

Behavioral Economics And COVID-19 Vaccine hesitancy: Using heuristics to both understand the reasons behind COVID-19 vaccine hesitancy within the United States and formulate policy that combats it.

Avani Lankapalli *

October 10, 2021

Abstract

This research paper will examine the relationship between behavioral economics and COVID-19 vaccine hesitancy within the United States using three heuristics: availability, confirmation bias, and framing. Each heuristic will be precisely defined, and its various mechanisms will be analyzed in great detail in order to understand the reasons behind COVID-19 vaccine hesitancy. Furthermore, the mechanisms of these heuristics will be exploited in order to formulate practical policy recommendations that stakeholders can use to combat vaccine hesitancy and encourage the American public into getting vaccinated, thus complementing the existing choice architecture. This paper will also evaluate existing policies or methods that aim to overcome these biases and increase vaccination uptake.

1 Introduction

The field of behavioral economics is centered around the use of heuristics and biases that influence an individual's decisions. It sways from the existing standard economic framework by combining the use of both psychology and economics to predict and study individual behavioral and outcomes, which then helps formulate policy. Israeli psychologists Daniel Kahneman and Amos Tversky first introduced the term heuristics in their paper – Judgment Under Uncertainty. They claimed that when faced with complex decisions under uncertainty, as individuals, we resort to heuristics (mental shortcuts) that allow us to reduce the complexity of these decisions.¹ However, heuristics can lead to biases which in turn cause systematic errors as a result of our judgement. They, in turn, explain why as consumers, we can diverge from the neoclassical framework by behaving irrationally. Therefore, behavioral economics allows us to understand many of the complex decisions that we make and can be applied to a diverse range of fields, including a topic on many of our minds – vaccine hesitancy.

Vaccine hesitancy is referred to by the WHO as a “delay in acceptance or refusal of vaccines despite availability of vaccination services”² Public health experts have long advocated for COVID-19 vaccinations, arguing that getting enough of the population vaccinated to establish herd immunity is crucial in putting an end to this pandemic.³ However, the current dire situation in the United States with the delta variant demonstrates how vaccine hesitancy puts the country far away from stopping the virus even in the presence of high availability. As of July 20th, the Axios-IPOS coronavirus Index shows that among the unvaccinated, none of the policies tested to encourage vaccination succeeded in converting better than 1/3 of the group. Some of the tactics included door-door canvassing and the

*Advised by: Dr Gallo

¹Tversky, A., Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *science*, 185(4157), 1124-1131.

²WHO.INT. (n.d) Vaccine Hesitancy: what it means and what we need to know in order to tackle it. Retrieved August 10, 2021, from https://www.who.int/immunization/research/forums_and_initiatives/1RButler_VHTHreat_ChildHealth_gvir f16.pdf

³Mandavilli, A. (2021, August 3). The Delta Variant Is the Symptom of a Bigger Threat: Vaccine Refusal. *The New York Times*. Retrieved August 7, 2021, from <https://www.nytimes.com/2021/07/25/health/coronavirus-vaccine-refusal.html>

use of incentives. “The common implication of all these tactics is that a majority of the unvaccinated said they would be not at all likely to get the vaccine, regardless of the outreach effort.”⁴

The inability of these vaccine holdouts to be swayed by existing policy demonstrates the need for behavioral economics. It helps us dive deeper into the roots of people’s decision-making by understanding the heuristics that influence them. This, in turn, complements the standard economic framework under which policymakers and scientific experts would expect the public to evaluate the vaccines just as they have, through a straightforward and methodical comparison of the risks and benefits given the scientific evidence. However, as humans, we are affected by biases that prevent us from viewing this decision in this rational manner.⁵ Instead, behavioral economics can provide us with a more nuanced perspective on how people view the costs and benefits of vaccinations, allowing us to create policy that “nudges” people to get vaccinated.⁶ Throughout this paper, I will analyze the use of three heuristics that people use in terms of COVID-19 vaccine decision making to gain an insight into the inner cognitive mechanisms that prevent people from getting vaccinated and exploit these biases to create policy that complements the existing choice architecture within the United States. Firstly, it is very important to understand the urgency of the situation that the United States currently faces due to this hesitancy. As of the last week of July 2021, after declining numbers of cases for months, the country has had increasing numbers of covid-19 cases again due to the delta variant, with 4 times the number of infections than there were almost a month ago. “The Delta variant represents 83 percent of new infections and unvaccinated people from the eligible population represent nearly 97 percent of severe cases.”⁷ The lack of vaccination can solely be attributed to vaccine hesitancy because the United States is one of the few countries with enough vaccines accessible to protect every resident (free of cost), but about 39 percent of adults remain unvaccinated, with this percentage even higher in some parts of the country.⁸ Given the constantly developing nature of this situation, it is also important to know that the statistics regarding COVID-19 reported within this paper are from between the first week of July and the first week of August.

This paper is divided into four sections. The first three sections will be dedicated to the three heuristics. The heuristics explored within this paper are the availability heuristic, the confirmation bias, and framing. The general format for each of these three sections starts with a precise definition of the respective heuristic, followed by describing its role in influencing vaccination decisions and then finally exploiting their mechanisms to suggest policy that can combat vaccine hesitancy. The exception is the confirmation bias, where existing policies will be evaluated instead of proposing new ones. The final section is the conclusion which is a detailed summary of all the points and claims made within this paper.

2 Availability Heuristic

The availability heuristic is defined by Tversky and Kahneman as a “judgmental heuristic in which a person evaluates the frequency of classes or the probability of events by availability, i.e., by the ease with which relevant instances come to mind.”⁹ It leads us to use information that comes easiest to mind when evaluating both the risk and frequency of possible outcomes surrounding an uncertain decision. The saliency of an event increases its availability, as do dramatic events as they come to mind more easily. Additionally, “personal experiences, pictures and vivid examples are more available

⁴Tina Reed. (2021, July 26) Why vaccinated America can’t turn its back on unvaccinated America. Retrieved August 15, 2021, from <https://www.axios.com/us-vaccines-covid-19-hospitals-delta-variant-970f3b99-d55d-4116-bd57-e55abd8b7648.html>

⁵Saleska, J. L., Choi, K. R. (2021). A behavioral economics perspective on the COVID-19 vaccine amid public mistrust. *Translational behavioral medicine*, 11(3), 821–825. Retrieved August 16th, 2021, from <https://doi.org/10.1093/tbm/ibaa147>

⁶Chen, F., Stevens, R. (2016, May 06). Applying lessons from behavioral economics to increase flu vaccination rates. Retrieved July 27, 2021, from <https://academic.oup.com/heapro/article/32/6/1067/2951036>

⁷Steenhuysen, J. A. S. (2021, July 29). How the Delta variant upends assumptions about the coronavirus. Reuters. Retrieved August 4, 2021, from, <https://www.reuters.com/world/china/how-delta-variant-upends-assumptions-about-coronavirus-2021-07-26/>

⁸Mandavilli, A. (2021, August 3). The Delta Variant Is the Symptom of a Bigger Threat: Vaccine Refusal. The New York Times. Retrieved August 7th, 2021, from <https://www.nytimes.com/2021/07/25/health/coronavirus-vaccine-refusal.html>

⁹Tversky, A., Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive psychology*, 5(2), 207-232.

than incidents that happened to others, or mere words, or statistics.”¹⁰ However, all of these may not necessarily coincide with their general frequency and the true likelihood of them taking place. For example, a devastating plane crash that has resulted in widespread dramatic media coverage will temporarily lead you to rate the risk of flying as much higher than it is. This demonstrates how the availability heuristic can easily result in systematic errors.

The availability heuristic is relevant when discussing the reasons behind COVID-19 vaccine hesitancy as it can lead to an underestimation of risk, which would then question the need for a vaccine. This can occur through the bias of imaginability, a subset of the larger availability heuristic which dives deeper into the relationship between saliency and the dramatics of instances to their availability. It is defined as “When the frequency of an instance is not stored in memory, we evaluate the frequency or probability of an event by the ease with which relevant instances can be constructed in our mind.” Conversely, the risk can also be underestimated if the potential dangers are difficult to conceive of or do not come to mind.¹¹ In a study described by American legal scholar Cass Sunstein in his paper about climate change and the availability heuristic, this bias of imaginability is evident in a public health scenario. Subjects of a college campus were asked to read about an imaginary illness that was becoming prevalent. In one treatment, the symptoms of the condition were concrete and dramatic, and therefore easy to imagine involving muscle aches, low energy, and frequent severe headaches. Within the second treatment, symptoms were vague and rather long-term, involving an inflamed liver, a malfunctioning nervous system, and a general sense of disorientation. Participants were asked to imagine a 3-week period in which they had the disease and wrote a detailed description of it. After that, they assessed their likelihood of contracting the disease is on a ten-point scale. The most significant finding was that the risk evaluation of contracting the disease was drastically different in both scenarios, as “the easily-imagined symptoms make people far more inclined to believe that they were likely to get the disease.”¹²

This study can be applied when discussing COVID-19 hesitancy in terms of young adults. Being young and healthy, its common symptoms (tiredness, fever, and body aches) and long-term impacts of damaged hearts, lungs, or brain) can fail to paint a vivid image in their minds. This would mean its risk is inaccurately underestimated, and they may not necessarily see the need in getting vaccinated. Compared to something like meningococcal disease, which the public can link to vivid and graphic images of amputated limbs and rashes, leading it to be rated as riskier.¹³ This could be a possible explanation for why young adults have the lowest vaccination rates in the country. According to the Center for Disease Control, as of July 16th, 41.8 percent of Americans ages 18 to 24 are fully vaccinated, compared to 66 percent of those ages 50 to 64 and 80.9 percent of those ages 65 to 74.¹⁴

Another possible way in which the availability heuristic leads to the underestimation of risk is to do with the saliency of personal experiences. This is because of an individual’s ability to relate and empathize with personal experiences, which increases the availability of these stories in their minds. For example, if someone we know has had a mild case of COVID-19 or had severe side effects after receiving the vaccine, we are more likely to judge COVID-19 as a mild disease or that the vaccine as unsafe. Furthermore, personal experiences can be more salient than mere words or statistics regarding the benefits of vaccination, because they are easier to recall and are more readily available. However, current government officials like the CDC and pro-vaccine groups on social media consistently seem to rely on a rather impersonal tone. They constantly appeal to scientific authority and facts rather than aiming to connect with people on a more personal level, therefore reducing the availability of positive vaccination information in the minds of the hesitant.¹⁵

We can exploit the availability heuristic by creating policy keeping in mind its specific mechanisms and relation to vaccine hesitancy. As previously stated, vaccine messages coming from health care

¹⁰Kahneman, D. (2017). *Thinking, fast and slow*, pg.129

¹¹Tversky, A., Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *science*, 185(4157), 1124-1131.

¹²Sunstein, Cass R., (2005, November) *The Availability Heuristic, Intuitive Cost-Benefit Analysis, and Climate Change*. U Chicago Law Economics, Olin Working Paper No. 263. Retrieved August 15, 2021, from <https://ssrn.com/abstract=844444>

¹³Luz, P. M., Nadanovsky, P., Leask, J. (2020). How heuristics and cognitive biases affect vaccination decisions. *Cadernos de Saúde Pública*, 36, e00136620. Retrieved July 29, 2021, from <https://doi.org/10.1590/0102-311X00136620>

¹⁴Deloso, M. (2021, July 16). What’s fueling Vaccine Hesitancy Among young adults? ABC News. Retrieved August 2nd, 2021, from <https://abcnews.go.com/Health/young-adults-remain-hesitant-covid-19-vaccine/story?id=78828317>

¹⁵The Art of Health Promotion. (2002) *American Journal of Health Promotion*. ;16(4):1-12. doi:10.4278/0890-1171-16.4.TAHP-1. Retrieved September 01, 2021, from <https://doi.org/10.4278/0890-1171-16.4.TAHP-1>

providers, social media and government officials take a one size fits all approach as they are targeted at the masses, rather than tailoring messages to fit the needs and expectations of specific audiences.¹⁶ However, given our understanding of the availability heuristic, a more personalized approach can be utilized to make vaccination benefits resonate with the vaccine hesitant population. For example, in an intervention within Canada, motivational interviewing between health care providers and their patients was used to decrease hesitancy among mothers for the influenza vaccination for their high-risk children. The interviews were crucial in fostering personalized interactions with parents of children with autism and with other conditions that put children at high risk for influenza complications. The results were promising, as records demonstrated that they reduced parental vaccine hesitancy rates by “50 percent within that particular locality significantly increased overall full coverage of childhood vaccinations by about 9 percent.”¹⁷

States such as Missouri, Alabama, Wyoming and where vaccination rates are consistently low, can use Canada’s example to formulate a program based on the same mechanisms of the heuristic. At least once every week, county judges or mayors can organize a live segment where individuals with positive vaccination experiences share their stories and directly address the public. This should preferably occur at the local county level in order to focus on a more specific demographic and make messages more relatable to the public. Speakers that share experiences should be a diverse range of individuals in order to cater to different audiences. For example, a mother who has had a positive experience with her children could possibly help cater to the large population of hesitant mothers. The older population should also be included and directly make moral appeals for others to get vaccinated because they are the most vulnerable. This could help sway the current judgement of the younger population if they stop and reflect about the safety of others. Furthermore, the use of moral appeals can be an impactful and promising way of promoting public attention to risks.¹⁸ Consequently, the focus on positive stories helps increase their positive recall and simultaneously minimizes the presence of negative instances in the mind of an individual. These stories can be made even more salient if they are personal due to the ability of an individual relate to them or leading an individual to rate their individual risk more accurately.¹⁹

Counties with low vaccination rates can also implement a policy where it is mandatory for all schools, hospitals, and local businesses to maintain a record of their employees/members in their community who are vaccinated. Then they should invite those that are unvaccinated for voluntary discussions with other members within their community who have had positive vaccination experiences or public health experts. For certain demographics, a matching system in terms of similar characteristics can also be employed. For example, currently pregnant women are one of the most hesitant communities. As of the first week of August, only 23 percent of them are fully vaccinated, citing concerns about the effect of the vaccine on their fertility, despite public health experts claiming otherwise.²⁰ Pregnant women that are hesitant can be matched to pregnant women with positive vaccination experiences, in order to directly address their as well as directly increase the saliency of the benefits of vaccinations in their minds. These discussions provide a platform for the hesitant to reflect, which is important as availability is one of the few biases whose effect can be mitigated through taking some time to stop and think and reflect. Furthermore, these discussions should be restricted to small groups of people (not more than seven at a time) in order to allow for a more personalized interaction that allows for individual questions and concerns to be answered. States should ensure that these sectors are well equipped with the necessary training conduct these discussions. This policy takes the same path as Canada’s motivational interviewing, that used this aspect of being personal to increase saliency and therefore availability in our minds. Both approaches have the fundamental goal of exploiting the availability heuristic to encourage people to view vaccinations as less hostile, by focusing less on the

¹⁶FrameWorks Institute., (April 2021) What the American Public Thinks About Vaccines and How Framing Can Help. Retrieved August 14, 2021, from <https://www.frameworksinstitute.org/wp-content/uploads/2021/05/AAP-Vaccination-White-Paper.pdf>

¹⁷Gagneur, A., Lemaître, T., Gosselin, V., Farrands, A., Carrier, N., Petit, G., Valiquette, L., De Wals, P. (2018). A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. *BMC Public Health*, 18(1), 811. Retrieved August 24, 2021, from <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-018-5724-y>

¹⁸Sunstein, 2005

¹⁹Chen, F., Stevens, R. (2016, May 06). Applying lessons from behavioral economics to increase flu vaccination rates. Retrieved July 27, 2021, from <https://academic.oup.com/heapro/article/32/6/1067/2951036>

²⁰Newsroom. (2021, August 17). Study: Pregnant women do well with Covid Vaccine. Retrieved September 15, 2021, from <https://newsroom.uw.edu/news/study-pregnant-women-do-well-covid-vaccine>.

science and appealing more to people's emotions through the use of personalized interactions.

3 Confirmation Bias

The confirmation bias, a term coined by British psychologist Peter Wason, “connotes the seeking or interpreting of evidence in ways that are partial to existing beliefs, expectations, or a hypothesis in hand.”²¹ This means that due to this bias, we have the tendency to both seek and favorably interpret information that confirms our existing beliefs or hypothesis. As individuals, this bias leads us to ignore available evidence before making decisions and leads us to approach an issue with a biased point of view. Therefore, conclusions that we draw from evidence interpreted in a biased manner are more likely to be false than when we approach an issue in an objective manner, leading to systematic errors. The confirmation bias can be explained by the cognitive dissonance theory, which proposes that situations involving conflicting behaviors, beliefs or attitudes produce a state of mental discomfort.²² This relates to Kahneman's observations about the two systems of thought in *Thinking Fast and Slow*. Our system 1 of thinking which operates automatically with little or no effort, leads us to favor coherent stories in our minds. This could explain why we ignore information that doesn't correlate with our beliefs because it leads to this cognitive dissonance.²³

The confirmation bias is relevant when considering COVID-19 vaccine hesitancy in terms of the widespread usage of the internet as a source of health information. The internet allows people to actively seek information that supports their beliefs, leading them to be selectively exposed to vaccination information. This is an issue because information online is not centrally controlled, which means anybody on the internet can be the source of information, regardless of whether they have medical qualifications. This means that the internet opens access to all kinds of perspectives about the COVID-19 vaccine, including misinformation, which due to the confirmation bias, people can possibly choose to evaluate as credible by ignoring all other scientific evidence.²⁴ This type of behavior is known as the backfire effect, which is defined as continuing to believe in misinformation despite evidence-based correction aiming to rectify it.²⁵ In effect, the internet serves as an echo chamber for individuals who have negative opinions towards COVID-19 vaccines and keep looking for information, credible or otherwise to support this pre-conceived notion. In a study described within the *Journal of Health Communication*, an online survey of 480 parents of children aged 0-4 was used to investigate the relationship between existing vaccination beliefs and the selection and evaluation of vaccine related information online. This experiment took place in two parts. First, in order to measure pre-existing beliefs regarding vaccination, the vaccination confidence scale (VCS) was used. “The scale consists of eight items (e.g., vaccines are necessary to protect the health of children) with answer options ranging from totally disagree (1) to totally agree (11).” After that, in order to evaluate how beliefs, influence message selection, participants of the study were exposed to a list of ten headers regarding early childhood vaccination, five of which were negative and five of which were positive. An example of a positive header was that “vaccines protect your child and the population,” whereas a negative header was “the disadvantages of vaccines are hardly mentioned.” Participants were asked to select the five headers that they were most interested in reading more about, demonstrating how this experiment acts almost like a simulation of the different perspectives of vaccine information we find on the internet. A sum score was calculated indicating the valence of the selected headers, ranging from 0(all negative) to 5(all positive), with a higher score indicating the selection of more positive vaccination messages.

The results demonstrated that vaccination beliefs strongly correlated with the selection and evaluation of headers. Figure 1 is a graph presented in the data within the original experiment, which demonstrates how the confirmation bias was evident on both the positive and negative sides of the belief spectrum. People holding negative beliefs about vaccination tend to select more negative headers and vice versa. “Zones marked with $p < .05$ indicate where the relationship between [health literacy]

²¹Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, 2(2), 175-220.

²²Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2). Stanford university press.

²³Kahneman, 2017

²⁴Flanagin, A.J., Metzger, M.J. (2000). Perceptions of Internet Information Credibility. *Journalism Mass Communication Quarterly*, 77, 515 - 540.

²⁵Swire-Thompson, B., DeGutis, J., Lazer, D. (2020). Searching for the Backfire Effect: Measurement and Design Considerations. *Journal of applied research in memory and cognition*, 9(3), 286-299. Retrieved September 02, 2021, from, <https://doi.org/10.1016/j.jarmac.2020.06.006>

and message selection depends on vaccination beliefs” Hence, one of the main findings from this study was that parents generally selected belief-consistent information regarding early-childhood vaccination and evaluated it positively, clarifying the relationship between the confirmation bias and vaccine hesitancy in terms of online health information seeking. ²⁶

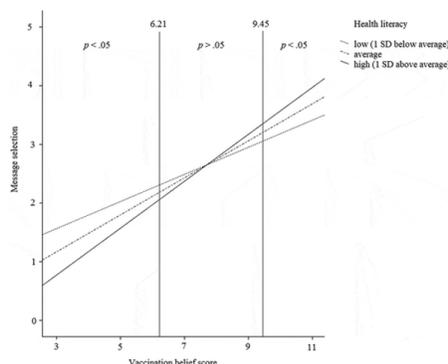


Figure 1: Vaccination beliefs and the selection of positive vs negative messages. (Meppelink et al.,2019)

Given that pharmaceutical companies such as Pfizer or Johnson and Johnson clearly have an extremely significant role in the development of the vaccines, people may also be hesitant to take the vaccine due to their pre-existing beliefs against these companies. In this case, the confirmation bias is evident as due to pre-existing negative beliefs about pharmaceutical companies, the public might choose to believe that the industry does not their best interest in mind, despite scientific evidence saying otherwise. According to a Gallup poll conducted in 2019 where the American public was asked to rate 25 U.S industries as either negative or positive , the pharmaceutical industry ranks last. 58 percent of Americans rated the pharmaceutical industry as negative compared to 27 percent who rated it positively. This demonstrates the long pre-existing beliefs of mistrust of the pharmaceutical industry that could be fueling vaccine hesitancy. This low image of the industry could possibly be generated from the idea that these industries are purely profit-driven, inferred from their high drug costs. The opioid epidemic that was widely believed to have been triggered by certain organizations within the pharmaceutical industry demonstrates the belief that the entire pharma industry may not have the public’s best interest in mind.²⁷ Both ways in which the confirmation bias helps us understand vaccine hesitancy could also offer an explanation as to why existing measures of stressing primarily scientific information haven’t worked as people tend to discount it and amplify misinformation that confirms their beliefs instead.

Unlike the availability heuristic, it is not easy to minimize the effects of the confirmation bias. This can be attributed to the backfire effect and the fact that it is hard to correct ideas that are deeply rooted in one’s belief system. “In the presence of such confirmatory bias in human reasoning, misinformation, once planted, is hard to eradicate.”²⁸ Therefore, instead of suggesting new policy, this paper will consider the effectiveness of content moderation on social media, an existing measure aiming to combat the confirmation bias by flagging or removing misinformation. An article published by the Harvard Kennedy School Misinformation Review provides some insight on this matter by exploring the relationship between COVID-19 conspiracy theories on social media and the effect of content moderation. The study concluded that content moderation practices in general strongly reduce the probability of conspiracy theories reappearing. However, the complexity and time involving this process results in obstacles affecting both efficiency and accuracy. Platforms managed to fact check only 15-50 percent of posts containing conspiracy theories, sometimes with the moderation only taking place

²⁶Meppelink, C. S., Smit, E. G., Fransen, M. L., Diviani, N. (2019). ”I was Right about Vaccination”: Confirmation Bias and Health Literacy in Online Health Information Seeking. *Journal of health communication*, 24(2), 129–140. Retrieved August 20th, 2021, from <https://doi.org/10.1080/10810730.2019.1583701>

²⁷Dunn, A. (2019, September 11). Public trust in drug makers is at an all-time low. Can biopharma recover? Retrieved August 29, 2021, from <https://www.biopharmadive.com/news/pharma-industry-public-trust-gallup-business-roundtable/561986/>

²⁸Qian, M., Chou, Y.C., Lai K. E. (2019, September 30). Confirmatory Bias in Health Decisions: Evidence from the MMR-Autism Controversy. Retrieved September 01, 2021,from https://www.lehigh.edu/~kw1409/qian_c_hou_1ai_v_accine.pdf

weeks after going viral, a pattern especially evident on Twitter. Furthermore, the study reported that the overall virality reduction of posts/stories reinforcing conspiracy theories on Twitter was only 61 percent after moderation. These statistics demonstrate that with regards to the confirmation bias, those among the American public that have negative opinions towards vaccinations may already have been exposed to misinformation on social media and have registered it as supporting their beliefs much before it is flagged or removed.

A further implication of this study is that platforms should explain what they are filtering and why. Especially with regards to political figures, removal of content or flagging without explanation can lead to mistrust among people that are in support of that particular belief. Therefore, additional transparency and explanation of their decisions to users by social media platforms can build trust between the American public and the services. This means they are more likely to trust and perceive the already filtered information on that platform as credible. Overall, an extremely concerning issue that social media platforms and mainstream news sources alike should be constantly vigilant about is the backfire effect. They should be aware that their information can be exploited for support and the reinforcement of conspiracy theories, and therefore develop additional technology or developments in the moderation process to combat that. Therefore, content moderation on social media is productive only to a limited extent as there are shortcomings that prevent these methods from overcoming the confirmation bias.²⁹

4 Framing

In their paper, *The Framing of Decisions and the Psychology of Choice*, Tversky and Kahneman first introduced framing as “the frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits and personal characteristics of the decision-maker” The characteristics used to evaluate the external validity of a heuristic include that it must have a precise definition and can be tested and validated in a range of both experimental and non-experimental studies. However, aspects of the definition that include the usage of norms, habits, and personal characteristics are rather vague and therefore cannot be validated experimentally to establish causality. Therefore, framing is often studied as a trigger for other heuristics. This particular paper will analyze how framing can trigger loss aversion. Loss Aversion is defined by Kahneman and Tversky as “the displeasure associated with losing a sum of money is generally greater than the pleasure associated with winning the same amount. *The Framing of Decisions and the Psychology of Choice*. To clarify, losses evoke stronger feelings and have a greater impact than gains.³⁰ Tversky and Kahneman first introduced their discussion of framing by an experiment known as the “Asian Disease problem.” 150 students were asked to imagine that the US is on the verge of an outbreak of an Asian disease that is set to kill 600 people. They were then asked to choose between two alternative programs. The first problem was that if program A is adopted, 200 people will be saved (72 percent), and if program B is adopted, there is a 1/3 possibility that 600 people will be saved, and 2/3 probability that no people will be saved (28 percent). The second problem was that “if program C is adopted 400 people will die” (22 percent), and finally if program D is adopted there is a 1/3 probability that nobody will die, and a 2/3 probability that 600 people will die. (78 percent). Both problems are identical, the only difference is that in problem 1 the outcomes are described by the number of lives saved and in the second one by the number of lives lost. However, only 28 percent chose option 1 in problem two compared to 77 percent of people who chose it in problem 2, despite them having the same outcome. Therefore, this example further demonstrates the fear of loss by showing how people are risk seeking when the outcome is loss framed.³¹

Framing is critical when it comes to increasing vaccine acceptance is an essential part of messaging and vaccine communication in general.³² Therefore, loss aversion can possibly be exploited to increase

²⁹Papakyriakopoulos, O., Serrano, J. C. M., Hegelich, S. (2020). The spread of COVID-19 conspiracy theories on social media and the effect of content moderation. *Harvard Kennedy School Misinformation Review*, 10. Retrieved August 29, 2021, from <https://pdfs.semanticscholar.org/9cbb/e218ed66f13cb9c588351b99cc4ab7f5015b.pdf> o

³⁰Tversky, A., Kahneman, D. (1981). The framing of decisions and the psychology of choice. *science*, 211(4481), 453-458.

³¹Kahneman, 2017, pg.337

³²Motta, M., Sylvester, S., Callaghan, T., Lunz-Trujillo, K. (2001, January 01). Encouraging covid-19 vaccine uptake through effective health communication. Retrieved August 02, 2021, from <https://www.frontiersin.org/articles/10.3389/fpos.2021.630133/full>

vaccine uptake through the use of loss frames. However, before proposing this policy, it is also important to understand the effect of gain and loss framed messaging outside of a controlled lab environment. In a field experiment conducted as a part of a workplace health promotion program, 133 women who had obtained fewer than average mammograms than they needed at their age were asked to watch a 15-minute video on breast cancer mammography. They were randomly assigned into two groups, half viewing a video on the benefits of mammography (gain-framed), and the other half viewing a video on the risks of getting mammography (loss-framed). 12 months later, 66.2 percent of the women who viewed the loss-framed video obtained a mammogram, compared to 51.5 percent of the women that viewed the gain-framed video.³³ The evidence from this field experiment helps verify the external validity of the larger impact on loss framed messages in nudging people to a certain behavior.

The above experiment reinforces the effectiveness of the exploitation of loss aversion through message framing. Therefore, stakeholders responsible for adopting vaccine related policy such as health care networks and providers, health plan insurers, federal local and state legislators can switch from consistently posting gain framed messages to loss framed.³⁴ It is common to see a message similar to this one “the Pfizer vaccine reduces the risk of getting COVID-19 up to 75 percent.”³⁵ Instead, the same statement can be reframed to elicit a stronger emotional response: “being unvaccinated increases your risk of getting COVID-19 up to 375 percent” (This calculation was made using an equation in a paper that created a loss-framed statement in order to increase flu vaccination rates).³⁶ This message can essentially be disseminated via doctors’ offices, social media, governmental websites, grocery stores, local businesses as well as pre-existing vaccine information campaigns. Another way in which loss aversion can be used is to highlight the personal and collective costs of being unvaccinated, by including the possibilities of being seriously sick, devastating consequences arising from lockdowns of the economy, and the possibility of infecting those that are vulnerable.³⁷

5 Conclusion

The continued issue of COVID-19 vaccine hesitancy in the United States is dangerous as it prevents herd immunity that is necessary for the country’s much awaited return to normalcy. Statistics show that certain states and demographics have consistently low vaccination rates, with existing tactics failing to influence them. Therefore, there is a pressing need to “nudge” the public into getting vaccinated. By challenging the standard economic framework, behavioral economics provides additional clarity into the reasons behind vaccine hesitancy which then allows us to find ways to increase its acceptance. Overall, the three heuristics explored provide insights on both understanding vaccine hesitancy and also finding ways to overcome it.

The availability heuristic can impact vaccination rates negatively through the bias of imaginability as it leads to the underestimation of risk. However, certain aspects of the heuristic as a whole can also be utilized by governments in a positive manner to formulate policy that increases vaccination uptake through exploiting the relationship between being familiar/personal to saliency that directly affects availability. The use of the confirmation bias also prevents the American public from getting vaccinated because of the public’s reliance on the internet as a source of healthcare information, which makes it easier for the backfire effect to come into play, because of the widespread presence of misinformation. The confirmation bias also has a role in the mistrust of pharmaceutical companies, which in turn increases hesitancy. The use of content moderation to combat the confirmation bias has limitations and therefore, there is a need to update and modify these technologies in order for them to become more effective. Framing, by serving as a trigger for loss aversion, can be exploited to increase vaccination rates. Stakeholders can reframe existing vaccination messages to create “loss frames” rather than “gain frames”. In conclusion, lessons from the field of behavioral economics are extremely relevant in

³³Bertrand, M., Mullainathan, S., Shafir, E. (2006). Behavioral economics and marketing in aid of decision making among the poor. *Journal of Public Policy Marketing*, 25(1), 8-23.

³⁴PolicyLab. (2017). Addressing Vaccine Hesitancy: To Protect Children and Communities Against Preventable Diseases. Retrieved August 12, 2021, from https://policylab.chop.edu/sites/default/files/pdf/publications/Addressing_vaccine_hesitancy.pdf

³⁵Machingaidze, S., Wiysonge, C. (2021, July 16). Understanding covid-19 vaccine hesitancy. Retrieved August 07, 2021, from <https://www.nature.com/articles/s41591-021-01459-7>

³⁶Chen, F., Stevens, R. (2016, May 06). Applying lessons from behavioral economics to increase flu vaccination rates. Retrieved July 27, 2021, from <https://academic.oup.com/heapro/article/32/6/1067/2951036>

³⁷Motta et al., 2001

both understanding the reasons behind vaccine hesitancy within the United States and making policy recommendations for the government to combat it.

6 Bibliography

6.1 Academic Papers and Books

Chen, F., Stevens, R. (2016, May 06). Applying lessons from behavioral economics to increase flu vaccination rates. Retrieved July 27, 2021, from <https://academic.oup.com/heapro/article/32/6/1067/2951036>

Luz, P. M., Nadanovsky, P., Leask, J. (2020). How heuristics and cognitive biases affect vaccination decisions. *Cadernos de Saúde Pública*, 36, e00136620. Retrieved July 29, 2021, from <https://doi.org/10.1590/0102-311X00136620>

Motta, M., Sylvester, S., Callaghan, T., Lunz-Trujillo, K. (2001, January 01). Encouraging covid-19 vaccine uptake through effective health communication. Retrieved August 02, 2021, from <https://www.frontiersin.org/articles/10.3389/fpos.2021.630133/full>

Sunstein, Cass R., (2005, November) The Availability Heuristic, Intuitive Cost-Benefit Analysis, and Climate Change . U Chicago Law Economics, Olin Working Paper No. 263. Retrieved August 15, 2021, from <https://ssrn.com/abstract=844444>.

FrameWorks Institute., (2021, April) What the American Public Thinks About Vaccines and How Framing Can Help. Retrieved August 14, 2021, from <https://www.frameworksinstitute.org/wp-content/uploads/2021/05/AVI-Vaccination-White-Paper.pdf>

Gagneur, A., Lemaitre, T., Gosselin, V., Farrands, A., Carrier, N., Petit, G., Valiquette, L., De Wals, P. (2018). A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. *BMC Public Health*, 18(1), 811. Retrieved August 24, 2021, from <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-018-5724-y>

Saleska, J. L., Choi, K. R. (2021). A behavioral economics perspective on the COVID-19 vaccine amid public mistrust. *Translational behavioral medicine*, 11(3), 821–825. Retrieved August 16th, 2021, from <https://doi.org/10.1093/tbm/ibaa147>

Meppelink, C. S., Smit, E. G., Fransen, M. L., Diviani, N. (2019). "I was Right about Vaccination": Confirmation Bias and Health Literacy in Online Health Information Seeking. *Journal of health communication*, 24(2), 129–140. Retrieved August 20th, 2021, from <https://doi.org/10.1080/10810730.2019.1583701>

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, 2(2), 175-220.

Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2). Stanford university press.

Flanagin, A.J., Metzger, M.J. (2000). Perceptions of Internet Information Credibility. *Journalism Mass Communication Quarterly*, 77, 515 - 540.

Swire-Thompson, B., DeGutis, J., Lazer, D. (2020). Searching for the Backfire Effect: Measurement and Design Considerations. *Journal of applied research in memory and cognition*, 9(3), 286–299. Retrieved September 02, 2021, from <https://doi.org/10.1016/j.jarmac.2020.06.006>

Qian, M., Chou, Y.C., Lai K. E. (2019, September 30). Confirmatory Bias in Health Decisions: Evidence from the MMR-Autism Controversy. Retrieved September 01, 2021, from https://www.lehigh.edu/~kwl409/qian_chou

The Art of Health Promotion. *American Journal of Health Promotion*. 2002;16(4):1-12. doi:10.4278/0890-1171-16.4.TAHP-1. Retrieved September 01, 2021, from <https://doi.org/10.4278/0890-1171-16.4.TAHP-1>

Papakyriakopoulos, O., Serrano, J. C. M., Hegelich, S. (2020). The spread of COVID-19 conspiracy theories on social media and the effect of content moderation. *Harvard Kennedy School Misinformation Review*, 10. Retrieved August 29, 2021, from <https://pdfs.semanticscholar.org/9cbb/e218ed66f13cb9c588351b99cc4ab7f501>

Tversky, A., Kahneman, D. (1981). The framing of decisions and the psychology of choice. *science*, 211(4481), 453-458.

Tversky, A., Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *science*, 185(4157), 1124-1131.

Kahneman, D. (2017). *Thinking, fast and slow*.

Bertrand, M., Mullainathan, S., Shafir, E. (2006). Behavioral economics and marketing in aid of decision making among the poor. *Journal of Public Policy Marketing*, 25(1), 8-23.

Tversky, A., Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive psychology*, 5(2), 207-232.

6.2 Websites and News Articles

Machingaidze, S., Wiysonge, C. (2021, July 16). Understanding covid-19 vaccine hesitancy. Retrieved August 07, 2021, from <https://www.nature.com/articles/s41591-021-01459-7>

Steenhuysen, J. A. S. (2021, July 29). How the Delta variant upends assumptions about the coronavirus. Reuters. Retrieved August 4, 2021, from <https://www.reuters.com/world/china/how-delta-variant-upends-assumptions-about-coronavirus-2021-07-26/>

Deloso, M. (2021, July 16). What's fueling Vaccine Hesitancy Among young adults? ABC News. Retrieved August 2nd, 2021, from <https://abcnews.go.com/Health/young-adults-remain-hesitant-covid-19-vaccine/story?id=78828317>

Mandavilli, A. (2021, August 3). The Delta Variant Is the Symptom of a Bigger Threat: Vaccine Refusal. The New York Times. Retrieved August 7th, 2021, from <https://www.nytimes.com/2021/07/25/health/coronavirus-vaccine-refusal.html>

WHO.INT. (n.d) Vaccine Hesitancy: what it means and what we need to know in order to tackle it. Retrieved August 10, 2021, from https://www.who.int/immunization/research/forums_and_initiatives/1_RButlervHTHreatC

Tina Reed. (2021, July 26) Why vaccinated America can't turn its back on unvaccinated America. Retrieved August 15, 2021, from <https://www.axios.com/us-vaccines-covid-19-hospitals-delta-variant-970f3b99-d55d-4116-bd57-e55abd8b7648.html>

Dunn, A. (2019, September 11). Public trust in drug makers is at an all-time low. Can biopharma recover? Retrieved August 29, 2021, from <https://www.biopharmadive.com/news/pharma-industry-public-trust-gallup-business-roundtable/561986/>

Newsroom. (2021, August 17). Study: Pregnant women do well with Covid Vaccine. Retrieved September 15, 2021, from <https://newsroom.uw.edu/news/study-pregnant-women-do-well-covid-vaccine>.

PolicyLab. (2017). Addressing Vaccine Hesitancy: To Protect Children and Communities Against Preventable Diseases. Retrieved August 12, 2021, from <https://policylab.chop.edu/sites/default/files/pdf/publications/Ad>