Vaccine-induced SARS-CoV-2 IgG Antibody titre over time, post-vaccination project

# Introduction

This project focused on the effect of time on the SARS-CoV-2 vaccine induced antibody titre. This study involved 21 employees from a company. 2019, the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) outbreak emerged in Wuhan, China, rapidly evolving to a pandemic. Vaccines such as messenger ribonucleic acid (mRNA)-based and Adenovirus-based, have been developed to counter severe Coronavirus Disease 2019 (COVID-19). However, many factors, for example, immunosuppression and prior infection can affect the antibody titre. There is compelling evidence suggesting that the vaccine-induced antibodies decrease over time. In This study evaluated the effectiveness in Anti-SARS-CoV-2 immunoglobulin (Ig) G production and decline over time, indicating the potential requirement for additional boosters. Furthermore, this study focused on how Adenovirus-based vaccine boosters and breakthrough infections affected the antibody titre.

## Objectives

* To determine the SARS-CoV-2 vaccine antibody titre of participants;
* To establish how the SARS-CoV-2 vaccine antibody titres were affected over a specific

period of time;

* To determine how SARS-CoV-2 vaccine antibody titres were affected by age;
* To determine how SARS-CoV-2 vaccine antibody titres were affected based on gender.

## Data Collection

Samples were collected at week 2, 4 and 8, post-booster. The sampels were collected from 21 participants. These samples were centrifuged and the plasma was removed until the date of testing. The samples were run on the Abbott Architect i1000SR analyser. All samples were tested with the SARS-CoV-2 IgG II Quant (Abbott) quantitative assay. The analyser is an immunoassay which uses Chemiluminescence microparticle immunoassay (CMIA) technology. This assay measures IgG antibodies against the S-RBD of SARS-CoV-2. A 2021 study (n = 143) has shown that the sensitivity for this assay was 98.3% (14 days after the onset of initial symptoms) and the specificity was 99.5% (English et al., 2021). The results are interpreted in Arbitrary units per mL mL (AU/mL). According to the manufacturer’s package insert, a result above 50 AU/mL is positive while a result below 50 AU/mL is negative. There were logistical difficulties in coordinating the timing of sample collection with the availability of the participants.

## Data Cleaning

The data was collected in excel and saved in CSV format. Outliers were calculated using the Tukey formula and highlighted in the discussion. A Spearman correlation was also performed, in order to address the outliers. Some of the non-parametric methods such as the median and IQR was robust to the outliers.

## Exploratory data analysis

### 5.1 Descriptive statistics

Descriptive statistics were used to analyse the results.

### 5.2 Data visualisations

Data visualisations such as box-and-whiskers charts, Violin plots and correlation graphs where used.

### 5.3 Variable Relationships

A Pearsons correlation was performed to identify the relationships between different variables.

### 5.4 Hypothesis

A hypothesis was designed, for this project as follows:

**Null Hypothesis (H0):** Time will not affect antibody titres.

**Alternative Hypothesis (HA)**: The antibody titres for all participants will decrease within a period of time but will not reach undetectable levels.

### 5.5 Modeling

ML model selection, training and evaluation to be assessed.

### 5.6 Evaluation Metrics

To be assessed.

### 5.7 Results and interpretations

To be assessed.

### 5.8 Challenges and limitations

To be assessed.

### 5.9 Conclusion

To be discussed.

### 5.10 Technical stacks

The language used was python with the program pycharm. Some of the libraries used includes NumPy, Matplotlib and Seaborn.

### 5.11 References

To be done

### 5.12 Code repository

The code repository can be found in the Github account: AdriaanMeyer (project: Python, Branch: matplotlib). The link is: <https://github.com/AdriaanMeyer/SARS-CoV-2-vaccine-project.git>