misunderstandings in the current pandemic.

Risk Perception and Availability Bias

The Context of Risk Perception and Availability Bias

Risk perception refers to “one’s subjective judgments about the likelihood of negative occurrences” (Paek & Hove, 2017). A frequently mentioned assumption regarding risk perception is one’s understanding of risk will affect their perception, but heuristics play a large role in risk evaluation. When one is exposed to more risk, they are more likely to believe risks happen frequently. It is crucial to understand that humans have the utter tendency to form opinions based on the first memories that come to their minds. Availability bias is defined as “the tendency to attribute more weights to factors that are easier to recall.” In one of the most familiar experiments, subjects were given a two list of names. One list read names of 19 famous women names and 20 less famous men names, while the other read names of 19 famous men names and 20 less famous women names (Tversky & Kahneman, 1973). Subjects concluded that the first list consisted of more women names while the second list consisted of more men names, although the opposite was the case. When asked to recall the given names, about 50% more famous names were recalled than nonfamous names.

The overestimation present in this experiment may result from various factors, but availability bias seems to instigate it. When one is presented with facts that are easier to remember, they use the information to prove false claims. This plays a large role in spreading COVID-19 vaccination controversies.

Availability Bias and COVID-19 Vaccine Myths

In a recent Census Household Pulse Survey, vaccine skeptics revealed their main reasons for their hesitancies (individuals were allowed to select more than one option). Figure 1 displays the results of the survey.

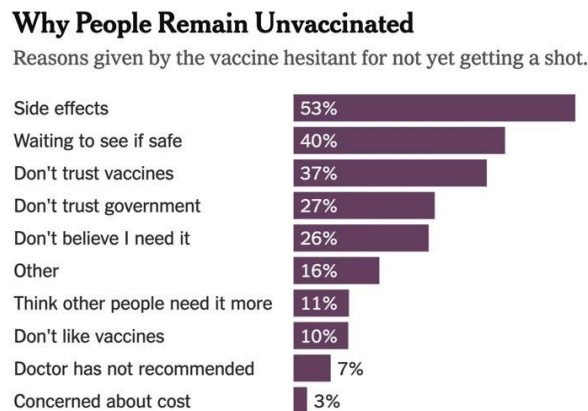


Figure 1. Reasons why people remain unvaccinated (Census Household Pulse Survey, 2021)

As shown by the data, the main concern among the population is the side effects, many of which are extremely rare or complete myths. The availability heuristic impels people to remember initial vaccine misconceptions even after reassurance by medical professionals. Common COVID vaccine myths include mentions that it affects women’s fertility, alters one’s DNA structure, and is composed of controversial materials, like tracking devices (Kelen & Maragakis, 2021). All of the mentioned myths were deemed false by medical experts, but still plague the minds of many for the reason of availability bias. Through the BMC Public Health’s extensive analysis of Adverse Events Following Immunization (AEFI) in databases such as the U.S. Vaccine Adverse Events Reporting System (VAERS), it is evident that emotionally compelling stories about a rare AEFI are more easily recalled than common mild symptoms. Hence, people overestimate the probability of rare AEFIs (Azarpanah, Farhadloo, & Vahidov, 2021). VAERS provides a platform for individuals to post any unusual and severe symptoms they believe to have experienced from a vaccine, regardless of the true cause of the symptom, and hence, plays a substantial part in SMIP (mentioned in section 2.2). Commonly cited examples of rare vaccine symptoms include the following: anaphylaxis (severe allergic reaction), thrombosis with thrombocytopenia syndrome (blood clotting), and Guillain-Barre Syndrome (destruction of immune cells). There have been almost 15,000 VAERS reports, although they only account for 0.0021% of those vaccinated (CDC, 2022).

In May of 2020, the Institute of Labor Economics (IZA) conducted an experiment with mostly young subjects to gain an understanding of the availability heuristic and its implications with COVID-19. The question asked was, “Suppose 1,000 people of your age are infected with the coronavirus, how many do you think will die from the virus?” As shown in Figure 2, participants were asked to record a mortality rate for the following age groups: Below 40, 40-49, 50-59, 60-69, 70-79, and over 80.

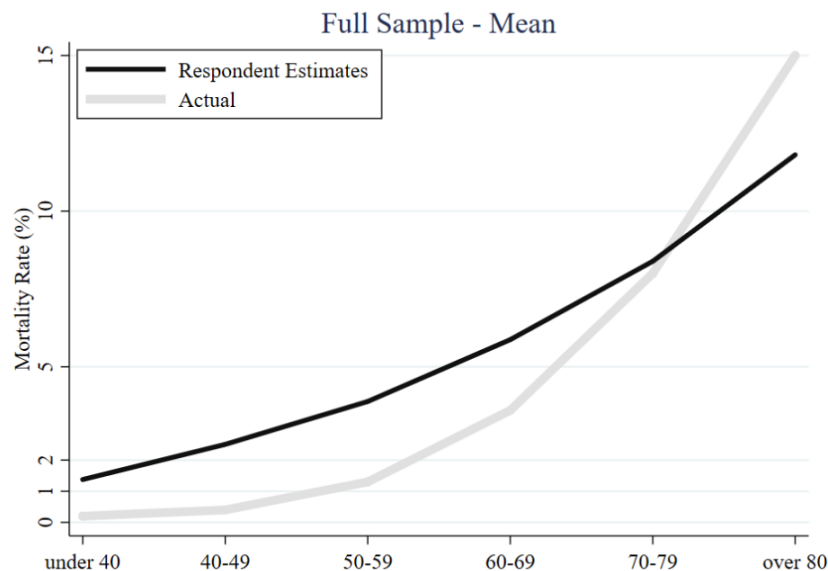


Figure 2. Mean COVID-19 mortality rate predicted by subjects of different ages (IZA, 2020)

The IZA’s data shows that people tend to overestimate the risk of mortality for younger people (up to the age of 70). On the contrary, people tend to underestimate the risk for older people. The younger the participants, the larger the risk perception. People dramatically overestimate personal risks that easily come to their minds because they are vivid or discussed frequently in the media, and underestimate those risks that are harder to relate to, such as risks of the elderly (IZA, 2020).

Status Quo Bias and Loss Aversion

The Context of Status Quo Bias and Loss Aversion

When individuals must make a decision, they typically stick with the default option. As Kahneman proposes in *Thinking Fast and Slow*, “the default option is naturally perceived as the normal choice; deviating from the normal choice is an act of commission.” According to Kahneman, the status quo is a direct consequence of loss aversion, or the notion that “losses loom larger than gains” (Kahneman & Tversky, 1979). In an experiment to evaluate the response to default options, some subjects were given a hypothetical scenario: “*You are a serious reader of the financial pages but until recently have had few funds to invest. That is when you inherited a large sum of money from your great-uncle. You are considering different portfolios. Your choices are to invest in: a moderate-risk company, a high risk company, treasury bills, municipal bonds*” Other subjects were given the same statement, but one option was selected as the status quo: “*A significant portion of this portfolio is invested in a moderate risk company... (The tax and broker commission consequences of any change are insignificant)*” (Kahneman, 2011). The results corroborate that the probability of selecting a certain option is higher when designated as the status quo. In addition, the advantage of the status quo increases when presented with more alternatives (Samuelson & Zeckhauser, 1988).

Status Quo Bias Inflicts Patient Inertia

Since the status quo bias gives preference for the current state of affairs, many Americans have ignored the new lifestyle brought by the pandemic and instead, continue to live under pre-pandemic conditions, avoiding social distancing and mask-wearing. Research by the Association for Psychological Science (APS) establishes that the main effect of status quo bias is patient inertia, which prevents patients from initiating physician contact and adhering to recommended medical regimens. The APS conducted several studies to understand the link between the status quo and patient inertia. One experiment involved the status quo and electric shock. In most cases, people would rather get shocked immediately than apprehensively wait. The APS strived to discover if status quo bias would impact this decision. They gathered 41 participants, all of whom were calibrated on the maximum shock they could tolerate. They were then randomly split into a proactive choice or forced-choice group. In the forced group, participants were required to press a button: one which would shorten the waiting time of the shock by 10 seconds, and one which would result in no change. Participants in the proactive choice group were given the option to press the button but were not forced to. The results of the experiment are summarized in Figures 3 and 4.

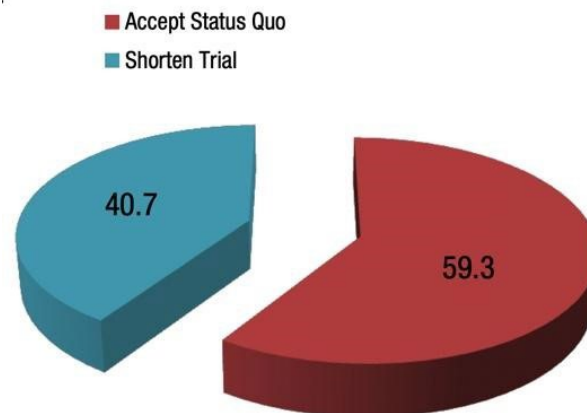


Figure 3. Results from APS experiment (proactive choice group) (APS, 2013)

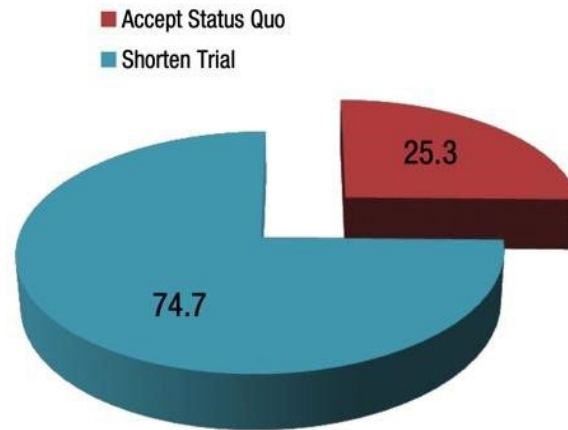


Figure 4. Results from APS experiment (forced group) (APS, 2013)

As shown by the data, 59.3% of people in the proactive choice group chose the status quo versus 25.3% of people in the forced group. When doing nothing was the status quo, participants decided to not press the button that would have reduced their waiting time to get shocked. However, when they were forced to make a choice, a substantial majority (74.7%) preferred to reduce their waiting time (Suri, Sheppes, Schwartz, & Gros, 2013).

In the current pandemic, the status quo exists because vaccine mandates are generally loose. Due to this, individuals severely underestimate the risk of infection. The status quo for vaccinations in the United States is to do nothing, just like the proactive choice group of the APS experiment.

Framing to Exploit Heuristics

The Context of Framing

The way a problem is presented, labeled, or described drastically impacts a crowd's response to it (Oxford Reference). An experiment performed by Daniel Kahneman and Amos Tversky became the paradigm for the framing effect. In this study, participants were invited to choose between two programs meant to cure a disease that was expected to kill 600 people. In one group, participants were introduced to Program A and Program B. Program A would save 200 people. For Program B, there was a $\frac{1}{3}$ probability that 600 people would be saved and a $\frac{2}{3}$ probability that nobody would be saved. In a second group, participants were introduced to Program C and Program D. Program C would kill 40 people. If Program D was adopted, there would be a $\frac{1}{3}$ probability nobody would die but a $\frac{2}{3}$ probability that all 600 people would die. The majority (risk-averse) participants favored Program A over B, which discussed no losses or gains. However, participants favored Program D over C. In the first group, participants picked the risk-averse option, while in the second group, people picked the risk-seeking option, despite both frames describing the same problem (Tversky & Kahneman, 1981).

Framing the COVID-19 Vaccine

Several steps can be taken to overcome the heuristics mentioned in this paper, but framing seems to be the efficient approach. Unfortunately, the first heuristic mentioned in this paper, confirmation bias, is the most difficult to overcome, as it is challenging to alter one's pre-existing views and prevent media polarization. However, availability bias can easily be overcome by developing an age-specific framework in lieu of a uniform approach. Several studies demonstrate that gain-loss framing has different effects on younger (18-30 years old) and older adults (60 or above).

Between younger adults, loss framing positively influenced vaccination but reduced recognition accuracy. Contrarily, there was no framing effect on attitudes of older adults which could be a result of the positivity effect, the attribution of positive over negative circumstances. The main reason for this is that younger people typically have more remaining lifetime and pursue long-term goals. Older people have less lifetime left, resulting in an avoidance of negative stimuli (Reinhardt & Rossmann, 2021). To frame the COVID-19 vaccine to younger adults, loss frames are more efficient. An example of this is, “You are risking your life and others by refusing to get vaccinated.” Positive frames, like “Vaccines will protect you and others around you” have a greater impact on the elderly. Currently, positive frames are more in use than loss frames, which could provide a possible explanation for why there is less vaccine hesitation among the older age groups.

Several methods can be used to overcome status quo bias. A 2008 study revealed that status quo framing increased support for the torture of prisoners, which was generally opposed by most Americans. Describing torture as a long-standing practice (in use for more than 40 years) rather than a new practice increased individual support and justifications of the tactic, even if it was considered disgraceful (Crandall, Eidelman, Morgan, & Skitka, 2008). A similar approach could be used to frame the COVID-19 vaccine. For example, reassurance in Pfizer’s long-term successes would increase trust in the new Pfizer vaccine. A possible statement could be “Pfizer already has a long history in vaccine development and has played a pivotal role in eliminating deadly infectious diseases like smallpox and polio globally” (This statement was taken from Pfizer Vaccine Research and Development). As mentioned in Section 4.2, the status quo is to not get vaccinated, which can be altered by framing the default option as a loss. An example of this is “Unvaccinated people are about six times more likely to test positive than vaccinated people, nine times more likely to be hospitalized, and 14 times more likely to die from COVID-related complications” (This statistic was calculated by CDC director Rochelle Walensky).” By posing the default as a risk, people will be persuaded to vaccinate.

Conclusion

Although the vaccines have been proven safe and effective, COVID-19 hesitancy in America is dangerous and on the rise. Insights from behavioral economics can help specify reasons for vaccine mistrust. In this paper, I discussed three heuristics that seem to be the largest factors of vaccine hesitancy.

First, confirmation bias has inflicted social media induced polarization (SIMP). Through networking and algorithms, false vaccine myths spread rapidly. Due to this, confirmation bias may be the hardest to overcome. The second heuristic discussed was availability bias. As a result of this heuristic, people remember the rare, severe cases of the vaccine rather than the common, mild symptoms. Those who have higher risk perception often have higher availability bias, as they primarily remember negative occurrences. The final heuristic discussed was the status quo bias. The status quo imposes patient inertia, which leads to reduced care for medical protection. This bias is less damaging than the others, as it can most easily be solved with the framing effect.

Framing the vaccine with regard to age groups is the most universal approach to exploiting most heuristics. As discussed in this paper, loss framing (which is not commonly used) is more effective in younger ages, while gain framing pleases older ages. These methods can help reduce availability bias among all ages. It is also important to mention the long-term successes of vaccines in order to overcome the status quo bias. By implementing these policies, America can tackle vaccine skepticism.

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