UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY AND FOOD TECHNOLOGY

ADVANCED DIPLOMA IN BIOTECHNOLOGY

MODULE BTN7X01

APPLIED DISEASE AND IMMUNE RESPONSE

CAMPUS **DFC**

MAIN SUMMATIVE ASSESSMENT NOVEMBER 2021 MEMORANDUM

AVAILABLE DATE: 01/10/2021 **DUE DATE: 01/11/2021**

ASSESSOR(S): **DR K KONDIAH**

EXTERNAL MODERATOR: **PROF AN TRAORE-HOFFMAN**

MARKS: 40

NUMBER OF PAGES: 3

INSTRUCTIONS TO STUDENTS:

1. **COMPLETE THE ACADEMIC INTEGRITY STATEMENT BELOW WITH THIS ASSESMENT.**
2. **SUBMIT THE ASSESSMENT ONLINE VIA BLACKBOARD.**
3. **REFERENCES MUST BE INCLUDED AND LISTED FOLLOWING THE HARVARD SYSTEM OF REFERENCING.**
4. **LABEL YOUR FILE AS FOLLOWS: FINAL ASSESSMENT_STUDENT NUMBER.**
5. **A TURN IT IN PLAGIARISM REPORT WITH LESS THAN 15% SIMILARITY SHOULD BE SUBMITTED.**
6. **GOOD LUCK!**

Academic Integrity Statement

I, _____, certify on my honor as a student of the University of Johannesburg that I have neither received nor given aid on this assessment.

I have read and understood 'Policies and Plagiarism Declaration' available in UJ Blackboard. I agree to be academically honest and will not cheat, lie or steal to influence the accurate assessment of my work and understand that there will be consequences should there be suspicions and evidence of my dishonestly.

The assessment I submit is entirely my own work under strict examination conditions.

Signed by: _____

Student Number: _____

Date: _____

Write a referenced essay of between 1500-2000 words providing an overview of the emergence of SARS-CoV-2 variants such as Delta, Mu and C.1.2. In your essay, further discuss why the Janssen and Pfizer-BioNTech COVID vaccines can still offer some protection against these variants. Also include with support from literature how you think herd immunity could be achieved and whether or not it can play a protective role against COVID in South Africa and the world. (40 marks)

Variants arise due to mutations across the genome. Some mutations are negative and the variants are lost but some are positive, making SARS-CoV-2 more infectious and highly transmissible. The mutations are found in throughout the genome but those influencing transmission and immune escape are mainly found in the gene coding for the S protein and especially in the receptor binding domain (RBD). These mutations improve the binding of the S protein to the ACE2 receptors, improve furin cleavage and reduce neutralization activity. Most variants carry similar mutations with a few exclusive to different variants. Delta mutant (B.1.617, India, Oct 2020) - mutations in the N-terminal domain (NTD) and the RBD that increase its immune evasion potential, Mu (21H/B.1.621, Columbia, Jan 2021) – nine mutations in S protein; less transmissible than delta but better immune evasion, C.1.2. (first sequenced in SA, Aug 2021) – additional mutations in NTD, RBD and adjacent to furin cleavage site.(5 marks)

Janssen made of DNA coding for modified S-protein and Pfizer made of RNA coding modified S-protein. Several epitopes on the S-protein to which antibodies are made ie polyclonals and not just to the RBD. Therefore even if some mutations occur and the epitope is changed, some of the other epitopes are still the same and the polyclonals formed against them can exert some immunity albeit reduced because of any RBD epitopes where neutralizing antibodies can no longer be formed against. However, even in natural immune response, sometimes the person infected could mount an adequate natural response to the changed epitope and therefore immunity may not be derived from the vaccine against the specific epitope but the immune system is poised to attack the general virus. Although this could take time to build up due to primary and secondary immune responses.

Herd immunity is when a large population of susceptible individuals are immune against the virus and therefore protect the few that are unable to for example be vaccinated or are immunocompromised. The larger a population that is immune, the less likely the virus can be transmitted from individual to individual. However, in the case of COVID, the emergence of variants means that vaccinated or naturally immune population may have immunity against one strain but infection of a different variant can continue to spread in the population. Also the low response to vaccination means that large numbers of the population can still become infected and spread the virus. There is also no evidence yet that vaccinated people stop becoming sources of transmission. They may be asymptomatic but they may still carry the virus and spread to other individuals. All these factors can make herd immunity unlikely in SA and the world. Additionally, in SA there is a large population of immunocompromised individuals (HIV and TB) that cannot receive the vaccine making it less likely for herd immunity to be achieved.

Alternatively, if at least 90% of the population is vaccinated, people practice the correct social behavior, it may be possible to stop the transmission of the virus. If vaccines are developed

against the variant strains this may also reduce transmission although the emergence of new variants occurs quite rapidly that it may not be easy to keep up with producing a “new” vaccine each time.

Logical arguments have been made.

Information flows between ideas/arguments/concepts and is well-presented.

Correct referencing technique in text and listed has been used.

At least 5 references have been cited.

Similarity % in turn-it-in report is ≤15%

Word limit has been maintained.