

Investigation of Some Immunological Markers in Covid-19 Vaccinated Individuals: A Review Article

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ABSTRACT

The COVID 19 pandemic has caused great havoc amongst the people in society across the globe. It has affected people both physically and emotionally. The epicentre of the virus has been attributed to Wuhan, from where it spread in the different parts of the globe. Vaccination emerged as one of the best solutions to deal with the proliferation of the virus. It also helped people to protect themselves against hospitalization and reduced death rates. The researcher has used Secondary sources to gather information and data related to the immunological markers in Covid-19 vaccinated population. A major immune marker is the manufacturing of neutralizing antibodies. However, the further implication in this aspect is still under research by scientists.

Keywords- COVID pandemic, virus, immunological markers, vaccinated

randomized clinical preliminaries and true observational examinations show that each of the three COVID-19 immunizations as of now approved for crisis use by the Food and Drug Administration* are protected and profoundly compelling for forestalling COVID-19–related genuine disease, hospitalization, and demise (1,2). Investigations of immunization adequacy (VE) for forestalling new diseases and hospitalizations owing to SARS-CoV-2, the infection that causes COVID-19), especially as the B.1.617.2 (Delta) variation has become dominating, are restricted in the United States (3). In this examination, the New York State Department of Health connected statewide inoculation, research facility testing, and hospitalization information bases for New York to gauge paces of new lab affirmed COVID-19 cases and hospitalizations by immunization status among grown-ups, just as comparing VE for full immunization in the populace, across every one of the three approved antibody items. During May 3–July 25, 2021, the general age-changed VE against new COVID-19 cases for all grown-ups declined from 91.7% to 79.8%. During a similar period, the general age-changed VE against hospitalization was somewhat steady, going from 91.9% to 95.3%. As of now approved antibodies have high adequacy against COVID-19 hospitalization, yet viability against new cases seems to have declined lately, matching with the Delta variation's expansion from <2% to >80% in the U.S. area that incorporates New York and unwinding of covering and physical removing suggestions. To lessen new COVID-19 cases and hospitalizations, these discoveries support the execution of a layered methodology fixated on inoculation, just as other counteraction methodologies like concealing and physical separating (Al-Amer et al., 2021).

Customarily, these means happen consecutively, and each normally requires quite a while for finishing. Coronavirus antibody improvement has sped up to an uncommon speed, with each progression happening more than a while. Moreover, in the COVID-19 immunization drive, stage I and II and stage II and III examinations have regularly been joined with a consistent change from one stage into the following. By the by, security models stay tough; information wellbeing and checking advisory groups (DSMCs) made out of free immunization specialists and study supports survey unfriendly occasions that are accounted for in each period of clinical investigation and endorse progression to the following stage. In the United States,

I. INTRODUCTION

Research background

The covid-19 disease has already caused severe damage to human health. The pandemic induced by the virus has turned out to be among the worst the world has encountered until now. When the virus first came out of Wuhan in China, scientists were unsure about devastatingly the virus is going to influence our health. Millions of people have already lost their precious lives due to this virus. The speed of the virus transmission has been so rapid that the authorities had to impose lockdown measures to take control of the transmission impact. It had been evident from the initial days that the pandemic could only come to a conclusion if effective vaccines are built and given to the public. Such an aspect caused the speedy development of vaccines against the coronavirus. However, a major issue in this light is that the virus is constantly changing its variants, and an existing variant tends to more impactful and transmissible among humans. This indicates the requirement of comprehending the efficacy of the vaccines in the case of each variant as they emerge with novel issues, making it more difficult for doctors and scientists to manage the more critical covid-19 patients (Walkey et al., 2021). Therefore, the requirement for getting vaccinated becomes significant, and it is important to comprehend the immunological markers of responses among people vaccinated. Information from

the Food and Drug Administration (FDA) should likewise endorse movement to each subsequent stage in human preliminaries, from inception of stage I preliminaries through movement to stage III preliminaries, in light of information produced in the earlier advance.

Live constricted antibodies are created by growing hereditarily debilitated forms of the wild-type infection; these debilitated infections reproduce in the beneficiary to produce an invulnerable reaction however don't cause illness (Dayal & Gupta, 2020). Constriction can be accomplished by altering the infection hereditarily or by developing it in unfavorable conditions with the goal that destructiveness is lost however immunogenicity is kept up with. A live constricted COVID-19 antibody would ideally invigorate both humoral and cell resistance to numerous parts of the entire lessened infection. One more benefit of live antibodies is that they can be controlled intranasally, similarly as with the live weakened flu immunization, which may actuate mucosal resistant reactions at the site of viral passage in the upper respiratory plot. Be that as it may, security worries with live weakened immunizations incorporate inversion to or recombination with the wild-type infection. A few live constricted COVID-19 immunizations are in pre-clinical turn of events, however none have arrived at human preliminaries [Diesel et al., 2021].

Our data sets (the Citywide Immunization Registry, New York State Immunization Information System, Electronic Clinical Laboratory Reporting System, and Health Electronic Response Data System [HERDS]) were connected to build a reconnaissance based partner of grown-ups matured ≥ 18 years living in New York by utilizing individual name-based identifiers, date of birth, and postal district of home. The Citywide Immunization Registry and the New York State Immunization Information System are utilized to gather and store all COVID-19 supplier inoculation information for people dwelling in New York City and the remainder of the state, separately (barring chosen settings like Veterans Affairs and military medical care offices); people were considered completely immunized ≥ 14 days after receipt of the last antibody dose.† The Electronic Clinical Laboratory Reporting System gathers all reportable COVID-19 test outcomes (nucleic corrosive enhancement test [NAAT] or antigen) in New York (4); another COVID-19 case was characterized as the receipt of another positive SARS-CoV-2 NAAT or antigen test result, yet not inside 90 days of a past certain outcome. Groups incorporates a statewide, day by day electronic overview of all inpatient offices in New York; new affirmations with a research facility affirmed COVID-19 conclusion are gone into HERDS day by day via prepared clinic staff individuals (Shaw et al., 2021).

After a time of staged COVID-19 antibody qualification dependent on age, occupation, setting, or comorbidities starting in December 2020, all New York

occupants matured ≥ 60 years were qualified for inoculation by March 10, 2021; qualification was extended to people matured ≥ 30 years by March 30, and to all grown-ups matured ≥ 18 years by April 6.§ To permit time for an enormous part of immunized people to accomplish full resistance, this examination was limited to the week starting May 3 during that time starting July 19, 2021.

Advancement contaminations were characterized as new cases among people who were completely immunized upon the arrival of example assortment. Hospitalizations among people with advancement disease were characterized as new clinic affirmations among people completely inoculated on the announcing day. The absolute grown-up state populace that was completely immunized and unvaccinated was evaluated for every day and separated by age bunch (18–49 years, 50–64 years, and ≥ 65 years). People who were to some degree immunized were rejected from examinations. For every week and age bunch, the paces of new cases and hospitalizations were determined among completely inoculated and unvaccinated people, by individually separating the means each gathering by the completely immunized and unvaccinated individual days in that week. Age-changed VE every week was assessed as the populace weighted mean of the age-defined VE.** The span between finishing inoculation and positive SARS-CoV-2 test outcome date was summed up utilizing the middle, interquartile range (IQR), and rate tried ≥ 7 days from being completely vaccinated.†† The proportion of hospitalizations to cases was figured for every immunization gathering to comprehend the general seriousness of cases. Factual testing was not performed on the grounds that the investigation incorporated the entire populace of premium and was not an example.

By July 25, 2021, a sum of 10,175,425 (65.8%) New York grown-ups matured ≥ 18 years were completely immunized; 1,603,939 (10.4%) were to some extent inoculated. Among completely inoculated grown-ups, 51.3% had gotten Pfizer-BioNTech, 39.8% had gotten Moderna, and 8.9% had gotten Janssen (Johnson and Johnson) immunizations. During May 3–July 25, a sum of 9,675 new cases (1.31 per 100,000 man days) happened among completely immunized grown-ups, contrasted and 38,505 (10.69 per 100,000 man days) among unvaccinated grown-ups (Table). Generally (98.1%) new cases among completely inoculated people happened ≥ 7 days subsequent to being ordered completely immunized (middle = 85 days; IQR = 58–113). During May 3–July 25, case rates among completely inoculated people were by and large comparative across age gatherings, as were case rates among unvaccinated people, declining through the finish of June prior to expanding in July (Figure 1). Week after week assessed VE against new research center affirmed disease during May 3–July 25 for all age bunches commonly declined, going from 90.6% to 74.6% for

people matured 18–49 years, 93.5% to 83.4% for people matured 50–64 years, and 92.3% to 88.9% for people matured ≥ 65 years. During May 3–July 25, the in general, age-changed VE against contamination declined from 91.7% to 79.8% (Figure 1) (Table).

A sum of 1,271 new COVID-19 hospitalizations (0.17 per 100,000 man days) happened among completely inoculated grown-ups, contrasted and 7,308 (2.03 per 100,000 man days) among unvaccinated grown-ups (Table). Hospitalization rates commonly declined during that time of July 5, yet expanded the long stretches of July 12 and July 19, and were higher among completely inoculated and unvaccinated people matured ≥ 65 years contrasted and more youthful age gatherings (Figure 2). Age bunch explicit assessed VE against hospitalization stayed steady, going from 90.8% to 97.5% for people matured 18–49 years, from 92.4% to 97.0% for people matured 50–64 years, and from 92.3% to 96.1% for people matured ≥ 65 years. During May 3–July 25, the by and large, age-changed VE against hospitalization was for the most part stable from 91.9% to 95.3% (Figure 2) (Table). The proportion of hospitalizations to cases was tolerably lower among completely inoculated (13.1 hospitalizations per 100 cases) contrasted and unvaccinated (19.0 hospitalizations per 100 cases) gatherings.

Research Objectives

The main focus of this research concentrates on the immunological response of markers among individuals who have been vaccinated against the coronavirus. In this context, the main objectives of the research are:

- To discuss the immunological markers of responses among humans.
- To assess the immunological markers or responses against diseases.
- To investigate the immunological markers for covid-19 vaccinated people.

Research questions

The main research questions in this study are:

- What are the immunological markers or responses of humans?
- What are the immunological markers or responses against diseases?
- What are the markers for covid-19 vaccinated people?

Problem statement

As a solution to the ongoing pandemic induced by the coronavirus, several pharmaceutical manufacturers have been developing over two hundred potential vaccines. However, among them, many have been cleared by FDA and other concerning health authorities in different nations. The majority of the vaccines that have been cleared and in use render at least seventy to ninety-five per cent efficacies (Moore et al., 2021). However, as the virus is constantly evolving, resulting in the emergence of different strains, the impacts are changing, and the efficacies of the vaccines

are coming into question. Therefore, it is crucial to investigate the immunological markers of the vaccines that have been already administered among people.

Immune markers

Immune markers are considered to be the ingredients that define the human capacity to resist detrimental agents, including bacteria and other substances that could induce severe health issues (Sadarangani, Marchant & Kollmann, 2021). Since this general procedure could also result in rejecting transplanted organs, it is therefore critical to comprehend the immune response. The coronavirus has become one of the worst pandemics in history, causing different severe issues within the human body, especially affecting the lungs in a very detrimental way (Sharma et al., 2020). The vaccines that have been developed until now seemed to have been somewhat effective in fighting the virus. Most of the vaccines come in two doses, and since the involvement of the virus is causing the emergence of new variants, the efficacy of the vaccines is under question. Thus, it is crucial to comprehend the immune markers in humans who have already been vaccinated against the virus (Müller et al., 2021).

Natural immune response against the virus

For comprehending the way the vaccines works against the coronavirus, it is first crucial to understand how the natural immune system responds to the virus. According to Mallapaty (2021), when bacteria or viruses like the covid-19 attack a human body, they are likely to multiply in numbers to render a more severe influence of that virus. This attack is recognized as an infection. The natural immune mechanism utilizes different instruments to fight the virus. Blood comprises red cells that disperse oxygen to different organs and tissues, and while cells that work as a defender against the virus. It is found distinct sorts of white blood cells tussles against the virus in various ways. First, macrophages are the sort of white blood cells that intake and digest viruses like covid-19 and cells that are in dying condition. They are the ones responsible for the creation of antigens. The human body recognizes antigens as per their severity and energizes antibodies to destroy them. Second, there are B-lymphocytes, which are white blood cells that work as a defence. They are responsible for manufacturing antibodies that invade the virus left behind by the macrophages (Wood & Schulman, 2021).

On the other hand, there are T-lymphocytes, which are different sorts of white blood cells that are defensive in nature. When an individual is infected by the coronavirus, it could take up to at least fourteen days for the body to render and utilize all virus-fighting instruments required to tackle the infection (Jeyanathan et al. 2020). Once the person is infected, the immune system will remember the virus and immediately create a response the next time the virus tries to invade the body. The T-lymphocytes works as memory cells that safeguard the human body the next the virus attacks. Besides, upon identifying the identical antigens, B-

lymphocytes manufacture antibodies to invade the virus and destroy them. However, scientists and scholars are still not sure about the longevity of the memory cells in terms of offering protection against the covid-19 virus (Bramer et al., 2020).

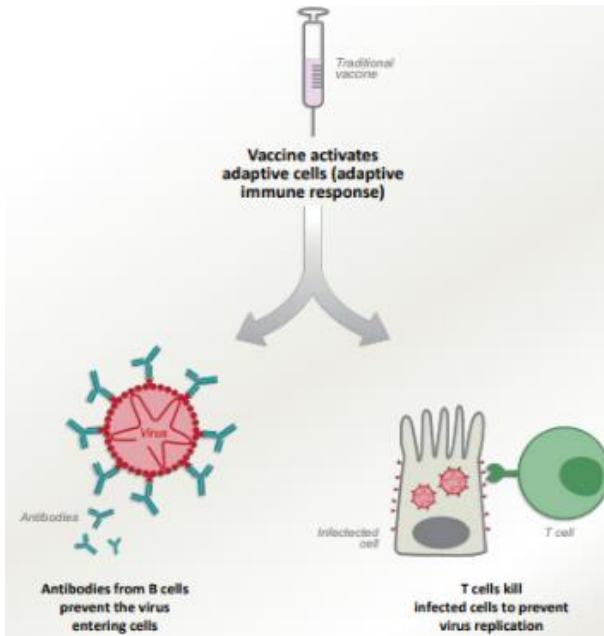


Figure 1: Immune response for induced vaccine (Source: Jeyanathan et al. 2020)

Understanding vaccine-induced immunity

Once individuals are vaccinated versus the virus of the covid-19, the degrees of infection preventing antibodies in the blood are a rigid pointer of how much safety they have attained in opposition to the virus (Saxena et al., 2020). Previous researches have depicted that the existence of even a small amount of these effective neutralizing antibodies implies that a vaccine is efficient in safeguarding against the covid-19 virus. These studies have turned out to be the most feasible attempts that have been made to describe the aspects of the immunological response that could work as a proxy for safeguard versus the covid-19 virus (Jin et al. 2021). This immunological response is recognized as a correlate of protection. It is important to render a well-described correlate of protection. They can be helpful in forecasting the effectiveness of a vaccine. Initial researches have portrayed the fact that if a vaccine is at least fifty per cent efficient, it would involve levels of antibody eighty per cent lower than in those who have regained health after getting infected by the virus (Taylor et al., 2020).

In this context, it is important to mention that vaccines that based on mRNAs have offered stronger neutralizing-antibody response against the virus in comparison to other types of vaccines (Callaway, 2021). They are considered to be the most effective. However, the antibodies are going to be effective for approximately eight months, and new studies are coming

up with suggestions that even after the two doses, individuals need to get a booster shot to strengthen the period of the antibody levels produced in the body by the vaccines. Furthermore, it is also worth mentioning that although the novel variants of the virus can minimize the capability of neutralizing antibodies to prevent the infection, the majority of the vaccinated (at least a single dose) individuals are likely to experience mild symptoms of the virus stipulated illness (Bagcchi, 2021).

Possible immune markers for covid-19 vaccinated people

Measuring vaccine-inflicted immune markers is a critical step in developing CoP for the covid-19 virus. A wide range of serological tests have been established, comprising live viral neutralizing assays in various forms, pseudovirus neutralizing assays employing various agents, and ELISA experiments utilizing various target bound antigens (PALCA, 2021). Comparing immunological responses to numerous vaccine prospects is difficult, leading to a shortage of uniformity among various tests and testing facilities. The benefit of efficacy studies is that they can discover the relationship between vaccination, immunological markers, and resistance. The vast resources necessary to perform such research, nevertheless, may restrict the quantity that can be done, such as the exact number of illnesses, the quantity, reliability, and the number of collecting points in time (Nguyen et al., 2021). The outcome of a different study in this context has revealed that scientists only have been able to identify neutralizing antibodies. These are proteins that are created by the immune system and recognized to defuse the covid-19 virus (Gilbert et al. 2021). Moreover, it is important to comprehend that in some cases, people who have been vaccinated, despite growing immune response against the virus, has developed issues like a blood clot and decreasing platelets (Kwok et al., 2021).

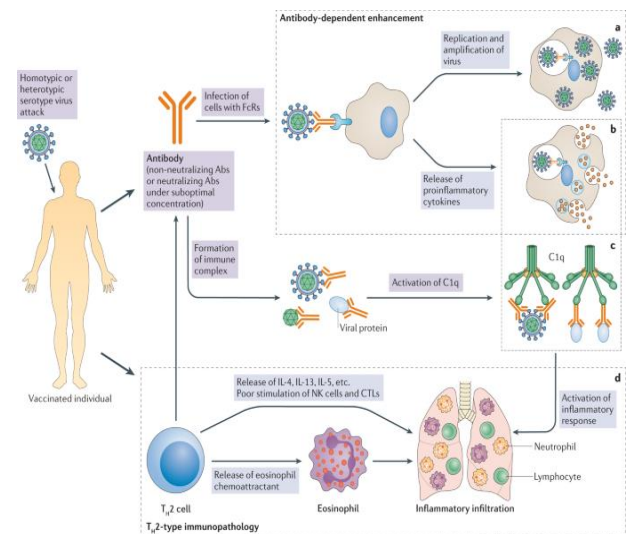


Figure 2: Development of Covid 19 safe and effective vaccines (Source: PALCA, 2021)

II. RESEARCH PHILOSOPHY, DESIGN AND APPROACH

Research philosophy plays the most important role in the completion of any research work as it helps to find out the recent data associated with the research topic (Hürlimann, 2019). The researcher in this specific research work has used the *positivist research philosophy* as it helped the researcher to find out the hidden facts associated with the prime markers of the immunological responses in the vaccinated people against COVID 19 (Dodd et al., 2021). The researcher has also used the *descriptive research design* to elaborate the research work. The selection of this research design helps to design the structure of the entire process of the research work that makes the process simple (Miyasaka, 2020). The researcher has also used the *deductive research approach* to prove the hypothesis associated with the research work.

III. DATA COLLECTION METHOD

Secondary Data Collection method

The Data Collection method plays the most effective role in terms of finding relevant data associated with the research topic. This helps to evaluate the relevant facts of the topic (Ruggiano & Perry, 2019). The researcher has used secondary sources like books, journals, magazines and website information to gather data associated with the common immunological markers in the individuals vaccinated against the COVID 19 virus. The researcher has used secondary qualitative data in the form of conducting thematic analysis. In this respect, two themes have been created to show its justification from relevant journals and supportive articles.

Ethical Consideration

The researcher has put special emphasis terms of maintaining the confidentiality of the sources used for the research work. As per the Data Collection Act 1998, the confidentiality of the sources is of prime importance as it helps to deal with copyright issues (Ribas et al., 2021).

IV. LIMITATIONS

The researcher faced difficulty in terms of accumulating enough information through various sources as the information regarding the immunological markers in COVID-19 vaccinated people are very limited, and research is still on progress associated with the topic. The researcher also faced constraints in terms of gathering a huge sum of money needed for the completion of the research as some of the websites are highly priced. The researcher also faced issues regarding time management.

V. ANALYSIS & DISCUSSION

Analysis

Theme 1: Vaccination helps to protect the individuals from death, severe disease and hospitalization; however, it does not provide full protection against COVID 19

The COVID 19 has created great unrest in society and has taken several innocent lives across the globe. Recent data have suggested the fact that mass vaccination across the various parts of the world has resulted in providing effective protection against the various strains of COVID 19 like Delta, Alpha and Beta (Christie et al., 2021). As discussed in the previous section, the vaccines belonging to various brands are capable of providing 70- 95% of protection against the various strains of the virus (Gilbert et al. 2021).

It has been also noted these vaccines are also effective in fighting the developing variants of the virus in society. For instance, the report submitted by Johnson & Johnson, one of the leading producers of the vaccine, in July 2021 says that the vaccine developed by them succeeded in stopping the proliferation of the virus in the society and proved to be highly successful against the quickly spreading Delta variant and other highly widespread SARS-CoV-2 viral variety in the society (DeRoo et al., 2020). A healthy healthcare system requires healthy healthcare workers. Protecting healthcare workers including nurses against COVID-19 is crucial, and vaccination could be a viable future option. However, vaccine hesitancy remains a global challenge. Nurses, as a trustworthy and creditable source of vaccine-related information, may build public confidence in vaccination. Hence, research on vaccine hesitancy among nurses is warranted.

Theme 2: Immunological markers in COVID-19 vaccinated people are a highly discussed topic in the present context. However, research is ongoing in this field.

Most nations are trying to vaccinate all the people so that the severity of the disease can be checked. Scientists across the globe have been focusing on the various facets of the immune response of the virus developed in people after the vaccination process (Sherman et al., 2021). This approach will help to make further development in this field and will also help to shed light on the hidden facts associated with the topic. The secondary sources used in gathering information about the effectiveness and the immune response of the vaccine revealed the fact that some of the symptoms in the people going through vaccination are prevalent (Ravichandran et al. 2021). The prime attributes of the response developed by the virus are attributed to the high level of **White Blood Cells** amongst the vaccinated population.

This marker has emerged as a prime aspect amongst the scientists in the society to mark the effectiveness of the vaccine and the mark to denote the

immune response developed by the vaccination process (Curtis, 2020). The other factor noticed in the vaccinated population is the low level of *platelets counts* at the initial stages after the vaccination process. Memory cells have been identified in the individual's vaccinated against the virus. This also attributes to be one of the prime markers of the immune response developed against the COVID 19 virus in the vaccinated people in the society. The *HCG* level has also risen in some of the pregnant mothers after taking the vaccine (Dagan et al., 2021). This has also been considered as a determinant of the immune response of the vaccine. The data collected from secondary sources are subjected to change in the near future as the research process is an ongoing process.

VI. DISCUSSION

Data collected from various research works have revealed the fact that the robustness of the immune response lasts at least eight months. In real practice, however, the effectiveness of vaccines in a society highly varies. No vaccine can provide full protection against the COVID 19 disease. Hence, people need to follow all the protocols along with the vaccination to stop the proliferation of the virus. In my opinion, the results of the research associated with the markers of immunological response amongst the vaccinated population revealed various astonishing facts. The results proved various physical changes, especially in terms of the Hematological changes in the individuals (Khubchandani et al., 2021).

There has been a severe change in the Platelet count in the individuals who went through the vaccination process. Memory T- Cells have also been found as a key determinant in the vaccinated population that marked that they have been already vaccinated (Sun, 2020). I think that increase in the WBC of the respondents also acted as a prime aspect that emerged as a marker of being vaccinated.

VII. CONCLUSION

The study has tried to highlight as many aspects as possible related to the immune response or markers in covid-19 vaccinated individuals. The study has discussed the natural immune response to the virus along with the virus-inflicted response. Vaccines, especially the mRNA ones, have been able to safeguard the virus invasion by manufacturing neutralizing antibodies. However, there have not been many studies done on this subject, as it would take a large number of people who are vaccinated and immense time to provide a conclusion regarding the immune markers against covid-19 vaccinated people.

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