How to Cite:
Baboolal-Frank, R. (2022). Immune response towards viral and bacterial infections due to COVID-19. *International Journal of Health Sciences*, *6*(S6), 3321–3326.
https://doi.org/10.53730/ijhs.v6nS6.11343

Immune response towards viral and bacterial infections due to COVID-19

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***Abstract*---**COVID-19 has caused drastic changes to the immune response towards viral and bacterial infections. There have been clinical studies that have shown that there are long impacting imprints on immunity relating to the SARS-CoV-2 virus that has changed the immune response. It is evident that people with immune suppressed issues are more vulnerable to more viral illnesses, than before as their environmental immunity did not develop fully due to lockdown conditions imposed. In South Africa, a country that is riddled with medical conditions such as tuberculosis, diabetes, heart diseases, cholesterol, high blood pressure, obesity, cancer, HIV and AIDS endemic which illnesses and viruses exposes these groups to be more vulnerable to contracting SARS-CoV-2 variants and influenza. The paper explores immune therapy and boosting that shall enhance compromised immune systems to overcome fatal infections. The paper postulates different strategies for international collaboration that may be undertaken to overcome the pandemic fully and permanently.

***Keywords*---**pandemic, COVID-19, immune system, immunocompromised, immune response

Introduction

There has been a downward trend to get fully vaccinated or boosted in South Africa. The choice of vaccination rests on the individual choice and responsibility, as the State encourages vaccination and boosters against the variants of the SARS-CoV-2 virus. The article explores, the immunity responses from various studies that has also influenced the choice of further vaccinations for people living in South Africa. More clinical studies need to be undertaken and conducted on the immune response in South Africa, including the various groups of partially vaccinated, fully vaccinated and not vaccinated individuals, as well as severely immunocompromised individuals relating to their immune response to infection and viruses. Medical conditions such as tuberculosis, diabetes, heart diseases, cholesterol, high blood pressure, obesity, cancer, HIV and AIDS pandemic which illnesses makes these groups more vulnerable to contracting SARS-CoV-2

variants and influenza, means more counter measures need to be taken for their medical well-being. A more diverse treatment plan is needed to cater for the different immune responses in South Africa. The elderly and immunocompromised individuals require treatment to boost the immune system and different immune therapies, such as immunomodulation can be investigated to assist patients in overcoming SARS-CoV-2 variants. The aim would be to target the cells to strengthen antibody response to SARS-CoV-2 variants.

Method

The material and methodology that has been employed is a study of published articles and clinical studies relating to the impact of SARS-CoV-2 variants on the immune system. The published academic findings are used as a benchmark to recommend, further measures to tackle future variants of SARS-CoV-2. It is known that adaptive immunity is triggered to overcome the SARS-CoV-2 virus, however there are different responses that are shown. There are different responses, asymptomatic and symptomatic. The asymptomatic response, more immune boosters are given to ensure that the T and B cell receptors overcome the inflammation stage of the consequences of the virus to the organs of the body. Shi et al (2020) discusses that that the group that has severe lung damage, need more strategies of treatment to be employed to assist the immune system to respond to the inflammatory response and the accumulated white gel build up in the lungs, that causes respiratory complications and difficulties to other organs. The termed 'cytokine storm' includes the inflammation response to all organs in the body. (Schultze & Aschenbrenner, 2021) Myocarditis and pericarditis has been commonly reported in patients after contracting the SARS-CoV-2 virus, and often it has gone untreated and undetected that has resulted in myocardial infarction and fatalities.

Access to healthcare is not an absolute right in South Africa, and to obtain medical State assistance, one has to brave the long queues that takes days to obtain the desperate health assistance, however the healthcare system is overburdened, under resourced and sometimes the basic medicines are out of stock, and this means that the patients would need to privately obtain their medications from pharmacies and chemists. Another risk factor consideration for SARS-CoV-2 is inflammatory diseases such as aforementioned including autoimmune diseases that makes people more susceptible and vulnerable on a molecular level to the virus. (Schultze & Aschenbrenner, 2021) The data reveals that with the more variants of SARS-CoV-2, illustrates that the adaptive and the artificial immunity does not last for a long period of time. This means that the focus of future studies needs to be on the immune response to the different variants. Clinical studies have shown that the variants are getting significantly weaker however, the spreadability is high, meaning that the virus is more easily spreadable and transmittable to persons, as we have seen more travel restrictions placed, when variants have been out of control, increased hospital admissions and more infected persons. The hospital admissions have been significantly less since the start of the pandemic in 2020. Older people and people with comorbidities are still more at risk to fatality due to the SARS-CoV-2 variants. (Blanco-Melo et al, 2020) It is significant to analyse the high numbers of the population that are affected by HIV, diabetes and tuberculosis.

Table
Figures of people infected

Diseases and Viruses in South Africa	Number of people infected as of 2022
HIV	8,2 million
Diabetes	4,5 million
Tuberculosis	450 000 each year
Cancer	43811 in 2019
Influenza	Approximately 50 000 per a year

The table represents a high number of South Africans with comorbidities that require their immune system to be boosted, as they are vulnerable to viruses and illnesses, as well as complications of SARS-CoV-2 variants, which arises. It is a consideration to be taken into account with more than 12 million people affected by diabetes and HIV, it is a necessary measure, for the government to invest in different treatment plans to assist in the recovery of immunocompromised patients. The State health care system is in crisis, in that it also relied on private hospital to seek treatment for public patients, as there were not enough beds, medication and facilities for the public patients. There needs to be more capacity created, recruit more health care professionals, build more hospitals that have all the necessary equipment to treat patients. Makeshift hospitals were a temporary measure, however, the healthcare crisis cannot continue as an accepted normality. The wake of nationalization of State care from private care, is not a solution to expensive healthcare, funding that is misappropriated and a crippled state healthcare systema and structures, that needs an overhaul of the current system.

The COVID-19 pandemic has shown us that healthcare professionals are understaffed and overworked. Many were overlooked when Cuban doctors were sourced, as there were doctors that were unplaced for their internship and community service programmes. Mental well-being needs to prioritized to prevent burnout for essential staff. Healthcare professionals need to be paid at improved rates, to encourage healthcare professionals not to immigrate, and be sufficiently financially stable and secure. State payment to healthcare professionals needs to be competitive, and they need to be well supported to fulfil their mandate and duty to the public. It is apparent that the healthcare system in South Africa cannot lose critical and essential workers to foreign countries. The understaffed issues of healthcare workers does not assist to propagate access to healthcare for everyone. Currently, healthcare professionals are buying medical supplies and medical equipment to keep the hospital afloat, that does not have the basic medical supplies for healthcare professionals to complete their daily tasks at hospitals and clinics throughout the country. Surgeons in government have their own surgical equipment, to ensure, that they shall be ready to operate, and cannot rely on the hospital for their essential equipment.

There are approximately 60 million people in South Africa, and the population is densely populated in a select number of provinces such as Gauteng and KwaZulu Natal, in relation to land mass and demographic population, as a result hospitals and care facilities are overburdened and do not have unlimited capacity to

accommodate sick patients that need hospitalization. During the COVID-19 pandemic many patients were not given access to healthcare, due to the capacity strain, many times, the public were referred to other hospitals and clinics that were countless kilometers away in distance.

Discussion

There has been very little research conducted in South Africa relating to immune responses to the SARS-CoV-2 viruses in the three groups of people namely, partially and fully vaccinated and unvaccinated persons. There are religious notions against vaccination, conspiracy theories relating to vaccination, personal preference, anti-support of the pharmaceutical companies and Bill Gates, not sharing the formulation of the vaccination to developing countries. Money over lives was the perceived propaganda, that circulated from pharmaceutical companies charging exorbitant fees to counties for vaccination. The side effects of vaccination, and the fear of severe illness or even death in the elderly was another drawback that encouraged anti vaccination. Mass hysteria about vaccination, was also propagated by the media, it depended which media network that you elected to read about pro vaccination as opposed to anti vaccination. There was also divided literature surrounding the most 'effective' vaccinations. The American reaction to anti-vaccination, also influenced pro choice for vaccinations. The employers, that required compulsory vaccination, otherwise the employees were retrenched, due to operational requirements. However, the data about the differentiation was clear about SARS-CoV-2 variants, however, the limited data exposed is unclear about the immune response relating to the numerous variants, as the vaccinations has a limited lifespan. The immune response is weakened to variants, as the spike against antigens has worn off.

Figure. Collaborative research strategy

Global lockdown conditions have shown that as a collective, more can be easily accomplished through the sharing of information and resources, for the common goal of overcoming the pandemic on a permanent basis. It is important to be able to obtain an enriching diversity for treatment of SARS-CoV-2 variants as clinical studies on different ethnic groups are limited. It is apparent that genetics also

plays a role in combating the variants and certain genetic codes also expose people more to the SARS-CoV-2 variants. A collaborative research approach means that healthcare professionals are able to tap into centralized databases of shared resources and information about patient treatment plans and strategies. It is of course essential for the consent of the patient to be obtained to have these central repositories of results relating to the treatment of patients overcoming the complications of the variants of SARS-CoV-2.

Conclusion

It is apparent from the results that more research in clinical studies and bigger groups across ages and diverse ethnic groups needs to be undertaken to illustrate results that can be an assimilated to the demographic population to ensure that there is proper demographic population representation. There needs to be more global collaborative measures of research findings and focus groups, to allow for collaborative approaches and funding for developing more measures to enhance the immune system of the global population in building stronger immune response to the present variants to SARS-CoV-2, this will curb global lockdowns that occur without notice and cause travel restrictions and impossibility for many foreigners visiting countries on holiday. A shared pandemic crisis means that it is a shared problem, and humanity comes firsts, meaning that when we serve the individual it is required to serve the collective health issues and crisis. Strengthening immune systems ensures that the pandemic will be overcome on a permanent basis, irrespective of the variants.

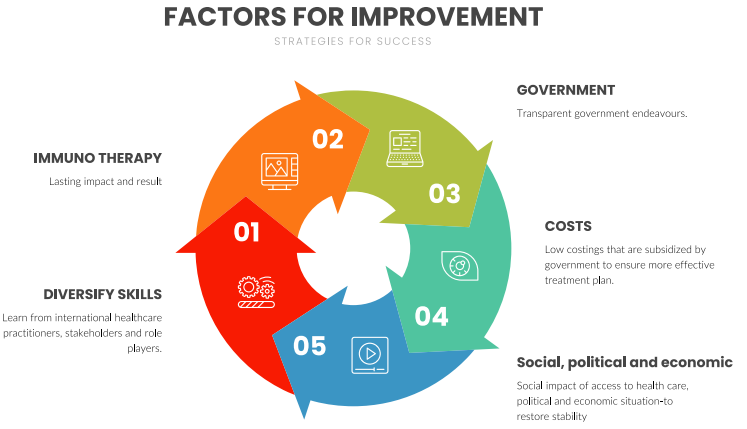

Figure. Factors for Improvement

It is quintessential that focus is given to clinical studies of Immuno therapy by using immunomodulation to enhance the antibody receptor cells response to SARS-CoV-2 variants. The stronger the antibody response is to the virus, the improved possibility of being asymptomatic to the virus and not leading to serious compilations or hospitalization, with limited inflammatory response to essential functioning organs. Other measures are also essential to change the DNA coding of the patient to improve the antibody response. In South Africa, government would need to play more of an active role beyond the vaccination and booster roll

out. Government would need to actively invest in the clinical trial of immunomodulation and explore immune therapy with the aim of improving and enhancing the immune response of compromised individuals due to age and comorbidities.

Acknowledgments

I would like to acknowledge the research that was conducted during clinical studies of smaller groups, as it provided useful results that encouraged further discussions and stimulated various debates in this paper. I would also like to acknowledge the healthcare professionals that have contributed to this paper through their research and clinical findings that has been cited in this paper.

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