

## **NUDGES ON PEOPLE'S DECISION TO TAKE COVID-19 VACCINE**

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DOI: 10.46609/IJSSER.2021.v06i11.004 URL: <https://doi.org/10.46609/IJSSER.2021.v06i11.004>

Received: 11 Oct. 2021 / Accepted: 12 Nov. 2021 / Published: 02 Dec. 2021

### **ABSTRACT**

This paper is targeted at the covid-19 pandemic and according to medical approaches. This research aims to examine the factors related to people's decision to take vaccines and develop a nudging strategy to enhance voluntary vaccine uptake. The linear regression model and behavioral economics principles help explain the relativeness between social, political, and economic factors and taking vaccines among people in America.

**Key words:** Covid-19 pandemic, vaccination, behavioral economics, nudges

### **1. Introduction**

Since the FDA issued emergency use authorization for the first Covid-19 vaccine on December 11, 2020, the vaccine's effectiveness in managing the pandemic situation and reducing the infected cases had been a central argument.

Several determinants associated with the decision to take vaccines include the perceived safety and efficacy of the vaccine and the social, financial costs along with disease infection; (Streefland, 2001) (François et al., 2005) individuals' vaccination decisions are also subjected to the impact of social influence. (Larson et al., 2011) For instance, suggestions from health professionals (Zijtregtop et al., 2009) and health-related newscasts would change people's perceptions of vaccine safety and efficacy. (Breban, 2011) Factors such as religious belief, community opinion and literacy rate, health insurance coverage, employment situation, and even political party stand may play an essential role in people's decision to get vaccinated.

By using behavioral economics and psychological experimentation to develop theories about decision-making, people's perceptions, and preferences in the context of the covid-19 pandemic

and the features that alter people's behavior can be better understood. Furthermore, since vaccination decision-making is not merely a process of payoff optimization but also an individual's response to the impact of social influence, (Xia & Liu, 2013) it is crucial to understand the incentives and concerns that drive or hinder people's decisions.

Similarly, complications like misinformation, vaccine hesitancy, and mistrust in the medical system have necessitated efforts to guide people in making the appropriate choices. Therefore, designing a new nudge that targets the covid-19 situation and fits the correlation trend between subjective factors and people's choices will result in prompter and rational response.

This paper overviews the general trend of vaccine uptake with the supporting theory of behavioral psychologic principles to weigh the factors that shape people's attitudes toward nudges and override people's previous concerns regarding vaccination, especially during the past several months. Recognition of factors associated with people's decision in taking vaccines during this early vaccination preparation period will help increase people's awareness of punctual healthcare, inform future strategies to welcome an increased rate of vaccination under emergence, as well as ensure equitable COVID-19 vaccine access indirectly, which will lead to an enormous change in the health rate in America.

## **2. Background**

The zoonotic origin of the novel severe acute respiratory syndrome coronavirus 2(SARS- CoV-2) was first reported in Wuhan, China. (World Health Organization, 2020) Community transmission of coronavirus disease 2019 (COVID-19) in the United States was first detected in February 2020.By mid-March, all 50 states, the District of Columbia, New York City, and four U.S. territories had reported cases of COVID-19. (CDC COVID-19 Response Team, 2020)

Despite the worsening economic situation and healthcare problems, state and national governments have adopted many approaches to curb the pandemic and address the wide-spreading problem. In the first months of the SARS-CoV-2 outbreak in the United States, states enacted restrictive SDMs intended to reduce transmission by limiting human-to-human contact (Miller et al., 2020). At the same time, the advice on masks and lockdowns as the policy remained conflictual.

In December 2020, two vaccines were granted an emergency use authorization (EUA) by the U.S. Food and Drug Administration. (Johns Hopkins Coronavirus resource center, 2021)The pandemic has triggered widespread misinformation that has undermined both understanding and acceptance of science and public policy, which has extended to vaccine acceptance. (de Figueiredo et al., 2020) Although concerns and distrust in vaccine led some people to refuse such

medical method, intent to receive COVID-19 vaccination increased among adults and across all priority groups, revealing that people choose to turn to vaccination as a means of problem solution and guardianship. (Nguyen et al., 2021)

### **3. Literature Review**

Geographic variation in numbers of Covid-19 cases and deaths likely reflects differences in epidemiologic and population factors as well as clinical and public health practices. (CDC Covid-19 Response Team, 2020) Meanwhile, differences in the availability and testing approaches and experiments likely have contributed to geographic differences in the vaccination uptake percentage.

From its principle, vaccination stands at the intersection between individual and society, which involves balancing an individual's decision to accept or refuse a vaccine and the benefits to public health from community immunity when large numbers are vaccinated. For optimal success, vaccination programs need a high level of uptake. Because of such a vital requirement for consistent cooperation, the implementation of vaccines faces multiple challenges in popularization and promotion. Vaccine hesitancy, the delay in acceptance or refusal of vaccination despite the availability of vaccination services, (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) is therefore being used to describe such initial or periodic rejection towards the medical treatment.

In research in which two sequential large-scale randomized controlled trials (RCTs) are being used to investigate whether nudging people to get vaccinated via reminders carefully designed to reduce barriers to follow-through can improve Covid-19 vaccine uptake, results show that behavioral science insights can increase and speed up Covid-19 vaccinations at close to zero marginal cost. While promoting vaccinations at scale requires a multifaceted approach, findings suggest that behavioral nudges could be an impactful strategy to consider. (Dai et al., 2021)

Existing studies on vaccination decision-making during pandemics typically focused on the analysis of hesitancy to receive vaccination (Khubchandani et al., 2021) and different barriers that prohibit such promotion, (Zhang & Fisk, 2021) and the shifting of attitudes in taking vaccines before the publication of immunization. (Pogue et al., 2020) However, with the updated data source for the vaccination rate and change in people's response regarding the pandemic, we can better generate a more accurate and up-to-day analysis in terms of people's decision in getting vaccinated in the Covid-19 pandemic case specifically by using behavioral economics and psychology as a backup explanation.

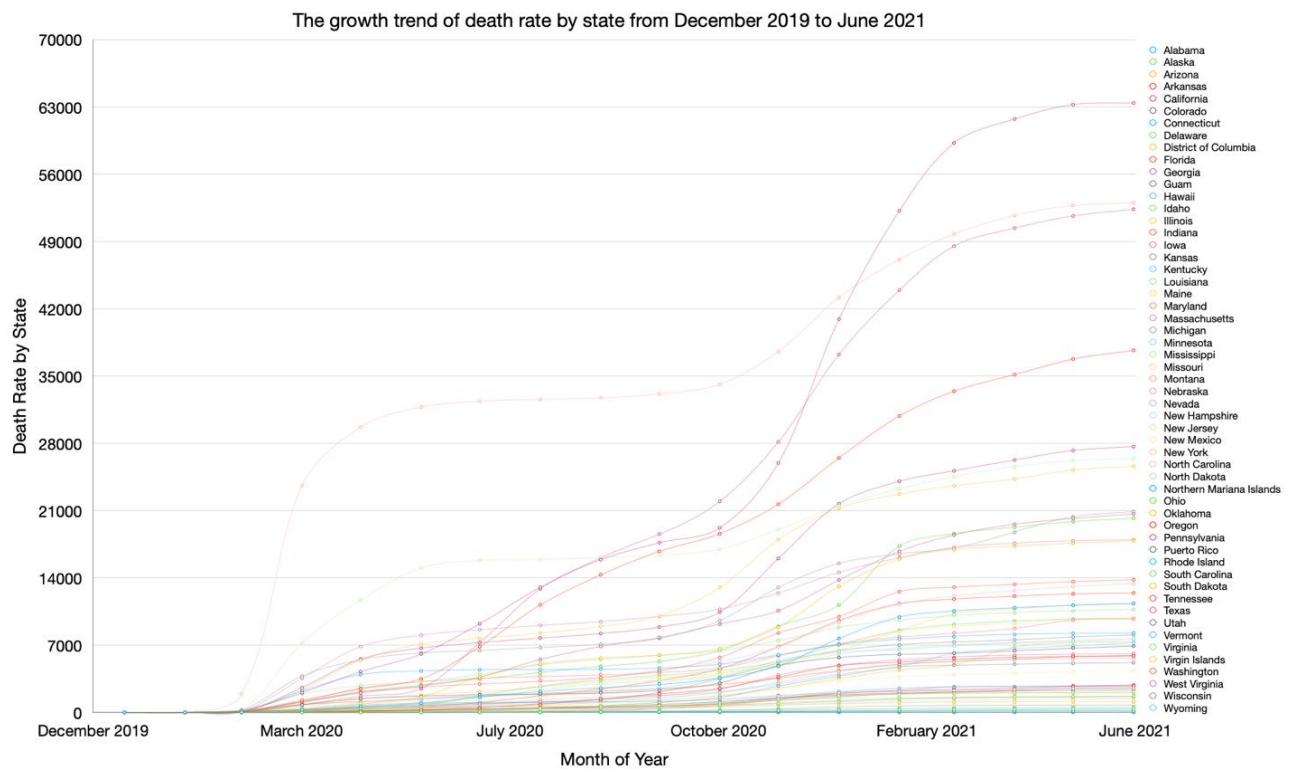
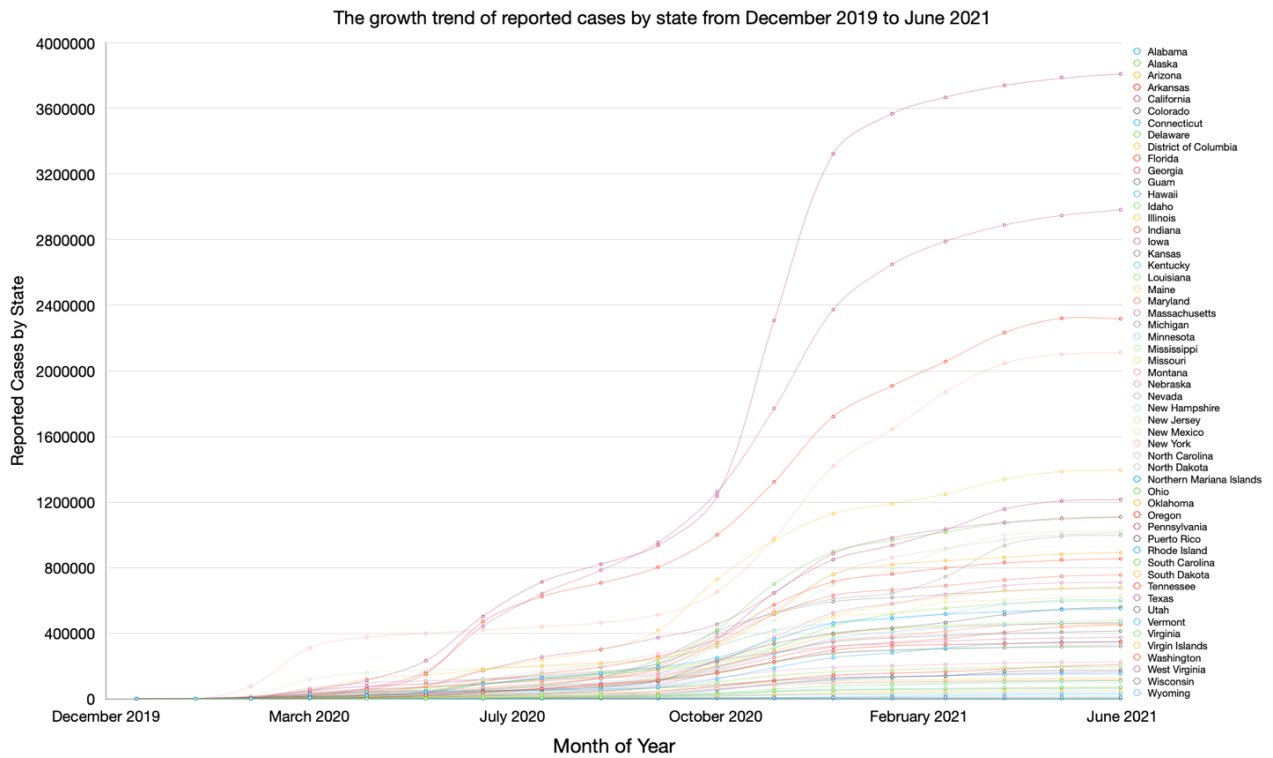
### **4. Influential Factors**

Many possible underlying assumptions about the change in people's attitudes and opinions regarding vaccination have been associated with the undergoing situations. For example, people were having greater intent and feeling for improving their life quality and were their minds affected mainly by a media campaign and political regulations. In addition, education level and insurance coverage limit people's accessibility and economic capability and contribute to the variance in people's decision to take vaccines. By generating regression models for the collected data and analyzing behavioral and social studies, we narrow down the influential features to six different factors.

#### **4.1 Reliance on Vaccination**

One factor would be the increased awareness of the effectiveness of vaccination. For instance, the wide availability of vaccination has slowed down the increment of death rate and reported cases significantly starting from January 2021. In addition, the amelioration of the pandemic situation, which proves the necessity of vaccines, has led many people to be more determined about altering the problematic status of Covid-19, believing in the efficacy of masks and scientific guidance on controlling the pandemic, and most importantly, having more vital willingness to take a Covid-19 vaccine when available.

The desire to get back to work and recover from the economic loss also led both the officials and individuals to pay closer attention to the availability of vaccination. Especially for ethnicity and low-income families who face tremendous challenges living and covering the medical expenses, they need to secure the stability of their occupation opportunity. With such strong intent to live an everyday life after a whole year of lockdown and emergence, many chose to take a dose shot to reduce the probability of infection and assure themselves of their safe travel plan. Furthermore, the duration of time surpasses people's previous concern about the safety and feasibility of vaccination in a dilemma. People in doubt, especially those who worry that vaccines have been adopted too quickly without enough safeguard tests and may result in unpredictable side effects, are reassured as they view mostly successful cases and the considerably delightful trend from the data source.

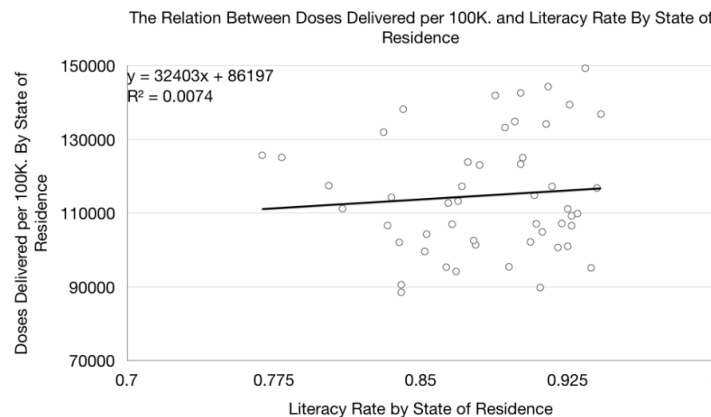
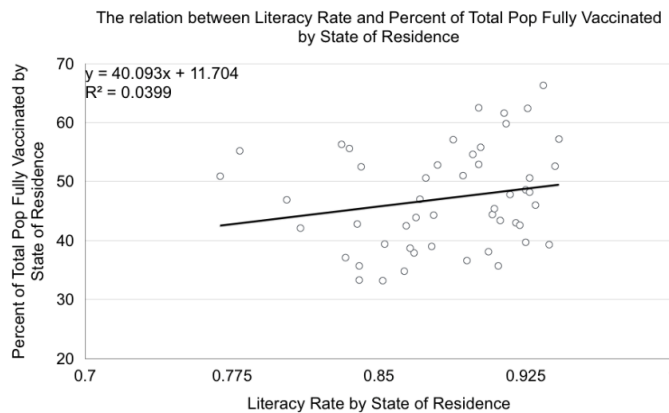


Data source: Covid-19 data, US-States-History, CSV, June 2021

### 4.2 Literacy Rate

Collective literacy skill levels and access to professional knowledge affect the implementation of vaccination programs. A significant influence of education - including university degrees - on vaccine acceptance has been observed in many studies. Health literacy, the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions, (Biasio, 2017) is also part of the influential incidences.

Since familiarity with medical knowledge predominantly affects people’s decision to approach schedule medical meetings and receive vaccines on time, literacy rate, primarily medically targeted acknowledgement is closely related to the acceptance of the vaccine. From the linear regression generated by the online data, a direct relationship can be observed between literacy percentage and percent of the total population fully vaccinated by the state of residence.



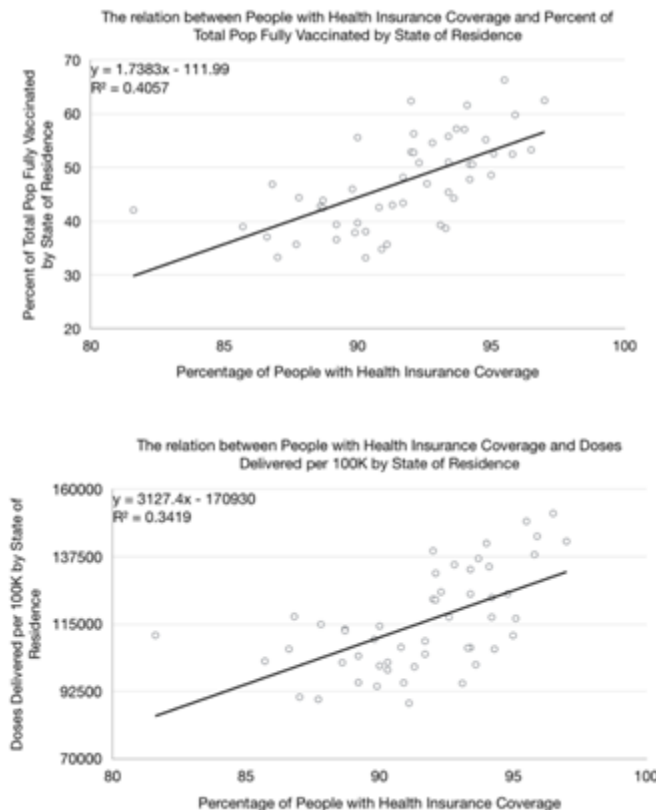
Data source: The Condition of Education 2020, US. Department of Education, May 2020

### 4.3 Medicare and Health Insurance

In addition to literacy rate, people’s awareness of medication is another determinant for vaccination. The cost has always been a barrier to receiving and providing timely preventive medical care to children living in poverty. (Smith et al., 2006)

According to a study that examined the impact of health insurance status on vaccination coverage among adult populations, adults without health insurance were significantly less likely than those with health insurance to be vaccinated for influenza, pneumococcal, and Tdap after adjusting for confounders. (Lu et al., 2015)

A similar trend is also shown as a result of the Covid-19 vaccination case. Based on the linear regression graph on the data source from Health Insurance Coverage in the United States: 2019 by US Department of Commerce, United States Census Bureau, the percent of the total population fully vaccinated by the state of residence is highly associated with the percent of the total population with health insurance coverage in 2019.



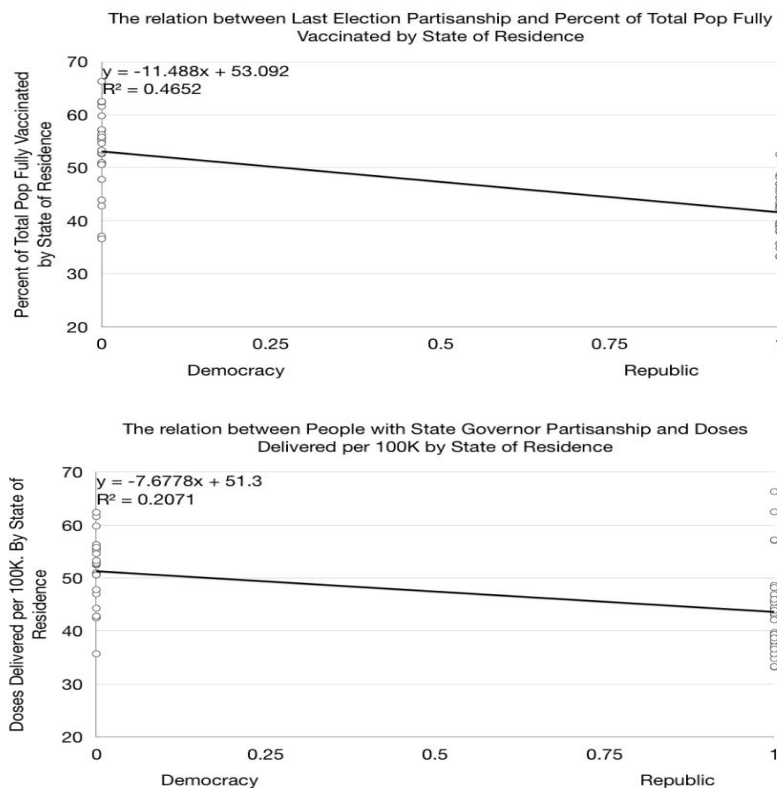


Data source: Health Insurance Coverage in the United States: 2019, Department of Commerce, U.S. Census Bureau, September 2020

#### 4.4 Partisanship in Engagement

The pandemic response has also become increasingly politicized. Generally, republican governors were less likely to enact policies aligned with public health social distancing recommendations at the beginning of the pandemic. (Adolph et al., 2021)

Such a trend extends to the point of vaccination acceptance that states that voted Republican in the last election and have republican governors tend to have a lower vaccination rate. The average percentage of the total population of fully vaccinated by the state of residence for states that voted for the Republican party in last election is about 41.6. The states that voted for the Democratic party in the last election is about 53.1; the average of the percentage of the total population fully vaccinated by the state of residence for states under the governance of the Republicans is 43.6, while that for states under the governance of Democrats is 51.3.





Data source: 2020 Election Result and 2021 state governor partisanship, National Archives

#### **4.5 Mass Media Campaign and Coverage**

The nature of new media platforms poses challenges for thinking about the effects of and remedies against misinformation in the very openness of Internet-based platforms to all sorts of content producers, resulting in the accuracy of delivering message becomes a matter of issue. Since some misinformation that receives widespread attention does not warrant intervention by public health institutions, the impact of such audience exposure vastly outweighs what relatively limited public health media campaigns are capable of a hindrance. (Southwell et al., 2019)Especially when the comprehensive reporting on vaccination is unavailable, the most common choice becomes the option that most assures people relying on the simplest way of attaining information and making choices.

Due to the scale of the targeted audience, a message reaches, the consequence of such influence can sometimes be massive. For example, when Trump reversed a plan for White House officials to receive vaccine in mid-December, his proponents and followers may swiftly change their minds about the vaccination plan. On the contrary, the popular trend of posting the “I Got Vaccinated” sticker on Instagram and Facebook in May can work the other way around. The sticker serves as a gentle social pressure, reminding people who may have forgotten to do it and calling for joint efforts. Leading by many popularities and stars with tens and hundreds of millions of followers, mass media drives more people to take the vaccine in a short period as celebrity endorsement can cut through the concerns and make people consider options they may have outright rejected using an encouraging and persuasive message.

Even though media platforms can be misleading, advertising campaigns can necessarily prevent and respond to the inaccurate information promptly and professionally, and more importantly, introduce people to updated medical adoptions and plans.

#### **4.6 Endorsement and Regulations**

Trust in the vaccines is also critically dependent on the ability of governments to communicate the benefits of vaccination and deliver the vaccines safely and effectively, which makes government actions of significant importance in terms of combating the declining compliance with public health-related rules. In addition to scientific validation, policymakers have developed and endorsed policies and environmental support systems that foster the promotion of Covid-19 vaccination programs. (Khubchandani et al., 2021)These organizations' endorsements successfully increase individuals' willingness to receive a vaccine.

While endorsements turn out to be motivating people's decisions many people also change their minds due to the regulations set by the government. Starting from June, employers could legally require Covid-19 vaccination for employees to re-enter the workplace and provide incentives to encourage employees to get a shot. Similarly, New York City would require proof of vaccination to enter all restaurants, fitness centers, and indoor entertainment venues in early August. Applying a limit on access to the workplace and public facilities pushes people who regard vaccination as low importance even further to their vaccination action. Either running out of choice or intentionally reconciling with previous worries, the motive to devote all attention to the right to share the public resource equally becomes one of the primary reasons to take the vaccine.

## **5. Behavioral Economics and Psychological Mechanics Principles**

### **5.1 Nudging**

Nudges, any aspect of the choice architecture that alters people's behavior predictably without forbidding any options or significantly changing their economic incentives, (Sunstein, 2012) pushes people in the direction that is perceivably "right" and "logical" by encouraging people to make better decisions. (Halpern et al., 2013) While one mode of thinking called reflective thinking enables us to make rational decisions by considering all the pros and cons of each choice, the other named automatic thinking allows us to make quick decisions with little effort.

### **5.2 Defaults**

Some of the most consistent and significant nudge effects arise out of the manipulation of defaults. Default is the course of events that will transpire when a person does not actively choose an alternative path. Though the quality of evidence varies across domains and contexts, defaults have been shown to affect several decisions, many of them related to health, such as getting vaccinated against influenza, donating organs for transplantation, and selecting specific options within advance directives. (Choi et al., 2002)

### **5.3 Mental accounting**

Mental accounting is defined as a type of decision framing in which individuals form psychological accounts containing the advantages and disadvantages of an event or option. (Henderson & Peterson, 1992) This concept has been used to explain violations of the principle of fungibility in examinations of saving behavior (Shefiindz Thaler, 1988) as well as decisions involving monetary gains and losses, as the starting point for a model of consumer behavior (Thaler, 1980, 1985).

#### **5.4 Prospect theory**

Prospect theory assumes that losses and gains are valued differently, and thus individuals make decisions based on perceived gains instead of perceived failures. Losses cause a more significant emotional impact on an individual than makes an equivalent amount of growth. Given choices presented two ways—with both offering the same result—an individual will pick the option offering perceived gains. (Tversky & Kahneman, 1992)

#### **6. Application of Principles on Factors Explanation**

When making decisions, people usually do not weigh outcomes by their objective probabilities but rather by transformed possibilities or decision weight based on their subjective preference and evaluation. Moving from the editing phase that involves interpreting options of different vaccine types and making judgments of their applicability, to the evaluation phase where people make a final decision about whether to take the vaccination, their way of processing information leads to different outcomes choosing from the same choices, and this is when the isolation effect occurs.

The nature of the decision-making process being interest-driven rationalizes the change in people's response to vaccine uptake. Either under the influence of political partisanship or because of a high degree of education background, people with (or people who perceive to) have a higher possibility of infection are more likely to get vaccinated, which can be explained by the certainty effect of the prospect theory. The certainty effect is exhibited when people prefer specific outcomes and underweight outcomes that are only probable, leading individuals to avoid risk when there is a prospect of a sure gain and contributes to those seeking risk when one of their options is an inevitable loss.(Tversky & Kahneman, 1992)When health risk is involved in the decision of vaccination and the probability of different unprecedented symptoms is unknown, those who understand infection as a sure loss would choose to take the risk and get vaccinated as preventive measures, while those who do not perceive the pandemic as a significant threat but rather fear the possible side effect of vaccine would avoid the attempt of taking the vaccine.

Further, peer influence on media platforms or in-person is related to a psychological mechanism, heuristics. These mental shortcuts are used in situations in which people assess the frequency of an event belonging to a class or its probability.(Tversky & Kahneman, 1992)When unsure how to act in a given situation, we solve problems by substituting unavailable information with a cue in the environment or by looking at and imitating others' actions. The popular trend followed by the pressure of involvement and norms temptingly makes people more susceptible to cognitive biases, systematic deviations from rational judgment.

Significant detriments as health insurance coverage and government regulations are correlated with status quo bias, which tends to place higher values on options perceived as status quo, explained because of loss aversion. (Tversky & Kahneman, 1992) Since financial crisis on the national level also has an unneglectable impact on individuals, families already under tremendous economic pressure tend to avoid any additional or unnecessary expenses but focus more on balancing every bill in an organized and planned-out manner. On the other hand, people capable of categorizing vaccination and the risk of infection to the “status quo” region would place vaccination as the most urgent task before all. Cognitively biased preference over health and safety at hand makes people want to get vaccines regardless of the cost or other sacrifice needed. Governments enforced policies such as regulations on entry to restaurants and other public spaces. Perception of these limitations concerns citizens as they feel a loss of freedom. As a result, overall wellbeing declines.

## **7. Design of Nudges**

Behavioral economists have identified striking ways in which trivial differences in the presentation of options can powerfully and predictably affect people’s choices. To maximize vaccinations in a population, it is critical to understand how to best design behavioral interventions to either boost intentions to get vaccinated, remove barriers to follow-through on good intentions, or do both. (Brewer et al., 2017) By developing a system that helps people make more efficient and rational decisions and achieves states of affairs that are more socially desirable in the eyes of nudging candidates, the problem of extreme vaccination hesitancy and misconception can be addressed more appropriately. (Lepenies & Maficka, 2015)

Scientific organizations, public health experts, media outlets, and clinic advertising have been educating the general population about the Covid-19 vaccine. Meanwhile, the shared incredible or false information about lockdowns, vaccinations, and death statistics, have fueled the panic of purchasing products and exacerbated insecurity with a state of fear and panic among the public. (Elhadad et al., 2020)

The spread and circulation of misleading information about the vaccination and its impact are ubiquitous, which reduce people’s confidence in the government and medical centers. Therefore, managing the spread of misleading and incredible information can perform well as a nudge that changes people’s minds about vaccination.

In the public sector, governments and public hospitals play an essential role in assuring the published data source's validity and promptly detecting unreliable reports. 1) Reviewing the collected ground-truth data with scientific experiments as a backup before releasing speech and reports; 2) establishing a particular department or collaborating with third-party service in charge

of identifying misleading information; 3) teaching the public, especially employees and students, the fact about vaccination and its applicability by creating promotion pamphlet; 4) adjusting and introducing new insurance and welfare policies corresponding to the pandemic situation by taking more economic aid into consideration.

In addition to the official governments and medical centers, large corporations and social network platforms matter. Hiding behind the screen and keyboard, many take advantage of the distance and lack regulation to eliminate the responsibility they are accounted for when publishing hoaxes and posting false news. With a single click, inauthentic reports would reach hundreds of accounts in one second, which is unpredictably powerful and dangerous. Thus, the following procedures are worthy considering: 1) Disrupting invalid advertising method such as economic incentives and misleading titles in advertisements and inflammatory articles for traffickers of misinformation; 2) Applying machine learning on the fact-checking system to assist in detecting fraud and lead the public to better control misleading news from the source; 3) Limiting the access to buying ads or trending flows through stricter enforcement of policies to reduce the chance of quick spread at scale; 4) making it easier to report a false news story on platforms such as Facebook and Instagram, for instance, by simply clicking a button so that stories that are flagged as false might show up at a lower frequency.

## **8. Conclusion**

This research examines the influential factors regarding the variance in vaccination uptake trend among states in America. The regression line model and mechanism analysis yield that reliance on vaccination, literacy rate, Medicare and health insurance, partisanship in engagement, mass media campaign coverage, and endorsement and regulations have an essential impact on people's decision to take the vaccine. By using behavioral economics principles such as nudging, defaults, mental accounting, prospect theory and other terms, not only were the underlying correlation between nudging factors and the resulting behavior being exposed, but also were some nudges targeted at eliminating misinformation being successfully designed to address the problem of vaccination hesitancy and boost vaccine uptake intentions among people.

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