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*ANALYSIS Of cellular Immune response*

9750 Final Project 12/17/19

**Executive Summary**

The purpose of this study was to see the effects that influenza immunization had on individual’s antibody and immune cell response in order to better prepare vaccines in the future. There were 4 different strains of the influenza viruses that were administered to each subject. The strains were A/California/7/2009, A/Brisbane/59/2007, A/Uruguay/716/2007, and B/Brisbane/60/2008. Two sets of data were analyzed from this, antibody titer, which detects the presence of antibody overall and ELISA, which also detects and measures specific number of immune cells. The cells that were analyzed in this study were the Effector and Memory Cells of IgG for H1N1, seasonal and overall total. For the titer analysis the participants were tested on -7, 0, 7, 28 days during the inoculation process. For the ELISA analysis the participants were tested on -7, 0, 7 days during the inoculation process. The main takeaway from this analysis is that individuals often have antibodies or some form of effector cell before the process of immunization occurs. Which shows that importance of the immune system before immunization to protect the body from harm when dealing with short term immunity. This also shows immunization creates a large increase in the number of antibodies and cells after vaccination and most importantly a large increase in the amount of memory cells. Memory cells are essential to the protection of individuals in the long term. This process showed the importance of that immunization has on the long-term immunization.

**Data Gathering**

For this projected I was interested in finding data that had to do with immunology. I found the website Immnospace.org, which house hundreds of studies focusing on immunization, which have multiple datasets per study. I chose this study because it had a large cohort and had the most possible days available to graph over time. I cleaned the data my removing the sections that didn’t have any information, as well as cells that contained day additional data in day for only a select. I also removed unnecessary columns which housed redundant information. I also filtered the data by virus or type of cells in order for the information to be clearly understood and for it to be graphed easily. For the infographics, tables and simple qplots were created in order to find basic information on the cohort, such as gender total and ages.

**Data Analysis**

Below are infographics of demographics of the cohort of the study. The study consisted of 63 people.

![A close up of a piece of paper

Description automatically generated]()

![A close up of a persons face

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From the demographics of this study, we can see that a large portion of the study’s cohort are young adults, which are individuals from age 20-39 years of age more specially in the 20-29 range. As for Gender, there were more women than men in this study. Finally, for race it was predominantly white in addition to three other races which include Asian, Black and Other.

A close up of a map

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A large crowd of people

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From the four animation you can see that at the period before immunization at day 0, that many participants in the study already had presence of the antibodies. This is understandable given the fact that people are exposed to viruses every day. We must also take into account that some of these individuals might have already contracted the viruses since this study was done during/before the time the viruses were first presented. As the time increases from -7 to 0 days there is a decrease in the amount of antibodies because the longer that individuals are not exposed to a virus the more the less likely they are to create antibodies that need to be used to protect them from against the virus. From day 0 to day 28 you can see that there is once again there an increase in the amount of antibody titer. This is because there is an increase in the number of antibodies produced from the exposure of the dead influenza virus that was in the immunization. The body once again creates antibodies in order to fight against viruses that inhibiting the body.

A screenshot of a cell phone

Description automatically generated

For the effector animations you can see that as time increases before immunization there is a decrease in the effector cells across all types of effector, since they are used to fight off active viruses and they are often short lived. Since individuals before the study are exposed to the viruses we also were able to see that most individuals in this study did have some amount in of effector t cells which shows that their body was ready to defend the viruses that they were being exposed to on a daily basis.

A close up of a map

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A screenshot of a cell phone

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For the memory cells you can see that some individuals that were apart of this study were already exposed to these viruses since they already have levels of memory cells available in the immune system. But after immunization you can see that there is a large increase in the amount of memory cells within only 7 days, mainly in that of the seasonal showing how important it is to have a vaccination every year.

**Conclusion**

In conclusion, we were able to build a model of antibody titers based on cell population alone to show whether or not individuals have a baseline immunity from a given virus before it is even known. From the data presented in this report, you can see that from the baseline of -7 or 0 days for both antibodies, effector cells and memory cells that most individuals already had a reserve of immune ready cells. This shows that before immunizations individuals most likely come prepared with some type of protection from a given virus. This can be important in the process of creating immunizations because we may be able to find a way to increase those number before the drop. This process also showed the importance of cellular immune memory and immunization. As there was an increase in effector cells and antibodies which are important for the current demand of protect but memory cells are important after that defense has died off. Immunization creates a strong foundation in immune memory which is vital for an organism that will most likely come in contact with the virus again. The organism will need that defense in order for it to be protect from the virus they may come in contact with in the near or distance future the body will be ready to fight the virus with much more ease and spend than the initial contact. Immunization is essential for both present and future protection.

**Appendix**

If animations are not working please visit this page <https://github.com/agilgeours/9750-Project.git>

In order to obtain more information about the data study please visit <https://www.immunespace.org/project/Studies/SDY80/>.

Attached is the R code used to create infographics and animations.