ATTITUDE AND ACCEPTABILITY TOWARDS COVID-19 VACCINE IN INDIA : INSIGHT FROM BEHAVIORAL ECONOMICS

A Dissertation Submitted to the Central University of Haryana

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DECLARATION

I hereby declare that dissertation entitled **'Attitude and Acceptability towards COVID-19 Vaccine in India: Insight from Behavioral Economics'** submitted to the Department of Economics of the Central University of Haryana for the award of the degree of Master of Philosophy, is a record of an original piece of research work carried out by me under the supervision and guidance of Dr. Ajeet Kumar Sahoo, Assistant Professor, Department of Economics, Central University of Haryana. The content of this bonafide research work has not been previously submitted for the award of any kind of degree or diploma in any university/institution or even the other same title of recognition.

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CERTIFICATE

This is to certify that the thesis entitled **'Attitude and Acceptability towards COVID-19 Vaccine in India: Insight from Behavioral Economics'** which is being submitted to the Department of Economics of the Central University of Haryana for the award of the degree of Master of Philosophy in Economics, appears as the record of the original research work carried out by Ms. Mahima Kathuria under my guidance and proper supervision. The matter shown in this research work has not been submitted partly or fully for any kind of other degree/diploma of this university or any other prestigious university/institution.

I declare and consider that this present research work is perfect and fit for further evaluation.

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ABSTRACT

The development of a vaccine against the disease is certainly being a challenge but it is quite more challenging to achieve the desired vaccine uptake. Vaccination decisions are typically seen as individual decision-making tasks where individuals try to weigh the costsand benefits of vaccination to make a decision. Taking into account the rational choice perspective, vaccination is more likely when subjective risks of the disease outweigh the risk of vaccination. The risk of infection decreases with the increasing vaccination uptake. People are uncertain about receiving the vaccine which is a difficult issue that needs to be resolved. The long-term success of public health in response to the coronavirus disease pandemic depends on the required immunity in sufficient proportion. So therefore, it becomes relatively essential to achieve widespread vaccination by taking into account Behavioral barriers in vaccine uptake and solving them. This paper takes into account all the factors such as demographic variables, attitude towards a COVID-19 vaccine and Behavioral factors which affect the covid-19 vaccine intake in India. The methodology adopted to obtain the required results is logistic regression analysis. The results obtained through proper modelling were then analysed.

Keywords: Behavioral factors, Vaccination, COVID-19

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Introduction

CHAPTER 1
INTRODUCTION

1.1 History, Origin and Spread of COVID-19

The 2019 novel coronavirus is a severe respiratory syndrome that has spread from the Wuhan city of China to other parts of the world (Singhal, 2020). The virus was initially originated in bats and was then transmitted to humans. It is still unknown about the transmission of the virus from animals to humans in Wuhan, China in December 2019. After the 1918 flu pandemic, the human coronavirus is a disease that has become the fifth documented pandemic (Liu, 2020). The COVID-19 pandemic outbreak is very similar to the other previous outbreaks of SARS and Middle East syndrome which were emerged in China and Saudi Arabia. (Arden et al., 2020). The World Health Organisation (WHO) has declared the spread of the COVID-19 disease as a pandemic. More than 212 counties and territories have confirmed coronavirus infection cases. As of May 2021, more than 192,274,819 cases have been reported by WHO so far worldwide (Kumar, 2020). In India, more than 29 lakh cases and more than 5, 17,000 cases were confirmed. The virus can be transmitted through inhalation or even by coming in close contact with the infected droplets. The period of incubation of the disease ranges from 2- 14 days. The first case in India of the COVID-19 virus was reported on January 30th, 2020 in the state of Kerala. After that, there was a drastic rise in the number of cases in India and worldwide. The general symptoms of the deadly virus include fever, dry cough, sore throat, malaise, breathlessness, fatigue. In the present scenario, the symptoms are much varied and some people are also found asymptomatic. Before the virus was deducted, it was called Wuhan Pneumonia by the press because the pneumonia symptoms were found in people. But after the sequenced testing, it was found that the causative agent is a novel coronavirus. Therefore the COVID-19 virus can be declared as the seventh member of the family which is

infecting humans (wu et al., 2020). Since the mortality rate from its transmissibility is very high, it is advisable to take measures that prevent the spread of the disease. In India and other countries, various societal measures have been implemented such as stay at home orders, travel restrictions etc.

1.2 Behavioral Perspective of COVID-19 Pandemic

COVID-19 is like a black swan event that has an outsized impact (Mishra, 2020). The event has been described as a black swan because it is harder to predict and even much harder to compute the probabilities. The Coronavirus has posed significant challenges to global public health (Park, 2021). It has been argued that after the Great Depression of the early 1930s, it is the COVID-19 because of which the global economies havesuffered a lot. So many major economies including India have witnessed a serious impact on income, output, inflation and employment over the last year. But on the other hand, some countries like Sweden and Switzerland have been able to combat the propagation of viruses up to a very large extent. There is a lot of information about the expected health and economic costs which the economies have to bear due to theoutbreak (Global Preparedness Monitoring Board, 2019) but little has been done in taking preventive measures to attenuate the risk of such large pandemics.

It is very obvious to say that the Coronavirus will not leave early and hence we need to adjust to the virus and change our lifestyle. With this realisation, people have restarted their economic and social life. It has been called as 'New Normal' (Kumar, 2020). New normal means life with COVID-19 rather than life after COVID-19. People are encouraged to adopt some behavioral changes to alleviate the sudden spread of COVID-

19. Due to this, there have been certain behavior changes among economic agents such as consumers, distributors and producers. There has been a significant change in the livelihood of people. Hence it can be argued that the virus is not only a threat to the life of thepeople but also

it has created a significant impact on the livelihood of human beings. The preventive strategies and certain behavior changes implemented by people include social distancing, avoiding touching face, stay at home policies, frequent hand washing (Smith, 2020). It can be seen that individuals are influencing the economic variables such as employment, income, output etc when they are adapting themselves to new kinds of behavioral patterns. In the phase of COVID-19, it is becoming challenging for people to make economic decisions based on rationality. Hence the costs of such decisions outweigh the benefits leading to irrevocable losses.

Behavioral economics is an emerging field that has received great attention from public policymakers. It focuses on understanding people's behavior and choices to formulate more effective public policies (Soofi, 2020). Traditional economics acknowledges that people are rational decision-makers. It assumes that people make decisions based on rationality assumptions, it follows that consumers try to maximize utility and producers try to maximize profits. But the concept of behavioral economics goes beyond thestandard economic theory of decision making. Behavioral economics deals with the bias involved in the decision-making process of the individuals and by capturing these behavior changes, it can be quite easy to use interventions to address such behaviors. It works on the simple fact that people are not rational agents and does not have the willpower to defend infinite rationality (Thaler, 2008).

Behavioral economics deals with many biases. But only some of these biases are relevantin the COVID-19 scenario. Individuals' daily choices are generally the trade-off that is between the immediate outcomes and the expected outcomes of the future. Present bias means when individuals prefer the payoff which is sooner over the payoffs which will be realised in future even if they are larger (Donoghue & Rabbin, 1999). In the case of COVID-19, people tend to prefer the pleasure of going out for the current benefit at the future cost of contracting the virus. Some individuals have the disproportionate to choose the current options and are unwilling to

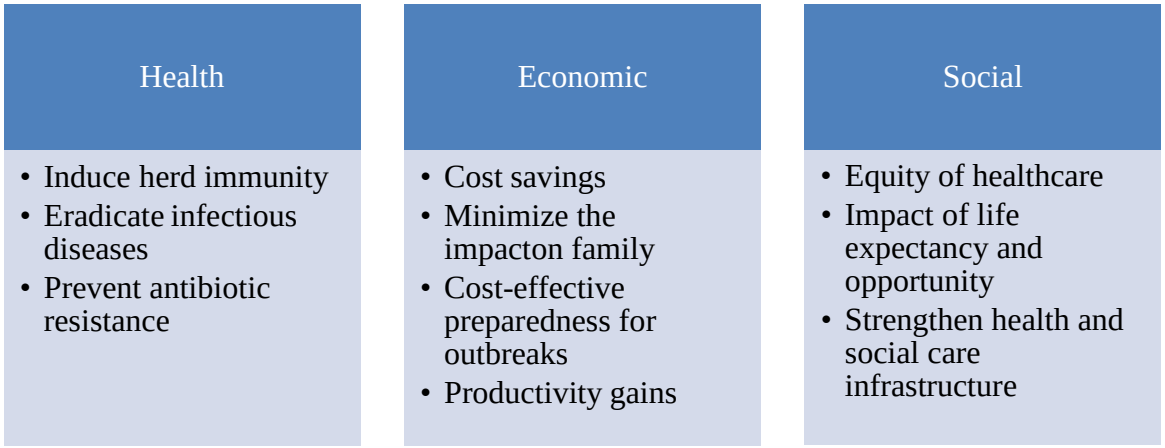
accept the change. This change can be referred to as 'new normal' as mentioned earlier. This preference of individuals can be defined as 'status quo bias'**.** People have also tended to misunderstand the impact of the virus and are venturing out with the critical thinking that the virus would not attack them. This is what an economist calls as 'optimistic bias and over confidence effect'.

It is also rightly said that individual choices are also influenced by the way the choices are mentioned or framed. These choices are then sometimes affected by the way possible outcomes are framed i.e. in terms of the gains or losses. This concept is known as the "framing effect". The behavior of the individuals is directed towards health-promoting decisions with the help of framing effect. For instance, if it is mentioned that the recovery rate in the case of COVID-19 is 77.76 per cent would be called a gain- framed message and the mortality rate is 1% would be called a loss-framed message. These messages in terms of the way they are framed affect the behavior pattern of the economic agents.

1.3 COVID-19 Vaccination Status Worldwide

It is indeed important to develop safe and effective vaccines which protect against diseases and hence the development of such vaccines is one of the foremost scientific advances in the 21st century (Plotikin, 2020). Vaccines provide health benefits bythe prevention of ill- health and death from infectious diseases such as COVID- 19. Vaccination, clean drinking water and sanitation are among the public health interventions which are responsible to improve health outcomes globally. It is indeed justified that the vaccinations not only improve the health outcomes globally but have keen benefits to society and different spheres of society such as health, economy and social fabric.

Figure 1.1: Benefits of Vaccinations on Different Spheres



The coronavirus disease has been a major threat to the world and hence there was an urgent need to develop a vaccine. The trials to develop and test the vaccine were started in 2020 when the spread of the virus began in China. The official announcement regarding the approval and the distribution of vaccines in the first quarter of 2021 was made in September 2020 by Dr Harsh Vardhan, then Health Minister. The vaccination program in India began on 16 January 2021 with 3,006 vaccination centres when the Drug Controller General of India (DCGI) approved the use of the Oxford - AstraZebeca vaccine under emergency which is also known as "Covishield". On 2nd January, DCGI also granted and approved the use of BBV152 (Covaxin).

Out of the total world population, 10.2% of individuals are fully vaccinated with the COVID-19 vaccine. The total numbers of 2,790 million doses are administered worldwide. 18 vaccines are approved worldwide after the successful trials. It has been four months since the vaccination drive has been started; the US peaked at 1 vaccine dose daily per 100 people whereas, in India, it is only 0.25 doses per 100 people (World in data)

India has vaccinated only 4.3% of the total population as of 2nd July 2021 (Federal Health

Agency, Ministry of Health). On the other hand, the U.S.A has vaccinated 47% of their total population. It is indeed true that India needs to go a long way to reach desired vaccinated status. Total numbers of 450,000,000 vaccines have been administered in the country out of which 350,000,000 individuals are vaccinated with the 1st dose and 100,000,000 individuals are fully vaccinated (World in data)

1.4 Challenges in Vaccine Uptake

Since the pandemic has started in December 2019, so many pharmacological and non-pharmacological solutions are tested. It is indeed true that multiple vaccines have been developed against the virus. Vaccines are the best solution to prevent the spread of the disease (Paudel, 2021). An effective vaccine is the best option to control COVID-19 (Forman & Shah, 2021). So many vaccines are already approved and are administered in many countries. In India, two vaccines are granted authorisation against the virus. The development of a vaccine against the disease is certainly being a challenge but it is quite more challenging to achieve the desired vaccine uptake. The COVID-19 vaccine isburdened with so many challenges as it requires not only the development of a safe vaccine but also the authorization, production, distribution and administration (Fisk,2021). These challenges are certainly arising from various structural problems but the real challenges in the case of vaccine acceptance include the behavioral problems which require certain attention of policymakers.

1.4.1 Structural Problems

The structural problems or barriers in the case of vaccination include issues that limit the access of an individual to vaccine service (Forman & Shah, 2021). These types of issues and problems require different kinds of attention which need to be addressed. Structural problems include-

- Production and supply bottlenecks i.e. disruption and constraints in the production, distribution and delivery of a particular vaccine.

- Limited access to vaccines includes cost and convenience barriers. Cost barriers could be the price of a particular vaccine or the cost incurred to reach thevaccination centre. Convenience barriers are the geographic and functional proximity to vaccines.

The current outbreak of the COVID-19 is much challenging and the vaccination programis an urgent requirement taking into account the severe effect of the pandemic. Reaching the desired goal with at least 70% of people vaccinated is a challenging task. So a political will, as well as required funding, is necessary for addressing structural barriers (Modlin, 2021).

Various measures have been taken by the government to overcome these problems. Time and cost act as a barrier in vaccine uptake so the government on their part is trying for mass vaccination and to make vaccines available at every end by removing these barriers. Even if the structural barriers are removed and resolved by making vaccines widely available free of cost will still not guarantee the vaccine uptake because the problem of behavioral barriers comes into the picture. The next section deals with behavioral barriers to vaccine uptake and why and how these issues need to be addressed more urgently.

1.4.2 Vaccine Hesitancy and Behavioral Problems

Even if the structural problems are solved, individuals have a negative attitude towards the vaccines and they are quite unwilling to accept the vaccine which is among the top barriersin improving the situation of the COVID-19 pandemic. People are uncertain about receiving the vaccine which is a difficult issue that needs to be resolved. The immunity in sufficient proportion is an essential requirement in response to the COVID-19 pandemic which is another essential element for the long term success of public health (Paul, 2021). So therefore it becomes relatively essential to achieve widespread vaccination by taking into account behavioral barriers in vaccine uptake and solving them.

Vaccination decisions are the task of individuals where they try to decide by taking into account the costs and benefits associated with vaccination. Talking about the rational choice perspective, the vaccine is accepted when according to the decision-makers, the subjective risks associated with the disease outweigh the risks associated with the vaccination but in the case when people are hesitant to take a vaccine, the case is opposite.

Vaccine hesitancy means the delay in the acceptance or refusal of vaccines despite the availability of vaccine services (Edwards, 2021). Individuals are unsure about getting a vaccine hence creating perceptions related to vaccines which are the major influencers of the decrease in vaccination uptake. Even before the COVID-19 pandemic, vaccine hesitancy was seen as a growing challenge to achieve the desired immunizations; it canbe witnessed from the polio vaccines (Norris & Khan, 2021). According to the World Health Organisation (WHO), among the top ten global threats, vaccine hesitancy is also recognised as one among them (WHO, 2019). Research work was carried out in the high-income countries and a framework model was developed which is identified as the 5C model of the drivers or factors of vaccine hesitancy. These drivers are confidence, complacency, risk calculation, convenience and collective responsibility (Shinghai, 2021).

In the various situations, where vaccination uptake is identified to be very low and does not meet the desired uptake, vaccine hesitancy is visible in such situations (MacDonald, 2015) which could be due to the system failures like limited availability of vaccination services etc. But even if the problems in the system failures are solved, the vaccine hesitancy remains intact due to some other reasons. In a multi-country survey, it was identified that among all the participants, there were only 71.55 participants who reported that they will accept the COVID-19 vaccine (Lazarus, 2021). According to some other surveys of the COVID-19 vaccine which took place, it was identified that perceived risk, effectiveness and safety, doctor's

recommendation are crucial factors driving vaccine hesitancy among people. Many studies have also found demographic, socio-economic and behavior factors directly influence the decision to get vaccinated. According to various studies conducted in the field of behavioral economics, the decision of an individual to accept the vaccine is generally based on perceived benefits associated with the vaccine, perceived risk of vaccine side effects and the effectiveness (Nicholas, 2021).

The decisions to vaccinate are highly varied according to the context, time, as well as place and thus vaccine hesitancy, is quite complex. There are wide ranges of factors that are encompassed within the phenomenon of vaccine hesitancy. Many advisory groups onbehavioral insights and science have identified the number of drivers and hence recommended contextualizing these drivers. If these complex behaviors of individuals are identified, then it would be easy to address these issues to increase vaccine uptake. Hence the interventions are aimed at influencing the behavior among people. These issues and biases can be addressed by changing the behavior of individuals through the use of '**nudges'** (Thaler & Sunstein, 2009).

Behavior science theory could help in both to find out the suitable reasons for vaccination acceptance among people and also to find the reasons for refusal. To promote vaccination uptake, nudges can be used. A nudge is any aspect of the 'choice architecture'which indirectly influences the individual's decision making in a way that the economic incentives for the individuals do not change (Hansen, 2013). Hence, nudge is anything that modifies the 'choice architecture' of an individual without reducing the optionsavailable to them. Policymakers have been using nudges to improve the decision-making behavior of an individual. It is used in many parts of the world and is applied in various domains such as education, health, finance etc.

1.5 Research Motivation

The existing literature related to vaccination in India is mostly descriptive, with very few

empirical studies that have covered demographic and socioeconomic drivers of vaccine acceptance or refusal. The attitude and behavioral analysis have remained unexplored. The previous findings take into account the fact that people behave rationally but the economic principles as discussed and formulated for a rational man does not fit perfectly in the real world (Singh, 2020). The actual decisions of a person are not rational. Hence a study is required to take into account the various behavioral factors as well as socio-demographic factors which influence the decision making of people for vaccine acceptance due to vaccine hesitancy, hence leading to irrational behavior.

1.6 Objectives of the Study

The following are the objectives that need to be fulfilled through this study-

i) To identify the underlying factors that determine the attitude of individuals towards COVID-19 vaccine uptake in India.

ii) To study the extent to which factors such as demographic, perception towards immunization, and behavioral variables can affect individual decision to vaccinate.

1.7 Research Question

What demographic, attitude related and behavioral factors influence the individual decision to vaccinate?

1.8 Organization of the Study

The following research study is organised into six chapters

After the introductory analysis in the present chapter, **Chapter 2** provides a theoretical framework of the study. This chapter gives a quick outlook about the emergence of various theories related to behavioral economics in the context of health. It cites the development of how individuals are moving towards irrational behavior from rational behavior and what are the behavioral biases associated with the case of vaccination decision making.

Chapter 3 discusses the features of data and the methodology adopted in this empirical analysis for simplification and analysing data to reach the desired results. This chapter alsogives a brief outlook about the theoretical concepts of the statistical tools which were followed by the concrete analysis.

Chapter 4 discusses the data analysis and evaluation of the results obtained. After the descriptive analysis, logistic regression analysis/model was used to analyse the associationof independent variables on the vaccination uptake and refusal and the results obtained were discussed thereafter.

Chapter 5 deals with the discussion and results. Finally, **chapter 6** confines the thesis by deducing the conclusion and policy implications. Additionally, this chapter also tried to discuss the further scope of the study and recommendations related to future research.

Chapter 2
Theoretical Framework

CHAPTER 2
THEORETICAL FRAMEWORK

2.1 Introduction

Traditional theories of economics as proposed by neoclassical economists endorse rational-decision making. Traditional economic theory assumes the fact that individualsare rational agents in the economy and they tend to maximise their gains and reduce their losses. Behavioral economics was proposed by Kahneman and Tversky in response to neoclassical theories. According to them, individuals are irrational and they make decisions based on heuristics and biases, which, may or may not yield the greatest gain in terms of the choices people make (Kahneman, 2011).

2.2 Behavioral Theories

There are various behavioral theories related to behavioral change that have examined the factors related to the low acceptance of vaccination and immunizations to promote uptake and acceptance. One of the most important theories is the framing effect which means howthe messages are framed and conveyed to the individuals to yield the attitude and behavioral perspective of an individual (Levin et al., 1998). The theory is originated from the prospect theory.

2.2.1 The Theory of Planned Behavior

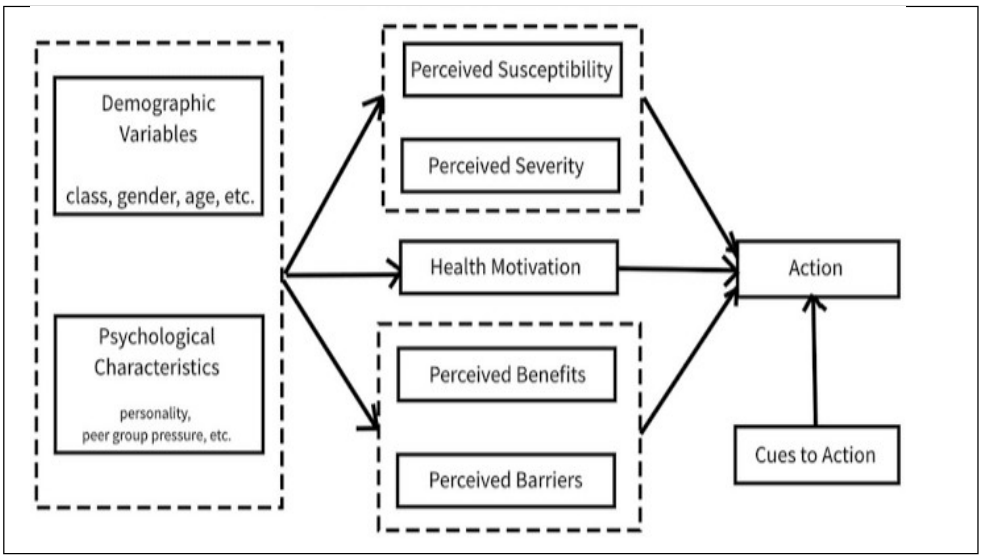
The theory of planned behavior (Ajzen, 1991) takes into account the factors whichdirectly influence the intentions of individuals to engage in a health behavior which encompasses attitude towards the behavior, the person's perception regarding the subjective group norms and the perceived behavioral control. The theory intends toexplain all the behaviors in which people have abilities to exert self-control.

It has been widely used in a wide range of health behaviors and intentions such as immunizations etc. It explains how behavioral achievement is dependent upon both motivation and ability.

2.2.2 Health Belief Model

The health belief model (Rosenstock, 1988) is a theoretical model of behavior which is mostly applied in studies of immunizations, perception regarding the severity of disease and perceptions regarding the benefits and risks of vaccines that directly influence health behaviors. The model takes into account six main theoretical domains which help to predict preventative behaviors that are perceived severity, perceived susceptibility, perceived barriers, perceived benefits, self-efficacy and call to action. The health belief model also suggests how people's perception regarding various health problems, perceived benefits of action, self-efficacy explains how people are engaged in health-promoting behavior. It suggests how a stimulus must be present to trigger the health-promoting behavior.

Figure 2.1: Health Belief Model



Source: The Health Belief Model, Charles Abraham

2.2.3 Prospect Theory

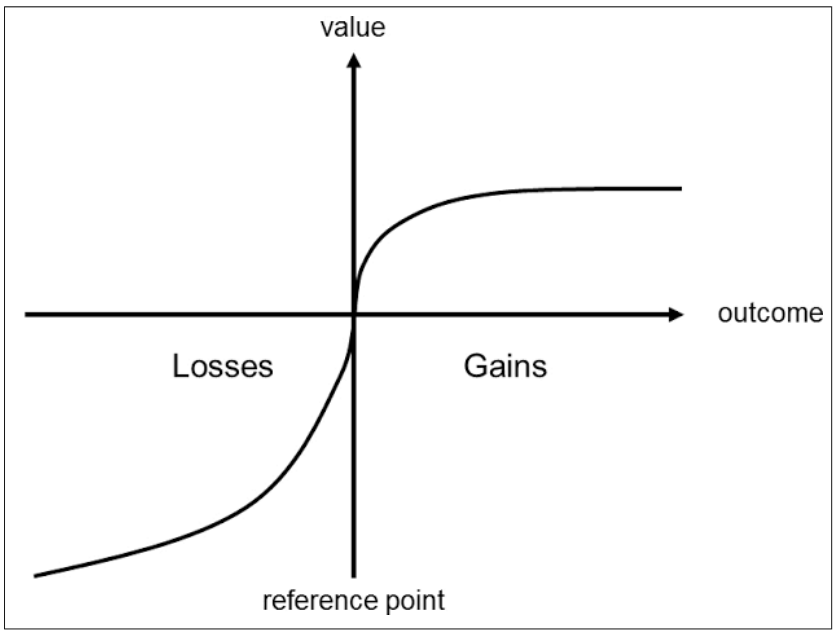
Surprisingly, individuals tend to become risk-taker or pro-risk in the case of loss situationssuch as while playing the lottery and risk-averse in the situations of gain, where the odds are stacked in their favour. Prospect theory (Kahneman & Tversky, 1979) help us understand the fact why individuals fail to do the right thing even after knowing what is right, just like in the case of vaccination. It explains how people assess the potential for loss or gain in an asymmetric manner which is dominated by the aversion from losing something. A gain frame is a positive side where individuals adopt behavior due to the benefits derived. On the other hand, loss-frame means the cost associated with not adopting the behavior. For instance, a gain frame message in the case of vaccinations would be "you reduce the chances of getting infected with COVID-19 virus if youvaccinate", whereas a loss frame message would be "you increase the chances of getting infected with COVID-19 virus if you do not vaccinate". Although, these statements have the same intense meaning, how these messages are framed can influence the behavior of an individual.

Prospect theory emphasizes the fact that due to the loss aversion behavior, losses have a more psychological impact than gains of the same amount. For example, a loss of Rs 1000weighs more than the gain of the same amount for an individual. So it can be said that individuals are more risk-seeking in the case when losses are emphasized more to avoidthe loss, whereas individuals are risk-averse to retain their gains in the case when gains are emphasized.

The fundamental part of the prospect theory can be explained with a two-stage choice model which (Kahneman & Tversky, 1981) defines in the form of the value function and weighting functions. Value function in prospect theory is explained through asymmetric S-curve which depicts how people avoid risks in the case of gains and how individuals seek risks in the case of losses often termed as loss aversion. The S-shape of the value functionmore specifically

indicates that the values are considered concave for the gains and convexfor the losses. For instance, people will value a raise in pay from Rs 500 to Rs1000 moreas compared to Rs 5000 to Rs 5500. The non-symmetry in the value function S-curve depicts that value drops much faster with the losses as compared to the rise with gains. It is represented in Figure 2.2 below.

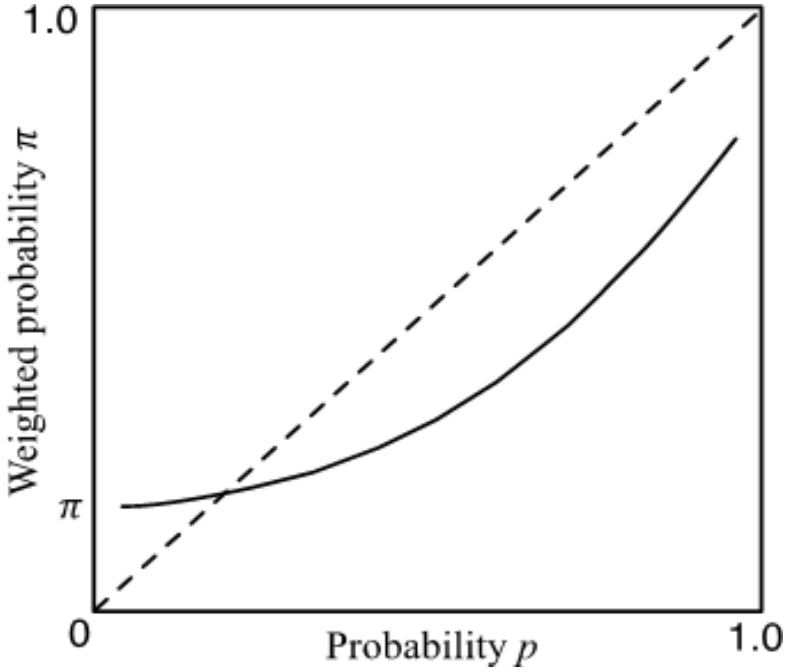
Figure 2.2: Value Function (Prospect theory)



Source: Kahneman and Tversky, 1979

In the case of the weighting function, the decision weight is not the case of probabilitiesbut instead a rising function of probabilities. The weighting function is a nonlinear convex curve that shows several properties regarding risky choice preferences such as overweighting, subadditivity, uncertainty and proportionality. Both the functions are an interplay of each other.

Figure 2.3: Weighting Function (Prospect Theory)



Source: Kahneman and Tversky, 1979

The behavior of individuals can be classified as prevention or detection. The distinction is important because both the loss frame and gain frame are effective but rather it depends on whether the behavior is for prevention or detection. In the case of prevention behaviors, gain frames are more effective while in the case of detection behaviors, loss frames would be more effective. It happens because of increased risk in the case of detection behaviors as compared to prevention.

In the case of vaccination, they are classified as preventative behavior since they reduce the risk of getting infected with the virus. People are afraid of side-effects and due to this framing effect is important as it influences the behavior of a particular individual. It is important to test the framing strategies before implementing the communication regarding vaccinations. It is also important to test the framed communications in different contexts.

2.2.4 Heuristics

Heuristics can be defined as a general time-saving rule of thumb that allows individuals to make decisions, move to a particular judgment or even resolve various problems. Unfortunately, these heuristics sometimes helps in solving particular problems but can often lead to various systematized cognitive biases. Tversky and Kahneman, Experts of behavioral economics pinpoint the fact how heuristics lead in the decision making in the case of vaccination and other relevant decision-making processes. We can define heuristics as any decision or plan regarding an action that an individual use to solve any kind of problem. It is not necessary that individuals always make the right decision and because of that various cognitive biases occur.

2.3 Behavioral Biases

Individuals are prone to various cognitive and behavioral biases which often lead to psychological errors and faulty decision making in various respects. Individuals often make non-efficient choices in the case of vaccinations when they come across various ambiguous decisions. Behavioral biases are also often termed cognitive biases and hence they are identified in the same manner as systematized errors. There are various cognitive biases and the classification of these biases is useful but there is no such fundamental theory in this regard that explains why individuals are prone to these biases. Some of the behavioral biases which are considered in the present study are:

2.3.1 Availability Bias

Availability bias means the tendency of the individuals to give greater weight to all the factors that are easy to recall for the individuals. It is a mental shortcut that explains how an individual relies on various examples which immediately come to the mind while making a decision or evaluating the risk of a particular outcome. It has been reported in various studies that how an anti-vaccination message by media is likely to affect individual decision making.

2.3.2 Anchoring Effect

The anchoring effect is also termed as 'First-impression bias'. It is regarding the tendencyof individuals to rely heavily on the values which are initially presented while making a particular decision.

2.3.3 Omission Bias

Omission bias means how individuals have a propensity that any action which they do (commission) is severe as compared to any action which they do not consider doing (omission). Omission will always be regarded as less severe even if the results from omission are severe or equal to the commission. It has been reported that in the case of vaccine-hesitant individuals, availability bias often leads to omission.

2.3.4 Ambiguity Aversion

Ambiguity aversion is the preference of the individuals towards known risk or certain probabilities over unknown risk or uncertain probabilities. It is one of the fundamental reasons for vaccine hesitancy. In the case of vaccines, individuals tend to take the risk of not getting vaccinated because of the side-effects fear over the risk of getting vaccinated toprevent disease.

2.3.5 Loss Aversion

Loss aversion is a propensity of individuals when they are ready to take risks in the case ofloss situations but does not risk in the gain situations. In the case of vaccination, the loss aversion from the commission is higher than the loss aversion from omission. This happens because individuals often evaluate vaccination outcomes both in the form of commission and omission.

2.3.6 Present Bias

Present bias means when individuals give more weight to all the costs and benefits which are associated in present over all the costs and benefits which can be realized in future. In the case of vaccinations, individuals can see the adverse effects associated with getting vaccinated

hence they often weigh it more since the cost associated with getting vaccinated is visible while decision making.

2.3.7 Risk Aversion

Risk aversion means overweighting of risk factors while risk-seeking means underweighting of risk factors. This type of behavior is largely associated with the willingness of individuals to vaccinate. A risk-averse individual will overweight the risk related to vaccination i.e. the perceived side effects from taking the vaccine and hence sometimes lead to irrational behavior.

Chapter 3
Research Methodology

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

The present chapter of this study deals with the research methodology which is adopted to attain the objectives of the current study. The main aim of the current study is to identify what all behavioral biases affect the decision-making process of individuals for the COVID-19 vaccination uptake or refusal. The study also deals with the attitude and perception of individuals in the case of vaccination and how this attitude leads to behavioral change among individuals. The methodology used to deal with the present research is the Logit model.

It becomes quite essential to investigate the behavior and emotional pattern of the respondents to garner meaningful responses and answers to the research question. Hence, firstly the methodology is framed to identify various behavioral biases, attitudes and demographic traits towards the decision- making process of individuals in the case of vaccination. After that, which specific factor is most significant to affect the decision of individuals to vaccinate is identified.

This chapter is divided into various sections and subsections underneath. The first section deals with the data collection process to run the logistic regression, data sources, tools used for collection of data, determination of sample and time frame of the study.The next section in this chapter provides the methodological specification of the model, methodology used to analyze the impact of demographic traits, behavioral factors, and geographical factors on the vaccination decision of individuals.

3.2 Data Implementation

3.2.1 Data Collection

The present empirical research study is based on primary data. The self-structured questionnaire is used for gathering information from respondents about their opinions, behavior and their perspective towards vaccination decisions. The main motive to undertake this research study is to identify all the various factors namely demographic traits, attitudes, perception towards COVID-19 vaccines and all the behavioral biases associated with the acceptance or refusal of vaccination. The questionnaire was trickily drafted to collect all the required information in the study without hurting the sentiments of individuals. The decision is also made by supplementing this study with personal interviews through video calls to gather a sufficient amount of information from the respondents related to the qualitative aspect. The self-structured questionnaire is divided into four different sections.

Section 1 consists of questions regarding general information of individuals which include name, age, gender, educational qualification, area of dwelling, occupation, whether they suffered from COVID-19 in past and whether they are vaccinated with the COVID-19 vaccine.

In **Section 2,** respondents were asked regarding their perception about COVID-19 vaccines, trust in the vaccines, whether they are worried about the side effects, all these questions were framed on a five-point "Likert scale" ranging from 1 to 5. Further, they were also asked some questions taking into account the geographical barriers associated with the uptake of vaccines and their confidence in the government and healthcare sector. These questions were also designed on five-point "Likert scale" ranges.

Section 3 consists of all the questions related to behavioral factors that are risk aversion, loss aversion, present bias, and impatient behavior to understand whether their vaccination decision is affected by any of the behavioral biases. All the behavioral related questions were designed

in the form of choices given to take part in a lottery and judgment is made accordingly.

Section 4 consists of the choices if respondents are interested in taking the vaccines in different cases. The questions related to these aspects were also designed on a five-point "Likert scale" ranging from highly interested (shown by 5) to not interested (shown by 1);where highly interested indicates that the respondent will take the vaccine in the given case and not interested means respondent is not interested to take the vaccine in the given case.

3.2.2 Sample Profile

The main aim of the present research study is to collect data from diversified individuals related to vaccines from distinct age groups, educational qualifications, occupations and areas of the dwelling. Since the population size is unknown, a sample of 150 respondents was picked randomly from the Delhi NCR region. Questionnaires were distributed to the respondents through online mode in June 2021. The credible number of responses from the questionnaires distributed was 125. Only those questionnaires were taken into consideration for further analysis which was duly filled in all the respects. After removing the incomplete questionnaires, the sample was reduced to 121 for further analysis. The sample is segregated based on specific demographic characteristics namely gender, age, area of dwelling, occupation and educational qualification.

3.2.3 Propositions of the Study

To meet the set objectives of the present study, the following propositions are built to verify empirically:

i) Demographic characteristics have a significant impact on thevaccination decision of an individual.

ii) Attitude, beliefs and opinions play a significant role in the vaccination decision of an individual.

iii) Confidence in the government and healthcare sector has a significant impact on the vaccination decisionof an individual.

iv) Geographical barriers have a significant impact on the vaccination decision of an individual.

v) Behavioral biases have a significant impact on the vaccination decision of an individual.

To test these propositions and to analyze them accordingly, various methodologies are used namely, chi-squared test and logit analysis. The level of significance is considered as 10%. The detailed specification of the given methodology is given in section 3.3.

3.3 Methodological Specification

For the detailed data analysis, Statistical Package for Social Sciences (SPSS) version 22.0 has been used. Data analysis is done by entering the collected data from theresponses received with the help of questionnaires, segregating the data accordingly and then evaluating it to extract some relationship among them.To graphically present the demographical characteristics of the respondents namely age, gender, educational qualification, occupation and area of dwelling, charts and tables are made using SPSS version 22.0. The various statistical techniques, tools used to bring out convincing presentation and analysis of the data has been discussed in the following sub-sections.

3.3.1 Logistic Regression

In various models, the dependent variable Y is quantitative; in such models, the main objective of running the regression model is to estimate its expected value for the various given values of the regressors. There are some cases when the dependent variable Y is qualitative; in such models, finding the probability of something happening is the main motive.

Therefore, these models are sometimes called qualitative response regression models or probability models. The dependent variable or regressand is generally binary or dichotomous

in such models. Three approaches are generally used in the case of binary response variables to develop a probability model: They are linear probability model (LPM), logit model, and probit Model. Among these, the logit model is used for the present research study.

The logit model is also known as logistic regression. The data used for the research purposein the present study is used to form a logit model to predict the discrete outcome from the various set of variables which can be discrete, continuous, and dichotomous or can be a combination of any of these. In the logit model, the dependent variable is generally dichotomous and can take two forms such as yes/no. It means that the dependent variable can take the value 1 or 0 where 1 means the probability of success p and 0 meansthe probability of failure 1- p. In the case of logistic regression, the relationship between predictor/dependent variable and the response variables is not a linear function rather logistic regression function is used. They also do not need to be normally distributed, linearly related or of equal variance within each group.

$$p = e^z / 1+ e^z \cdots\cdots (1)$$

Where, $z = \beta_1 + \beta_2 X_i$

β_1 = Constant term of the equation

β_2 = Coefficient of the predictor variables in the equation

The logistic distribution function is represented by Equation (1) where the value of z in the equation, ranges from $-\infty$ to $+\infty$ and the value of p range between 0 and 1. Moreover, pis non-linearly related to z. It can also be inferred that estimation cannot be done through the use of OLS because p is non-linear in X_i as well as in the β's.

Since Equation (1) above shows the probability of success p, therefore it means that the probability of failure i.e. 1 – p can be written as:

$$(1 – p) = 1/ 1+ e^z \cdots\cdots (2)$$

So, from Equation (1) and Equation (2),

$$\frac{p}{1-p} = 1+e^{z}/1+e^{-z} = e^{z} \cdots\cdots (3)$$

Equation (3) indicates the odds ratio in the favor of probability of success p i.e. ratio of the probability of success to the probability of failure. Now, by taking a log in Equation (3), the following resultant equation is obtained:

$$L = \ln \left[\frac{p}{(1-p)} \right] = z = \beta_1 + \beta_2 X_i \ldots\ldots (4)$$

In the above Equation (4), L represents the log of odds ratio which is linear in parameters as well as linear in X. Therefore, it is called the logit model. The features of the logit model include; (i) Probabilities lie between 0 and 1 and the value of logit L goes from $-\infty$ to $+\infty$. It means that the logits are not so bounded, (ii) L is linear in X_i but the probabilities are not, (iii) There can be many independent variables or regressors in the model, as the casemay be according to the theory, and (iv) The slope i.e. β_2 in the above Equation (4) measures the changes in L for a unitchange in X_i.

For the estimation purpose, Equation (4) can further be rewritten as:

$$L = \ln \left[\frac{p}{(1-p)} \right] = \beta_1 + \beta_2 X_i + u_i \ldots\ldots (5)$$

Since it is notpossible to estimate the equation with the OLS method due to some of the drawbacks, hence, the Maximum Likelihood Method (MLE) will be used to estimate the parameters in the given equation.

The logit model for the present study can be written as,

$$L = \frac{p}{1-p}$$

OR,

$$L = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + u_i$$

Where, L = 1 or 0 1 = Acceptance of vaccination

0 = Refusal of vaccination

X_i = Independent variables used in the study

β_i = Logit coefficients

u_i = Error term

Here, it can be seen that it is not possible to directly compute the value of parameters through the standard OLS and hence, the value of p =1 foraccepting the vaccine and p = 0 for refusal of vaccine cannot be put directly. Therefore, it is always preferred to use Maximum Likelihood Estimation (MLE) in the case of a binary logistic regression model.

Before moving to the next section, it is quite important to discuss a few things regarding the methodology and techniques of the present study:

i) R^2 is one of the widely used conventional measures to check the goodness of fit of the model, but it is not generally accepted to use R^2 in the case of a binary regression model. So instead of that, Pseudo R^2 will be used in the current analysis.

ii) To check the propositions framed in the study, the Likelihood Ratio test or statistic will be used which is a counterpart to the F statistic in the case of a linear regression model.

iii) In the Maximum Likelihood method, standard errors obtained are asymptotic which is generally in the case of a large sample.

After checking for the regression analysis, Hosmer and Lemeshow test is used to check the

goodness of fit of the model. This statistic helps to determine how accurately the model is described by the data. It is one of the most widely used statistics in the caseof a binary regression model.

3.3.2 Multicollinearity Check

Multicollinearity in the model arises when two or more explanatory variables in the case of multiple regression models are correlated with each other. There arises a problem in the case of multicollinearity because independent variables should be independent and if they are correlated then the problem occurs with the fitness of the model. If multicollinearity present in the model is moderate, then it may not be a trouble. But, high multicollinearity can cause trouble and serious obstacles in the model.

In the case of the present research study, the multicollinearity is checked for the explanatory variables used in the study to understand whether the variables such as attitude towards a vaccine, trust in the vaccine, behavioral biases is correlated witheach other. This is done by using the correlation matrix. The correlation coefficient matrix helps to understand the correlation coefficient values among the explanatory variables used along with the level of significance.

3.3.2.1 Variance Inflation Factor

There are various measures to detect multicollinearity in the model. Since the regression model used in the study is binary logistic regression analysis, so the best way to detect thepresence of multicollinearity is the Variance Inflation Factor (VIF). The variance inflation factor depicts how much the variance of the explanatory variable or the behavior of the explanatory variable is inflated by the correlation of other independent or explanatory variables. It helps to understand quickly how much the variable is affecting the standard error. In the case of SPSS, VIF value is depicted to detect the presence of multicollinearity but some software for data

analysis provides the value of Tolerance (TOL), which is reciprocal or reverse of VIF. Following is the procedure to calculate VIF:

i) First, it is required to run the OLS regression where one of the explanatory variable act as a dependent variable and is a function of other explanatory variables:

$$X = b_0 + a_1X_1 + a_2X_2 + a_3X_3 + ...+ a_nX_n + e$$

Here, b_0 is a constant term and e signifies the error term.

ii) After running the OLS regression, the value of VIF can be obtained by using the formula for VIF:

$$VIF = 1/ 1- R^2_i$$

The value of VIF should be checked to predict the presence or absence of multicollinearity. If the value of VIF obtained is equal to 1 then the explanatory variables are not correlated, if the value ranges between 1 and 5, then the moderate multicollinearity is detected. There is a presence of strong multicollinearity if the value exceeds 5. If strong multicollinearity is detected in the model, then various remedial measures should be used to solve the problem of multicollinearity.

Chapter 4
Data Analysis

CHAPTER- 4
DATA ANALYSIS

4.1 Introduction

The data collected from the respondents are analysed in this section. 121 questionnaires are taken into consideration out of 150 samples. Samples taken into consideration were reduced to 121 because of the incomplete and invalid questionnaires filled by 29 respondents. The following sections in this chapter will analyse the demographic characteristics of individuals, the perspective of individuals towards the COVID-19 vaccine, behavioral biases associated with the decision making of individuals towards vaccination along with the other questions that were asked from the respondents towards the vaccine intention. This analysis will be succeeded by using various tests and methods described in the previous chapter.

4.2 Analysis of Respondent's Demographic Characteristics

This section will cover the analysis of demographic characteristics and the personal profile of respondents. This analysis will be useful for a better understanding of their background.

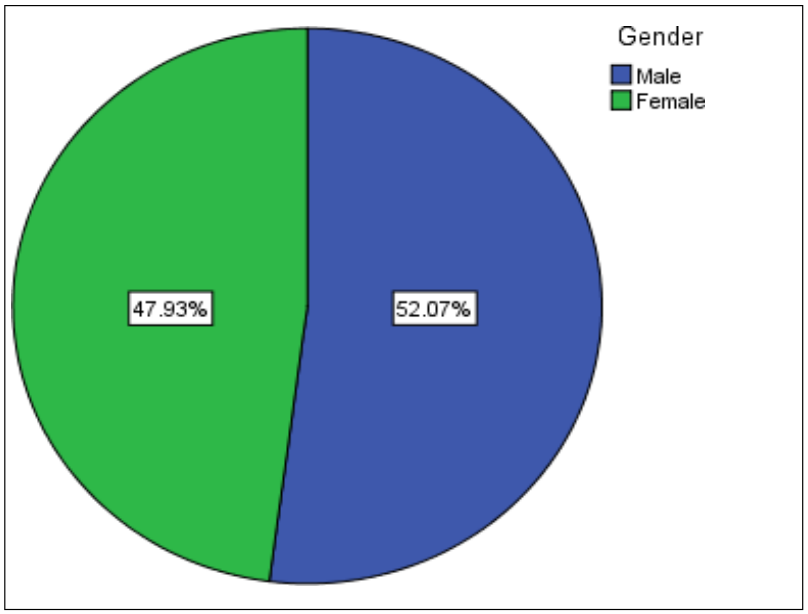
4.2.1 Gender Distribution of Respondents

The gender distribution of respondents is represented in Table 4.1 and Figure 4.1. Gender is one of the most important factors in the study; this factor helps to ascertain the attitudes of individuals towards vaccine intention based on gender. Out of the sample size of 121 respondents, 52.1% (n= 63) of respondents are male and 47.9% (n=58) of respondents are female.

Table 4.1: Gender Distribution Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	63	52.1	52.1	52.1
	Female	58	47.9	47.9	100.0
	Total	121	100.0	100.0	

Figure 4.1: Gender Distribution of Respondents



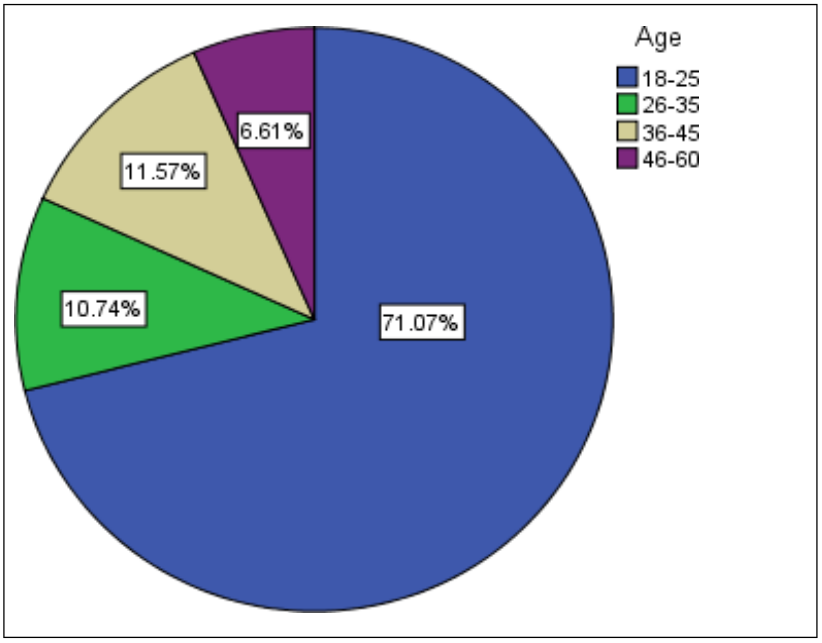
4.2.2 Age Distribution of Respondents

Age is also one of the important criteria to understand the behavior and attitude of individuals towards the COVID-19 vaccine, it helps to analyze which age group is more affected by behavioral bias and hence makes decisions irrationally regarding the uptake ofCOVID-19 vaccination. According to the sample, 71.1% of individuals come under the age group 18-25, 10.7% of individuals come under the age group 26-35, 11.6% of individuals come under the age group 36-45 and 6.6% of individuals come under the age group 46-60. The age distribution is represented in Figure 4.2 and Table 4.2 respectively.

Table 4.2: Frequency Table of Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	86	71.1	71.1	71.1
	26-35	13	10.7	10.7	81.8
	36-45	14	11.6	11.6	93.4
	46-60	8	6.6	6.6	100.0
	Total	121	100.0	100.0	

Figure 4.2: Age Distribution of Respondents



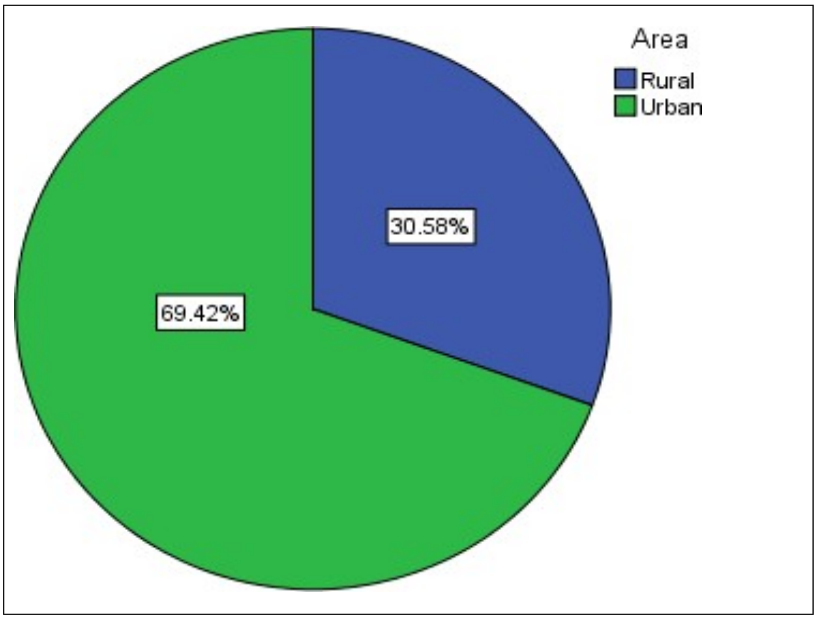
4.2.3 Area of Dwelling

Area of dwelling means whether the respondents belong from a rural area or urban area. Area of dwelling is one of the important considerations in the study because it will help to understand which area is affected much from the behavioral biases and what is the decision making process of individuals according to the area from which the respondents belongs. In the survey done, 30.6% (n = 37) respondents are from the rural area and 69.4% (n = 84) respondents are from urban areas. Figure 4.3 and Table 4.3 represents the area distribution.

Table 4.3: Area Wise Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	37	30.6	30.6	30.6
	Urban	84	69.4	69.4	100.0
	Total	121	100.0	100.0	

Figure 4.3: Area wise distribution of respondents



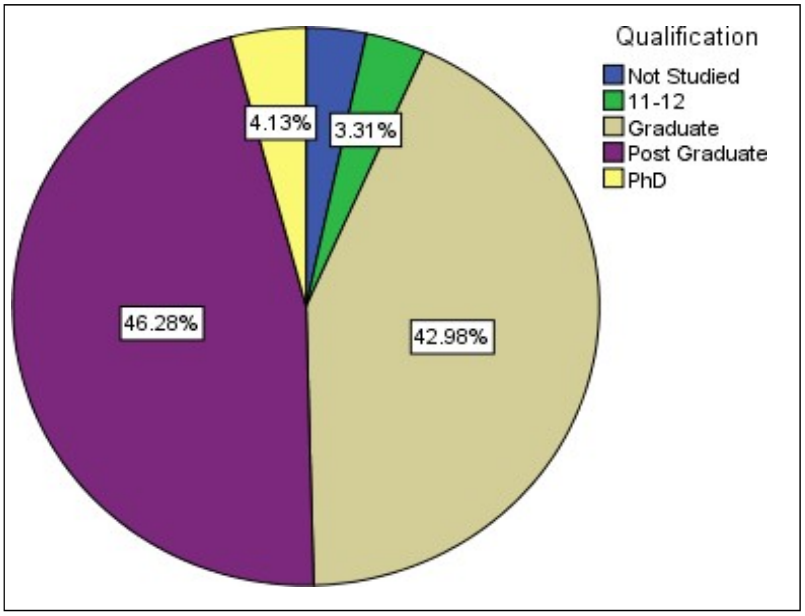
4.2.4 Educational Qualification of Respondents

Education plays an important role in the decision-making process of an individual and has its significance. It is quite important to analyze how education acts as one of the factors which directly affect the decision of an individual to vaccinate. The educational background of the respondents is displayed in Figure 4.4 and Table 4.4. It can be seen from Figure 4.4 that the majority of respondents who took part in a survey possess a good educational qualification. 4.13% of respondents have PhD degrees, 46.28% of respondents are postgraduate, and 42.98% of individuals have graduate degrees whereas 3.31% of respondents are passed from high school.

Table 4.4- Educational Qualification Level of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Studied	4	3.3	3.3	3.3
	11-12	4	3.3	3.3	6.6
	Graduate	52	43.0	43.0	49.6
	Post Graduate	56	46.3	46.3	95.9
	PhD	5	4.1	4.1	100.0
	Total	121	100.0	100.0	

Figure 4.4: Distribution of Respondents According to Qualification



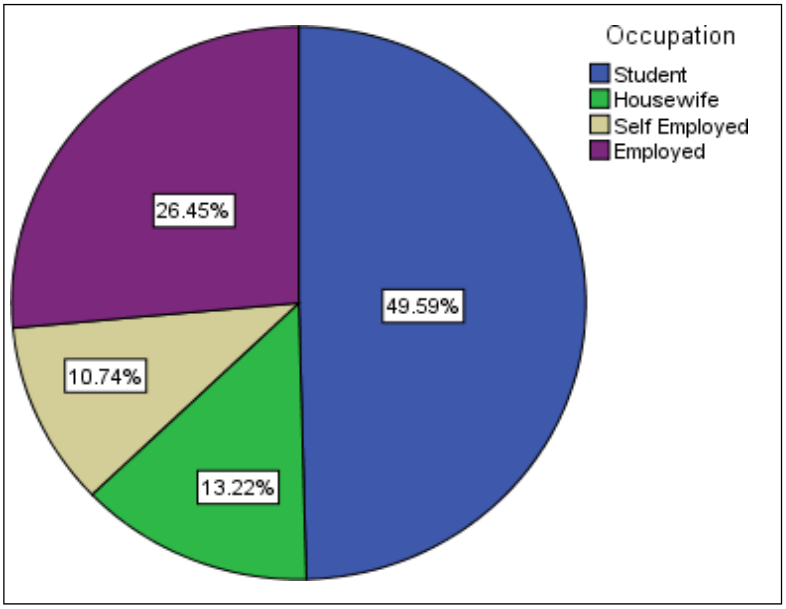
4.2.5 Occupation of Respondents

Occupation level is considered as an important factor in the case of various analyses related to health, vaccination etc. It is an important basis to extricate the decision making of individuals in the case of vaccination. In the present study, 49.6% of respondents are students, 26.4% of respondents are salaried persons or employed, 13.2% of respondents are housewives, and 10.7% of respondents are self-employed and pursuing their own business. Figure 4.5 and Table 4.5 portrays the occupation of the respondents.

Table 4.5: Frequency Distribution of Occupation of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	60	49.6	49.6	49.6
	Housewife	16	13.2	13.2	62.8
	Self Employed	13	10.7	10.7	73.6
	Employed	32	26.4	26.4	100.0
	Total	121	100.0	100.0	

Figure 4.5: Occupation of Respondents



4.3 Information Related to COVID-19

To examine the psychology of respondents related to the COVID-19 vaccine, attitude and perception towards the vaccine and the decision of individuals regarding the uptake of COVID-19 vaccine, it is important to understand their views related to COVID-19 disease and whether they suffered from COVID-19 or not. The information related to the COVID-19 virus is depicted in Table 4.6. 32.2 % of the respondents suffered from COVID-19 inpast and 89.35% of respondents feel that COVID-19 is a life-threatening disease.

Table 4.6: Questions Related to COVID-19 Disease

Questions	Response	Percentage (Responses)
Have you suffered from COVID-19 in past	Yes	32.2
	No	67.8
Do you feel COVID-19 is a life-threatening disease	Yes	89.3
	No	10.7

4.4 Attitude and Perception towards COVID-19 Vaccine

This study aims at analyzing the demographic factors, geographical factors, attitude and perception and some behavioral biases associated with the vaccination uptake and refusal. In this section, all the factors which are related to attitude and perception towards COVID-19 vaccine are analyzed. It is one of the important considerations regarding the psychological factors associated with the vaccination uptake or refusal. This section is further divided into different subsections.

4.4.1 General Perception Related to COVID-19 Vaccine

In this sub-section, general factors related to the vaccination uptake and decision to the vaccine are identified and analysed, Participants were asked a few questions regarding the COVID-19 vaccine i.e. whether they are vaccinated with the COVID-19 vaccine, whether they are interested in getting vaccinated and what is the general perception they have regarding the COVID-19 vaccines. All these questions were asked in the form of Yes/No responses and a five-point Likert scale. Different responses concerning the questions were obtained. Table 4.7 depicts the questions and responses obtained.

Table 4.7: Information Regarding the Perception of Individuals towards COVID-19 Vaccine

Questions	Responses	Frequency	Valid Percentage
Did you get yourself vaccinated with the COVID-19 vaccine?	Yes	57	47.1
	No	64	52.9
Are you interested in getting yourself vaccinated?	Highly interested	53	43.8
	Interested	24	19.8
	Neutral	16	13.2
	Little interested	18	14.9
	Not interested	10	8.3
Do you feel vaccines protect against COVID-19 infection?	Strongly agree	22	18.2
	Agree	54	44.6
	Neutral	30	24.8
	Disagree	12	9.9
	Strongly disagree	3	2.5
Do you feel the COVID-19 vaccine has serious side effects?	Strongly agree	8	6.6
	Agree	28	23.1
	Neutral	45	37.2
	Disagree	31	25.6
	Strongly disagree	9	7.4
Do you feel there are alternate ways to prevent COVID-19 infection?	Strongly agree	6	5.0
	Agree	26	21.5
	Neutral	33	27.3
	Disagree	40	33.1
	Strongly disagree	16	13.2
Do you feel immunity can be increased naturally and hence vaccine is not required?	Strongly agree	11	9.1
	Agree	30	24.8
	Neutral	30	24.8
	Disagree	34	28.1
	Strongly disagree	16	13.2

It can be depicted from the responses that, 52.9% of respondents are not vaccinated against COVID-19 infection. Mixed responses are obtained concerning the questions askedregarding general perception concerning the COVID-19 vaccines. Around 23% of respondents are not willing to get vaccinated while 13% of the individuals feel that the vaccine does not protect against the infection. Approximately 30% of the individuals responded that the COVID-19 vaccine has serious side effects. All these responses are displayed in Figures 4.6, 4.7 and 4.8 respectively.

Figure 4.6: Interest in Vaccination

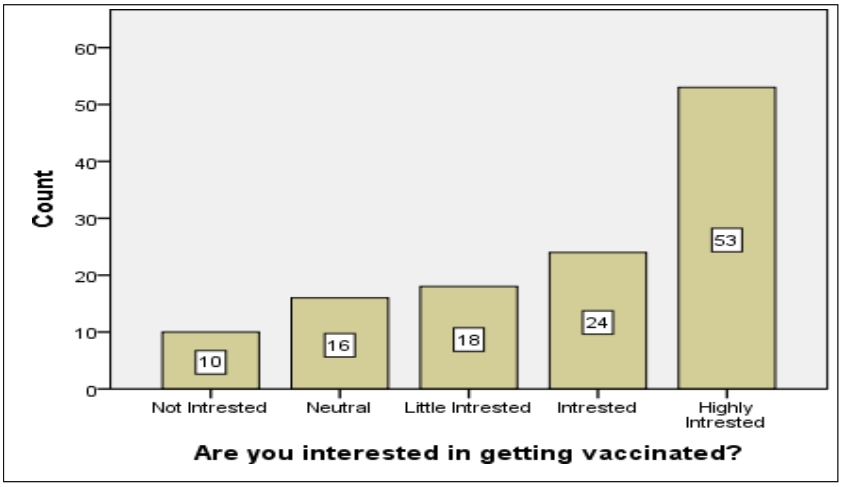


Figure 4.7: Protection Against COVID-19 Infection

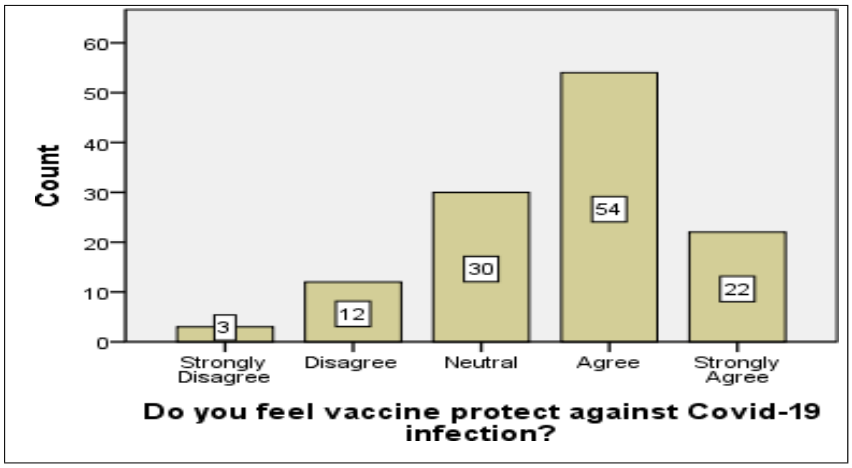
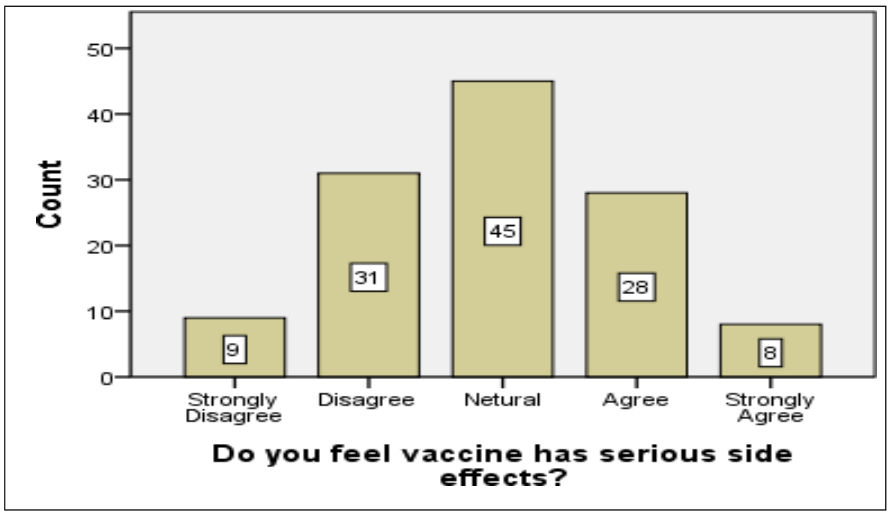


Figure 4.8: Side Effects of COVID-19 Vaccination



4.4.1.1 Trust on COVID-19 Vaccine

Trust in a particular vaccination is one of the important factors which should be taken under consideration. Since trust in the vaccine is vital, it is indeed important to understand if an individual is hesitant about the vaccine. An issue concerning vaccine hesitancy cannot be addressed without understanding the perception of individuals towards vaccine concerning "trust on vaccination", here in the present study; it is the COVID-19 vaccine. Respondents were asked how much they trust vaccines on a scale of 1-5. 24.7% ofindividuals do not trust the vaccine and around 27% of respondents are neutral regardingthe COVID-19 vaccine. The responses received are displayed in Table 4.8.

Table 4.8: Trust on COVID-19 Vaccination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	13	10.7	10.7	10.7
	2.00	17	14.0	14.0	24.8
	3.00	33	27.3	27.3	52.1
	4.00	36	29.8	29.8	81.8
	5.00	22	18.2	18.2	100.0
	Total	121	100.0	100.0	

4.4.2 Confidence in Government and Healthcare Sector

The general perception of the COVID-19 vaccine has been analyzed in the previous section. This section attempts to analyze all the factors which are associated with the perception of individuals towards the Government and healthcare sector regarding the COVID-19 and COVID-19 vaccines. Whenever a new vaccine develops against any kind of disease, the government, as well as the health care sector, plays a major role in the distribution of vaccines by addressing structural problems and behavioral problems which are associated with vaccination. So the general questions related to this were asked from the respondents regarding their views. The questions were asked on a 5-point Likert scale. The responses obtained are shown in Table 4.9.

Table 4.9: Information Regarding Respondent's Confidence in the Government & Healthcare sector

Questions	Responses	Frequency	Percentage
Do you feel the government is managing the situation of the COVID-19 pandemic well?	Strongly agree	10	8.3
	Agree	26	21.5
	Neutral	29	24.0
	Disagree	34	28.1
	Strongly disagree	22	18.2
Do you agree government is deciding in your best interest concerning the COVID-19 vaccine?	Strongly agree	10	8.3
	Agree	28	23.1
	Neutral	40	33.1
	Disagree	29	24.0
	Strongly disagree	14	11.6
Do you feel the informationprovided by the government about the COVID-19 vaccine is true enough?	Strongly agree	15	12.4
	Agree	38	31.4
	Neutral	29	24.0

	Disagree	25	20.7
	Strongly disagree	14	11.6
Do you agree that vaccine producers are interested in your health?	Strongly agree	8	6.6
	Agree	36	29.8
	Neutral	45	37.2
	Disagree	21	17.4
	Strongly disagree	11	9.1
Do you feel that pharmaceutical companies are providing safe and effective vaccines?	Strongly agree	11	9.1
	Agree	48	39.7
	Neutral	34	28.1
	Disagree	20	16.5
	Strongly disagree	8	6.6

It can be inferred from Table 4.9 that around 37% of the respondents are dissatisfied withthe government in the case of management of the COVID-19 pandemic. Around 35% of individuals feel that the government has not decided in the best interest of people when it comes to the COVID-19 vaccine. 31% of individuals feel that information provided by the government about the COVID-19 vaccine is not true while 43% of respondents are satisfied with the information provided. Strangely, around 23% believed that vaccines are not safe enough and 28% of respondents are neutral in this regard i.e. they are not sure about the vaccines.

4.5 Analysis of Geographical Factors Associated with COVID-19 Vaccines

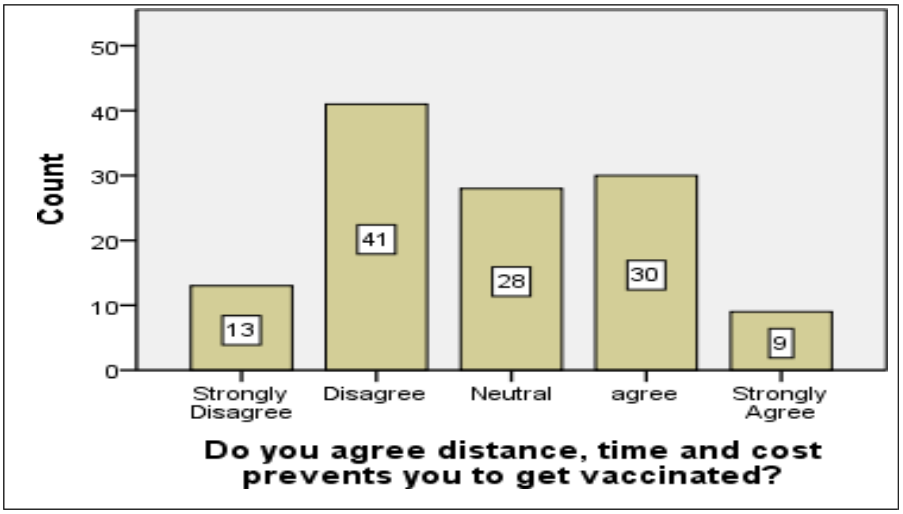
While understanding the factors associated with the vaccination intake of individuals, it becomes very important to consider geographical factors which are associated with the decision making of individuals for vaccination uptake or refusal. Geographical factors mean the distance which needs to be covered to reach the health care centre. Hence the questions related to the geographical factors were asked from the respondents on the 5- point Likert scale and received

mixed responses which are further shown in Table 4.10.

Table 4.10: Geographical Factors Associated with COVID-19 vaccine

Questions	Responses	Frequency	Percentage
Do you agree that distance, time andcost prevent you to get vaccinated?	Strongly agree	9	7.4
	Agree	30	24.8
	Neutral	28	23.1
	Disagree	41	33.9
	Strongly disagree	13	10.7
Do you agree with distance, time andcost incurred are notworth receiving a vaccination?	Strongly agree	11	9.1
	Agree	22	18.2
	Neutral	30	24.8
	Disagree	43	35.5
	Strongly disagree	15	12.4

Figure 4.9: Graph Showing the Responses towards Geographical Factors



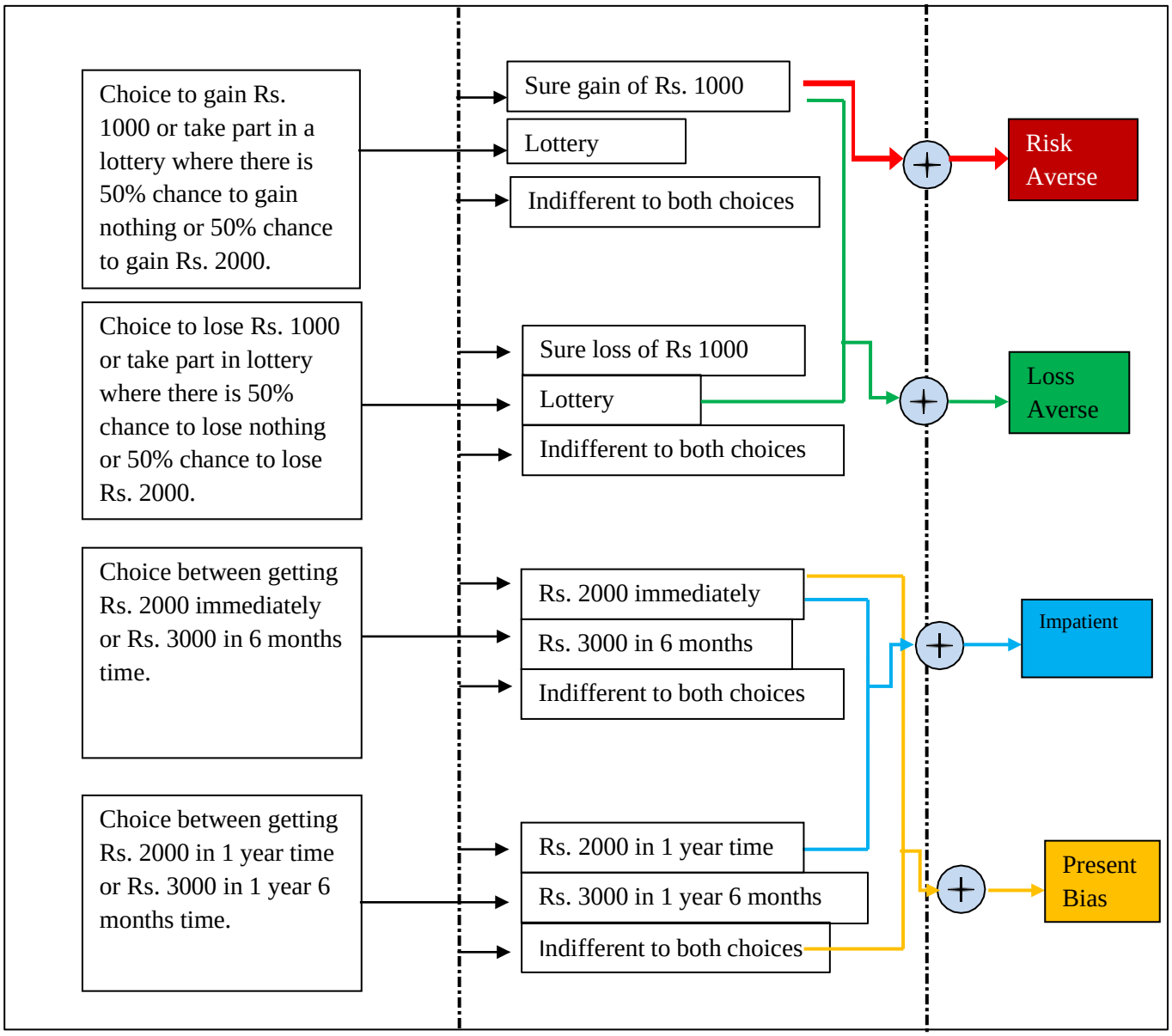
4.6 Behavioral Factors Associated with COVID-19 Vaccines

There are various behavioral biases associated with the vaccination which directly or indirectly affects the decision making of individuals in terms of uptake of vaccination. Some of the behavioral biases which are taken into consideration in the present study include **present bias, loss aversion, impatience and risk aversion.** All these behavioral biases act as four different independent variables and are already discussed in the previous chapter. This section is divided into various subsections, so the next subsection deals with the classification of individuals in the respective biases by which they are affected.

4.6.1 Basis of Classification of Respondents Affected by Behavioral Biases

Individuals have different perceptions related to vaccines and thus have different intentions towards accepting or refusing the vaccine. But, some behavioral factors also needto be considered that directly affects the decision making of individual towards vaccination decision. Individuals suffer from various behavioral biases, so to classify that, respondents were asked various questions related to taking part in a lottery or getting monetary incentives as mentioned in Figure 4.10. Different kinds of responses were obtained from respondents and with the help of the responses received, individuals, are categorised as risk-averse, loss averse, impatient or present biased each characterising an independent variable which are unified to become 4 different independent variables inthe study. The next subsection explain in detail about the results obtained.

Figure 4.10: Basis of Classification of Respondents into Different Categories of Behavioral Biases



4.6.2 Classification of Respondents Affected by Behavioral Biases

Based on various questions asked from respondents related to taking part in the lottery and getting monetary incentives as shown in the previous subsection, respondents are classified as exhibiting risk aversion behavior, loss aversion behavior, impatient behavior and present biased behavior. Table 4.11 shows the classification of respondents.

Table 4.11: Classification of Respondents Affected by Behavioral Bias/Factor

BEHAVIORAL FACTORS	CLASSIFIED BY PARTICULAR FACTOR (YES/NO)	FREQUENCY	PERCENTAGE
Risk-averse	Yes	81	66.9
	No	40	33.1
Loss averse	Yes	36	29.8
	No	85	70.2
Impatient	Yes	35	28.9
	No	86	71.1
Present bias	Yes	31	25.6
	No	90	74.4

4.7 Preliminary Analysis: Multicollinearity Check

The various responses which were collected on a 5-point Likert scale where individuals were asked to give their agreement or disagreement for the particular questions in a questionnaire are unified to form different independent variables. These independent variables are further checked for the presence of multicollinearity. Multicollinearity is checked in SPSS version 22.0 with the help of a correlation matrix. The correlation

matrix shows the correlation coefficient among independent variables. The multicollinearity can be detected by the value of the correlation coefficient, if the value of the correlation coefficient is found to be more than 0.7 then it can be said that high multicollinearity exists among the variables. The correlation matrix for a different set ofindependent variables can be seen in Tables 4.12, 4.13 and 4.14.

Table 4.12: Correlation Matrix for Variables Related to the Perception of Individuals towards COVID-19 Vaccine

		Constant	Interested in vaccine	Protection from Covid	Trust	Side Effects
Step1	Constant	1.000	-.169	-.603	-.410	-.662
	Interested in Vaccine	-.169	1.000	-.521	-.080	.147
	Protection from Covid	-.603	-.521	1.000	.140	.208
	Trust	-.410	-.080	.140	1.000	-.073
	Side effects	-.662	.147	.208	-.073	1.000

From Table 4.12, it can be inferred that independent variables which are related to attitude and general perception of respondents towards COVID-19 vaccine do not show multicollinearity. Since all the values of the correlation coefficient are less than 0.7, this confirms the non-existence of a high degree of multicollinearity among variables.

Table 4.13: Correlation Matrix for Independent Variables Related to the Perception of Individuals towards Government and Healthcare Sector

		Constant	Best interest	Information	Interestedim health	Safe vaccines by Companies
Step 1	Constant	1.000	-.128	-.026	-.246	-.324
	Best interest	-.128	1.000	-.322	-.060	-.325
	Information	-.026	-.322	1.000	-.207	-.320
	Interested in health	-.246	-.060	-.207	1.000	-.424
	Safe vaccines by Companies	-.324	-.325	-.320	-.424	1.000

From Table 4.13, it can be seen that in the case of independent variables which are related to the perception of respondents towards government and healthcare sector, none of the variables shows multicollinearity among them. All the correlation coefficient values are less than 0.7, thus indicating the non-existence of multicollinearity.

Table 4.14: Correlation Matrix for Behavioral Biases

		Constant	Risk aversion	Loss aversion	Impatient	Present bias
Step 1	Constant	1.000	-.579	-.200	-.460	-.366
	Risk Aversion	-.579	1.000	-.248	.048	.037
	Loss Aversion	-.200	-.248	1.000	.014	-.118
	Impatient	-.460	.048	.014	1.000	-.075
	Present bias	-.366	.037	-.118	-.075	1.000

Multicollinearity is checked for all the behavioral factors which are included in the study as independent variables. It is necessary to check multicollinearity among the behavioral biases so that can be further used for regression analysis. Table 4.14 shows the correlation matrix for the behavioral factors. It can be inferred from the matrix that all the correlation coefficient values are less than 0.7, thus indicating no evidence for multicollinearity among them.

From all the tables, it is clear that there is no association between independent variables if there is evidence of multicollinearity, and then various steps can be taken such as dropping a variable to eradicate the problem of multicollinearity. Now, here, in this case, regression analysis can be performed.

4.8 Logistic Regression Analysis

Logistic regression analysis is performed to find the relation between demographic variables, distance-related factors, the attitude of individuals towards vaccines, confidence in the government sector and behavioral factors on the dependent variable. The dependent variable in the study is binary and is taken as “yes” if the individual is vaccinated and “no”if the individual is not vaccinated. The value assigned for the dependent variable is 1 for yes and 0 for no. Logistic regression analysis is done by taking independent variables in a different set.

4.8.1 Logistic Regression (Demographic Variables)

The logistic regression model is formed by taking demographic variables namely age, educational qualification, occupation and gender as independent variables to check for their association with the dependent variable. Table 4.15 shows the results for performing logistic regression analysis by taking demographic variables as independent variables.

4.15: Parameter Estimates

Did you get yourself vaccinated with the COVID-19 vaccine? [a]		B	Std. Error	Wald	Df	Sig.	Exp(B)	90% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
No	Intercept	2.122	1.264	2.819	1	.093			
	Age	.324	.274	1.393	1	.238	1.382	.880	2.170
	Gender	.694	.422	2.706	1	.100	2.002	1.000	4.006
	Area	-.282	.454	.385	1	.535	.755	.358	1.591
	Qualification	-.861	.321	7.205	1	.007	.423	.250	.717
	Occupation	.186	.160	1.348	1	.246	1.204	.926	1.566

a. The reference category is: Vaccinated.

Logit coefficients value “0” indicates no relationship while a positive value indicates a positive relationship. From the results displayed in Table 4.15, it can be depicted that logit coefficients have a positive value for gender indicating a positive relationship with not getting vaccinated. Since the qualification coefficient is negative, then it means there is a negative relationship with not vaccinating. Only qualification and gender are significant at a 90% confidence interval, which means only qualification and gender affect the dependent variable. With the increase in one unit of qualification, the odds of individuals not getting vaccinated decreases by 86% (reference category is vaccinated).

Table 4.16: Pseudo R-Square

Cox and Snell	.159
Nagelkerke	.213
McFadden	.126

Pseudo-r-square value “0” means that model is an absolutely good fit and “1” means the model is not a good fit. For the logit model in which demographic variables are treated as independent variables, the value of McFadden r-square is found to be 0.126, Cox and Snell's r-square is 0.159 and Nagelkerke r-square 0.213 (Table 4.16) which indicates that the model is quite a good fit.

The next step in this model involved checking the value of Hosmer and Lemeshow statistics, Hosmer and Lemeshow test is also one of the most reliable tests for goodness of fit in the case of a binary logistic regression model. It will help us understand whether the selected model is a good fit or not. Hosmer- Lemeshow value less than 0.05 or 0.1 indicatesthat the model is not a good fit. But in the selected model, as it can be seen from Table 4.17, the value of the Hosmer statistic is 0.613 which confirms that the model adequately fits the data.

Table 4.17: Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	6.302	8	.613

4.8.2 Logistic Regression (Variables Related to General Perception and Attitude of Individuals towards COVID-19 Vaccine

The questions related to the general perception of individuals towards vaccination were asked on the 5-point Likert scale where individuals were asked to give their agreement and

disagreement. Disagree was assigned the value "1" and agree was assigned the value "0".

Table 4.18 shows the logistic regression result where the independent variables used in the model are interested in the vaccine, protection from COVID-19, trust in vaccine and side effects from the vaccine. These independent variables are checked for their association with the dependent variable i.e. vaccinated (yes/no).

Table 4.18: Parameter Estimates

Did you get yourself vaccinated with the COVID-19 vaccine? [a]		B	Std. Error	Wald	Df	Sig.	Exp(B)	90% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
No	Intercept	-1.269	1.488	.727	1	.394			
	Interested in vaccine	-.242	.193	1.579	1	.209	.785	.572	1.078
	Protection from covid	-.062	.285	.047	1	.829	.940	.589	1.502
	Trust	.164	.172	.909	1	.340	1.179	.888	1.565
	Side-effects	.681	.240	8.065	1	.005	1.976	1.332	2.933

a. The reference category is: Vaccinated.

From Table 4.18, it can be seen that only fear of side effects from the vaccine is significant (p-value = 0.005) at a 95% confidence level, hence, showing an association with the dependent variable. Since the valueof the logit coefficient is 0.681 in the case of side effects from the

vaccine, there is a positive association of this variable on individuals not getting vaccinated. In other words,it shows that with the unit increase in individual perception regarding the side effects fromthe vaccine, the odds of individuals not getting vaccinated also increases by 68.1% as compared to the reference category which is vaccinated.

The goodness of fit is further checked from Hosmer and Lemeshow statistics, the value of the Hosmer test is found to be 0.195 (Table 4.19) which confirms that the model is a good fit.

Table 4.19: Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	11.120	8	.195

4.8.3 Logistic Regression (Variables Related to Individual's Confidence in Government and Healthcare Sector)

Individuals were asked various questions related to their perception towards the government sector and health care sector related to COVID-19 vaccines. The questions were asked on a 5-point Likert scale and respondents were required to give their agreement and disagreement. The logistic regression analysis is performed by taking factors related to perception towards the government sector on the right-hand side with the dependent variable being vaccinated or not. Table 4.20 shows the results obtained from the binary logistic regression analysis. From the various independent variables used that is government interest in public health, government decision in the best interest of people regarding vaccine and safe vaccines by pharmaceutical companies; only safe vaccines by companies is found to be significant with a p-value of 0.062 at 90% confidence interval.

The logit coefficient for the significant factor is found to be -0.556 which means that witha

unit increase in the safe vaccines by companies, odds for individuals not getting vaccinated decreases by 55.6% as compared to the reference category which is vaccinated in the performed model. Hence it is clear that the safe vaccines by companies have anegative association with the dependent variable.

Table 4.20: Parameter Estimates

Did you get yourself vaccinated with the COVID-19 vaccine? [a]		B	Std. Error	Wald	df	Sig.	Exp(B)	90% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
No	Intercept	1.890	.704	7.215	1	.007			
	Best interest	-.057	.231	.060	1	.806	.945	.647	1.381
	Interestedim health	.076	.257	.087	1	.769	1.079	.707	1.646
	Safe vaccines by companies	-.556	.298	3.482	1	.062	.573	.351	.936

a. The reference category is: Vaccinated.

Further, there is a need to check whether the model is a good fit or not, it can be checked with the help of Pseudo r-square and Hosmer and Lemeshow test. The value of Pseudo r- square is found to be 0.054 (Table 4.21) indicating that the model is a good fit. Accordingto the Hosmer and Lemeshow test, the value is found to be 0.613 (Table 4.22) which is greater than 0.1 indicating that the model adequately describes the data.

Table 4.21: Pseudo R- Square

Cox and Snell	.072
Nagelkerke	.096
McFadden	.054

Table 4.22: Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	6.302	8	.613

4.8.4 Logistic Regression (Distance Related Factors)

Individuals were asked if they feel that distance and cost to reach the health care sector for vaccination prevents them to take the vaccine and if they feel it is worth it, they were required to give their agreement or disagreement on it. The logistic regression analysis is performed by taking geographical factors as independent variables to find the association between these factors on the dependent variable. The results found are displayed in Table 4.23. From both the independent variables used, distance to reach the health care sector is found to be significant at a 95% confidence level with a p-value of 0.04. The logit coefficient value is found to be 0.325 which indicates that with the unit increase in distance and cost to reach the healthcare sector, the odds of individuals not taking vaccine also increases by 32.5% as compared to the reference category which is vaccinated.

Table 4.23: Parameter Estimates

Did you get yourself vaccinated with the COVID-19 vaccine? [a]		B	Std. Error	Wald	Df	Sig.	Exp(B)	90% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
No	Intercept	-.986	.497	3.926	1	.048			
	Distance worth	.172	.165	1.089	1	.297	1.187	.906	1.556
	Distance	.325	.158	4.230	1	.040	1.384	1.067	1.795

a. The reference category is: Vaccinated.

Further, for the goodness of fit, the value of Pseudo r-square and Hosmer and Lemeshow statistic is considered. It can be inferred from Table 4.24 that the value of Pseudo r- square is 0.038 which implies that the model is quite a good fit. The value of the Hosmer and Lemeshow test is found to be 0.256 (Table 4.25) which also clearly indicates that themodel is a good fit as it is less than 0.1.

Table 4.24: Pseudo R-Square

Cox and Snell	.052
Nagelkerke	.069
McFadden	.038

Table 4.25: Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	8.959	7	.256

4.8.5 Logistic Regression (Behavioral Factors)

Respondents are classified as risk-averse, loss averse, impatient and present biased based on the responses received. Further, logistic regression analysis is performed to check the association between these independent variables on the dependent variable. The results obtained from the logistic regression analysis are displayed in Table 4.26.

Table 4.26: Parameter Estimates

Did you get yourself vaccinated with the COVID-19 vaccine? [a]		B	Std. Error	Wald	Df	Sig.	Exp(B)	90% Confidence Interval forExp(B)	
								Lower Bound	Upper Bound
No	Intercept	-.462	.434	1.134	1	.287			
	Loss aversion	-.284	.387	.538	1	.463	.753	.398	1.424
	Presentbias	.330	.375	.775	1	.379	1.391	.751	2.577
	Impatient	.027	.373	.005	1	.943	1.027	.556	1.898
	Risk aversion	.781	.411	3.618	1	.057	2.183	1.111	4.289

a. The reference category is: Vaccinated.

From Table 4.26, it can be inferred that risk aversion behavior is significant (p-value- 0.057) at a 90% confidence level. The logit coefficient is found to be 0.781 indicating a positive relationship. So, with a unit increase in risk aversion behavior among respondents, odds of individuals not getting vaccinated also increases by 78.1% in comparison to the reference category which is vaccinated.

Further, to check if the model adequately fits the data, Pseudo r-square and Hosmer and Lemeshow test is used. The value for Pseudo r-square is found to be 0.027 (Table 4.27) which

implies that the model is a very good fit. The Hosmer and Lemeshow statistic is 0.836 (Table 4.28) indicating the goodness of fit of the model.

Table 4.27: Pseudo R-Square

Cox and Snell	.036
Nagelkerke	.048
McFadden	.027

Table 4.28: Hosmer and Lemeshow Test

Step	Chi-square	Df	Sig.
1	4.224	8	.836

4.9 Motivation to Vaccinate

Participants/respondents were endorsed with various choices and asked if they would like to get themselves vaccinated in those particular scenarios. Mixed responses are received under the different circumstances and choices offered. Table 4.29 depicts all the choices which were provided with the particular number of responses received therein.

Table 4.29: Motivation to Vaccinate

CHOICES	RESPONSES	FREQUENCY	PERCENTAGE
Would you like to get yourself vaccinated if the vaccine is made available to you at your doorstep?	I will definitely take	37	30.6
	I will take	43	35.5
	Not sure	18	14.9
	I will not take	12	9.9
	I will definitely not take	11	9.1
Would you like to get vaccinated if vaccine information is available through mass immunisation campaigns?	I will definitely take	37	30.6
	I will take	42	34.7
	Not sure	21	14.9
	I will not take	13	8.3
	I will definitely not take	8	5.8
Would you like to get vaccinated if monetary incentives are available for taking the vaccine?	I will definitely take	40	33.1
	I will take	38	31.4
	Not sure	22	18.2
	I will not take	10	8.3
	I will definitely not take	11	9.1
Would you like to take the vaccine if your family/friends recommend you takethe vaccine?	I will definitely take	42	34.7
	I will take	44	36.4
	Not sure	18	14.9
	I will not take	10	8.3
	I will definitely not take	7	5.8

Would you like to get vaccinated if any celebrity advocates in favour of the vaccine?	I will definitely take	17	14.0
	I will take	31	25.6
	Not sure	31	25.6
	I will not take	25	20.7
	I will definitely not take	17	14.0
Would you take the vaccine if your doctor recommendsit?	I will definitely take	41	33.9
	I will take	48	39.7
	Not sure	14	11.6
	I will not take	10	8.3
	Definitely not take	8	6.6
Would you take the vaccine if India also follows a lottery system for taking thevaccine?	I will definitely take	44	19
	I will take	23	36.4
	Not sure	21	17.4
	I will not take	18	14.9
	I will definitely not take	15	12.4
Would you take the vaccine if it is available to you according to your flexible time, needs and preferences?	I will definitely take	50	41.3
	I will take	38	31.4
	Neutral	9	7.4
	I will not take	12	9.9
	I will definitely not take	12	9.9

Chapter 5
Major Findings and Policy Implications

CHAPTER -5
MAJOR FINDINGS AND POLICY IMPLICATIONS

5.1 Introduction

The ambiguousness among the individuals is very significant in the health care sector, especially in the case of vaccination. Before the emergence of behavioral economics, it was considered that individuals make rational choices by weighing costs and benefits. But there is a serious problem in the line of thinking, individuals are often misguidedand do not always act in their own best interest. The decisions of individuals are often affected by various biases, beliefs and perceptions which divert individuals to take a rational decision.

The present thesis entitled 'Attitude and Acceptability towards COVID-19 Vaccine in India: Insight from Behavioral Economics' is sincerely carried out to meet two major objectives. They were-

i) To identify the underlying factors that determine the attitude of individuals towards COVID-19 vaccine uptake in India.

ii) To study the extent to which factors such as demographic, perception towards immunization, and behavioral variables can affect individual decision to vaccinate.

To meet the above objectives of the study, the following five propositions were built to verify empirically-

i) Demographic characteristics have a significant impact on thevaccination decision of an individual.

ii) Attitude, beliefs and opinions play a significant role in the vaccination decision of an individual.

iii) Confidence in the government and healthcare sector has a significant impact on the vaccination decision of an individual.

iv) Geographical barriers have a significant impact on the vaccination decision of an individual.

v) Behavioral biases have a significant impact on the vaccination decision of an individual.

To meet the set objectives and to verify the propositions, a descriptive analysis is conducted for various variables used in the study. This was followed by a multicollinearity check using a correlation matrix. The first group of variables used for detecting multicollinearity was the attitude and beliefs of individuals towards the COVID-19 vaccine. Secondly, a multicollinearity check was performed on variables related to an individual's confidence in the government and health care sector. Lastly, a multicollinearity check was performed on the behavioral factors.

After determining the absence of multicollinearity, logistic regression analysis was performed for establishing the association of demographic variables, attitude related variables, distance-related variables, confidence in government and behavioral variables individually on dependent variable i.e. vaccinated (yes/no).

5.2 Findings of Descriptive Analysis (Identification of the factors)

To meet the first objective of the study, various factors related to demographic characteristics, perception towards vaccines, confidence in the government and health care sector, geographical barriers and behavioral factors were identified using the theoretical research framework.

The questionnaire design included a variety of questions. Some questions were asked directly, some were designed on a 5-point Likert scale and some questions were related to yes/no responses. Mixed responses were obtained and descriptive analysis was done.

Various responses were received related to the perception of individuals towards a vaccine, it

was found that around 44% of respondents were not interested to take the vaccine against COVID-19 disease which is quite strange. When it was asked whether you feel the vaccine protects against the COVID-19, 14.9% of respondents showed theirdisagreement. Around 34% of respondents felt that the COVID-19 vaccine has serious side effects. From all these responses received related to the perception of individuals towards the vaccine, it is quite clear that people have misbelieve in the vaccine.

Among the questions related to individuals' confidence in the government and health care sector, around 33% of individuals feel that information provided by the government is not true regarding the vaccines whereas 35% of individuals believed that vaccine producers are interested in the health of the public. Around 48% of individuals feel that the vaccines produced by pharmaceutical companies are safe enough. From the responses received, it was analysed that most of the individuals lack confidence in the government and healthcare sector but many respondents are confident in the government regarding vaccines and management of the pandemic.

When respondents were asked if the distance, time and cost prevent them to get vaccinated and if they feel it is not worth receiving vaccines, 20% of respondents responded that distance factor prevents them to take the vaccine while around 18% of respondents felt that cost and distance associated with taking the vaccine is not worth. Around 63% of respondents showed their disagreement with the distance factor and others were neutral. Hence it shows that distance also acts as a barrier but up to some extent.

While categorisation of individuals based on risk aversion behavior, loss aversion behavior, impatient behavior and present biased behavior, it was found that around 67.85% of individuals show risk-averse behavior i.e. preferring certainty overuncertainty. While in 44.6% of individuals, loss aversion bias was depicted. Around 52.9% of respondents show impatient

behavior whereas 49.6% of individuals' present biased behavior was depicted. Hence, it is clear that an individual's decision making is affected by behavioral biases but in the case of vaccination decision, only risk aversion behavior showed the significant impact.

5.3 Findings of Logistic Regression Analysis (Contribution of the factors)

To meet the second objective of the study, logistic regression analysis was performed, to determine up to what extent can factor related to demographic characteristics, attitude towards a vaccine, confidence in the government sector, distance-related factors and behavioral factors can affect the individual decision to vaccinate.

5.3.1 Findings of Demographic Variables on Vaccination Decision

A logistic regression model was made to analyse the impact of age, gender, area of dwelling, qualification and occupation on vaccination decision. Logistic regression was used to determine which demographic variable is influencing the dependent variable i.e.vaccinated (yes/no). From the results obtained, it was determined that only gender and qualification were significant and were showing association with the dependent variable. According to Hosmer and Lemeshow test also, the model was quite a good fit as the test statistic value obtained was 0.665.

5.3.2 Findings of Perception towards Vaccine Related Variables on Vaccination Decision

A logistic regression analysis was performed to understand which factors related to individual decisions to vaccinate are significant enough to impact the dependent variable. The variables used were individual perception related to vaccine protection from Covid -19, side effects of the vaccine, interest in vaccine and trust in the vaccine. From all the independent variables taken into consideration, it was found that fear of side effects

from vaccines has a close association with an individual decision to vaccinate. The Hosmer and Lemeshow test statistic obtained also showed that the model is a good fit and adequately describes the data. The value of the Hosmer test obtained was 0.195 confirming the goodness of fit of the model.

5.3.3 Findings of Variables Related to Individual's Confidence in Government and Healthcare Sector on Vaccination Decision

It is quite important to consider individuals' confidence in government and the healthcare sector regarding COVID-19 vaccines. Hence, these variables were also analysed to find if there exists any association with the dependent variable. When the logistic regression analysis was carried out, it was found that the effectiveness of the vaccine has a close association with the dependent variable i.e. respondents' decision to vaccinate depends upon the perception of the effectiveness of vaccines made by the pharmaceutical companies. When the model was analysed with the help of the Hosmer and Lemeshow test, it was confirmed that the model adequately describes the data as thevalue of the test was 0.613.

5.3.4 Findings of Distance Related Factors on Vaccination Decision

This study also took into account geographical factors to understand if it has anyassociation with the dependent variable. Logistic regression analysis was carried outand it was found that distance to reach the healthcare sector prevents individuals to take the vaccine i.e. distance factor has a close association with the dependent variable. The fitness of the model was checked with the help of the Hosmer and Lemeshow test and the model was found a very good fit with the value obtained was 0.256.

5.3.5 Findings of Behavioral Factors on Vaccination Decision

In this study, four behavioral factors were taken into consideration that are risk aversion, loss aversion, impatience and present biased. Through proper analysis i.e. using logistic regression analysis, it was found that from all the behavioral variables, risk aversion behavior among individuals shows a close association with the decision to vaccinate. If an individual is a risk-averse person, then the willingness of the individual to take the vaccine decreases. The fitness of the model was checked through Hosmer and Lemeshow test and the value obtained was 0.836 confirming that the modeladequately describes the data.

Hence, with the help of logit analysis, it can be confirmed that the gender, qualification, fear of side effects from the vaccine, effectiveness of vaccines made by companies, distance factor and risk aversion behavior among individuals affect the decision to vaccinate i.e. has a close association with the willingness to take the vaccine. It can be confirmed by accepting the propositions of the study that not only the demographic variables but perception and attitude of individuals regarding the COVID-19 vaccine and behavioral factor i.e. risk aversion behavior plays a major role in vaccination decision.

5.4 Policy Implications

Vaccination is a matter of concern that is closely related to the behavioral aspects of the individual. Looking at the recent COVID-19 pandemic wherein vaccination was realized as the only fast and effective remedy. But various behavioral issues inherent or adopted created a lot of resistance to the vaccination drive of the government of India. The present study attempted to identify and extract the behavioral variables and their association with demographic characteristics.

Through this study, it can be seen that the decision to vaccinate is typically influenced by the attitudes and behaviors of individuals. The spread of anti-vaccine is quite common nowadays

leading to vaccine-fear sentiments among people. Although many research body argues that such sentiments are multidimensional and nuanced. Many instances have been obtained that even if the public policies related to vaccinationare consistent and go well with the sentiments of individuals, still empirical data shows conflicting results. This is true because the individual's actual behavior differs fromthe behavior towards vaccination which therefore generates astonishing results.

The acceptance and uptake of the COVID-19 vaccine is undoubtedly a challenge in itself. Making vaccines reach masses and achieving desired and targeted uptake of vaccination in India requires tailored strategies. Even proper management of expectations is essential. The vaccination successful programme does not depend upon just the behaviors of individuals but also depend upon the behavior of other "actors" in the system i.e. those who are offering the vaccination. They are the policymakers who are part of the administration. They are actors who plan how and where to offer thevaccination with properly planned strategies.

The findings of the present study highlight various policy initiatives that must be taken into consideration by policymakers who are responsible for ensuring maximum possible vaccination uptake. The following are the policy implications suggested through this research work-

i) **Use of Nudges as Interventions**- Nudge based interventions (Thaler, 2009) can be one of the prominent strategies to improve perceived vaccine efficacy and can tackle all the findings of the present study related to vaccine hesitancy. The nudge-based interventions include reminder interventions, default options, emotional primes, providing incentives etc. All the mentioned strategies can be designed to provide a meaningful framework within which new knowledge can be considered to shape the forthcoming policies in a better way.

ii) **Engagement of Local Communities**- It is essential to make the most use of existing scientific knowledge but also it is most important to understand what works in real-time and what does not. To ensure proper learning and information regarding vaccines, it is essential to engage target populations in local communities to listen and understand their perspectives, concerns as well as expectations related to vaccination. These types of actions will build target population trust in the government and healthcare sector since it was found that individuals are not confident in the government and healthcare sector. This will also ensure the proper delivery of policies and services which are responsive and are available for the local needs.

iii) **Enabling Conducive Environment**- It was found that individuals are worried about side effects related to vaccines and thus show risk aversion behavior. So, to tackle this part of vaccine hesitancy, there is a need for a well enabled positive environment. There are three categories of drivers of vaccine demand and uptake. The people must have proper knowledge and information regarding the vaccines. Other than that, there is a need for a) the enabling environment; b) social influences, and c) interventions. The policymakers can ensure that an enabling environment is there for individuals that include location, time, cost, quality, proper information as well as a proper health regulation. The negative social influences also sometimes act as a barrier to vaccination uptake. Social influences here means that people are often influenced by beliefs in what others do, for example, if people receive anti-vaccine sentiments from the vocal groups then they may change their beliefs from the favour of vaccination to against the vaccination. Hence, for a successful vaccination drive, social influences can be used to promote favorable behaviors of health professionals as well as the general public. This includes making social norms in favor of vaccination or highlighting emerging norms in the favor of vaccination.

iv) **Ensuring Appropriate Channel of Correct Information**- The reasons for low acceptance of vaccination are highly varied and can be encompassed into one term i.e. vaccine hesitancy. The use of interventions can help mitigate fear and misinformation related to vaccine side effects. The information relatedto vaccination can be spread through social and print media and by also providing doctors with a credible platform to bust myths. This can also act as a motivation for an individual to get vaccinated as discussed in section 4.9 in the present study.

Hence, to conclude it is indeed important to have an effective strategy for behavior change to address the COVID-19 vaccines uptakes. There is a need for a well-designed framework and national plans for promoting COVID-19 vaccination. National plans should address the behavioral determinants and all the barriers to vaccinating which are found in this study.

5.6 Limitations and Further Scope of the Study

Though the present study entitled "Attitude and Acceptability towards COVID-19 Vaccine in India: Insight from Behavioral Economics" meets all its set objectives successfully, there are some issues that may be included in the further studies and; are the limitations of this study-

i) There is a scope to expand the area of the study as the presentresearch is limited to the area of Delhi NCR.

ii) It was also observed that some people who got vaccinated have accepted the vaccine under pressure but were quite hesitant; this aspect of vaccine hesitancy was not captured in this study. Thus, this aspect can be included in future studies.

iii) The present analysis is limited to the logit model. Further studies may be conducted applying other suitable models for the generalization of the studies.

iv) Social desirability bias created complexities as they are dynamic. This dynamism can be included in future studies to showcase a better picture of behavioral mapping.

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Appendices

Appendix

A. Research Survey Questionnaire

Section-1

Q1) Your name_____

Q2) Age

☐ 18-25 ☐ 26-35 ☐ 36-45 ☐ 46-60 ☐ 60+

Q3 Gender

☐ Male ☐ Female ☐ Other

Q4) In which area do you live?

☐ Rural ☐ Urban

Q5) Name of the city/village _____

Q6) What is your educational qualification?

☐ Not studied ☐ 11^{th} - 12^{th} ☐ Graduate ☐ Post graduate ☐ Ph.D

☐ Other_____

Q7) What is your occupation?

☐ Student ☐ Self employed ☐ Employed in government organisation

☐ Employed in private organisation ☐ Retired ☐ Housewife

☐ Other_____

Section -2

Q8) Have you suffered from COVID-19 in past?

☐ Yes ☐ No

Q9) Do you feel that COVID 19 is a life-threatening disease?

☐ Yes ☐ No

Q10) Did you get yourself vaccinated with COVID 19 vaccine?

☐ Yes ☐ No

Q11) Are you really not interested in getting yourself vaccinated?

☐ Not interested

☐ Little interested

☐ Neutral

☐ Interested

☐ Highly interested

Q12) Do you agree that the vaccine helps in preventing COVID 19 infection?

☐ Strongly agree

☐ Agree

☐ Neutral

☐Disagree

☐ Strongly disagree

Q13) Which among the following do you feel is the matter of concern the most?

☐ COVID-19 virus ☐ COVID-19 vaccine

Q14) How much do you trust the vaccine?

☐ Very much

☐ Moderately

☐ Neutral

☐ Little

☐ Not at all

Q 15) Do you agree that the COVID-19 vaccine has serious side effects?

☐ Strongly agree

☐ Agree

☐ Neutral

☐Disagree

☐ Strongly disagree

Section-3

Q16) Are you adhering to COVID-19 guidelines of government?

☐ Properly following

☐ Little following

☐ Not following

Q17) Do you agree that the government is managing the situation of the COVID-19 pandemic well?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q18) Do you agree that the government is deciding your best interest concerning the COVID-19 vaccine?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q19) Do you agree that information provided by the government regarding the safety of the vaccine is true enough?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q20) Do you agree that the healthcare system is managing the situation of the COVID-19 pandemic well?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q21) Do you agree that vaccine producers are interested in your health?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q22) Do you agree that pharmaceutical companies are providing safe and effective vaccines against COVID-19 infection??

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q23) Do you agree that distance, time and cost needed to reach a healthcare centre prevents you to get yourself vaccinated?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q24) Do you agree that time, cost and effort to reach a health centre is not worth receiving a vaccination?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q25) Do you agree that there are better ways to prevent COVID infection other than the vaccine?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Q26) Do you agree that immunity can be increased naturally and a vaccine is not required?

☐ Strongly agree

☐ Agree

☐ Neutral

☐ Disagree

☐ Strongly disagree

Section-4

Q27) If you have a choice to gain Rs. 1000 or take part in a lottery where there is a 50% chance to gain nothing or a 50% chance to gain Rs. 2000. What will you choose?

☐A sure gain of Rs. 1000

☐ Lottery

☐Indifferent between both the choices

Q28) If you have a choice to lose Rs. 1000 or take part in a lottery where there is a 50% chance to lose nothing or a 50% chance to lose Rs. 2000. What will you choose?

☐ A sure loss of Rs. 1000

☐ Lottery

☐ Indifferent between both the choices

Q29) If you get a choice between getting Rs. 2000 immediately or Rs. 4000 in 6 months. What will you choose?

☐ Rs. 2000 immediately

☐ Rs. 4000 in 6 months

☐ Indifferent between both the choices

Q30) If you get a choice between getting Rs. 2000 in 1 year or Rs. 4000 in 1 year 6 months. What will you choose?

☐ Rs. 2000 in 1 year

☐ Rs. 4000 in 1 year 6 months

☐ Indifferent between both the choices

Q31) Please attempt the following questions and rate them on the scale of 1-5 where 5 means you will definitely take and 1 means you will definitely not take

1. Would you like to get yourself vaccinated if any government worker comes to your doorstep to give you the dose of the COVID- 19 vaccine?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

2. Would you like to get yourself vaccinated if there are monetary incentives available for all for taking the vaccine?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

3. Would you like to take the vaccine if the information regarding your concern for a vaccine is available to you door to door or through mass immunization campaigns?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

4. Would you like to take the vaccine if your family/friends/relatives who have already taken ask you to take the vaccine and tell you that the vaccine is safe and has no serious side effects?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

5. Would you like to take the vaccine if any celebrity advocates in the favour of vaccine and how it is beneficial to prevent the COVID infection?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

6. Would you like to get yourself vaccinated if your doctor recommends you to take the vaccine?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

7. If India also follows a lottery system just like US and favour „lucky draws‟ for the people who will take the vaccine, would you get yourself vaccinated?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

8. Would you like to take the vaccine if you see other people around you getting the vaccine and are therefore safe?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

9. Would you like to get yourself vaccinated if a vaccine is available to you according to your flexible time, needs and preferences?
   - ☐ Definitely take
   - ☐ I will take
   - ☐ Not sure
   - ☐ Not take
   - ☐ Definitely not take

Q33) Please rate the following statements on the scale of 1-5 where 5 means that you totally agree and 1 means you totally disagree

1. COVID 19 is a serious illness
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

2. COVID 19 vaccine is effective
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

3. Healthcare workers must get vaccinated
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

4. By getting vaccine I protect people close to me from COVID 19
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

5. It is better to get infected with a virus rather than take the vaccine
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

6. COVID 19 vaccine has serious side effects
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

7. The vaccine can cause COVID 19
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially disagree
   - ☐ Totally disagree

8. Opposed to vaccination
   - ☐ Totally agree
   - ☐ Partially agree
   - ☐ Don‟t know
   - ☐ Partially agree
   - ☐ Totally disagree