**A hand holding a syringe

Description automatically generated with medium confidence**

TOPIC: Data analytics on Covid 19- A novel machine learning classification model to predict important features in efficacy of Covid-19 vaccine in different pe as well as identifying the factors responsible for the survival of patients post vaccination.

*Submitted as Master Dissertation in SIT723*

**Jasdeep Kaur**

STUDENT ID: 220181376  
COURSE: Master’s in information & Technology Professional (S779)

*Supervised by: Dr. Sasan Adibi*

Contents

[Introduction: 1](#_Toc81666886)

[References: 3](#_Toc81666887)

# Introduction:

Started in December 2019, pathogenic outbreak severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has continued to spread around the world now causing 4.46 million deaths across the globe. Occurred in Wuhan City, Hubei Province, China, viral Covid-19 has caused the worst pandemic in the age of globalization leaving society to cope with unprecedented threats and challenges. Aided by vaccination, countries have been trying to quench the virus impact by acquiring immunity through vaccines. While novel covid-19 vaccines have been contributing to the declining graph of mortality, various adverse reactions have been encountered causing potentials risks ultimately leading to vaccine hesitancy (Blumenthal et al. 2021). Wedlund and Kvedar (2021) discussed uninfected people will take the most benefit from the vaccine without getting severe symptoms, on the other hand Ahamad et al. (2021) tried to relate acute reactions from vaccine with patients prior illnesses. Tissot et al. (2021) studied patients with Covid 19 history having at least one adverse reaction to the vaccine. Consequently, a great deal of research has been focussed on understanding allergic reactions on different classes of people obtained from covid vaccines.

Due to limited amount data of vaccinated people, this area has been explored until recently and most of the literature has focussed on possible vaccine treatments for covid mitigation. This study will discuss the relationship between vaccine and reported events by looking at substantial variation of adverse reactions on different classes of people in United States. The aim is to understand the extent to which the data analysis enables us to understand which vaccine will be most effective along with predicting the important features or attributes suitable for deciding the efficacy of vaccines on different people. The mortality rate will also be studied across each state in the US and a machine learning model will be devised to predict life threatening symptoms against three different vaccines. This study will be followed by Deep learning and machine learning algorithms to stimulate association between adverse reactions and efficacy of covid vaccines.

Hatmal et al. (2021) suggests machine learning can be an effective tool to predict the severity of side effects of covid vaccines by analysing the adverse reactions. This research has been carried out in Jordan however, to further appreciate the study, we must investigate, in detail, the different methodologies which can be a crucial in predicting efficacy of vaccines.

Whilst researchers have been trying to perform a comprehensive review of these unparalleled initiatives of combating with the deadly virus. However, there are still many uncertainties looming around the efficiency of the vaccines and their side effects. Therefore, predicting life threatening symptoms after vaccination could be beneficial in reducing patient risk and reliability towards vaccine treatments.

While the above studies discuss statistical strategies through a set of classification machine learning algorithms to discuss the negative outcomes of the vaccine. The limitation lies with the precarious nature of the virus and effectual protection through covid vaccines. Hence, further investigation needs to be exercised on data from other countries to explore the possibilities of reducing the risk of poor outcomes.

Most research involves machine learning to understand and predict the implicit impact of vaccine on people around the world Ong et al. (2020), Brooks et al. (2021). Deep learning has been found effective in prediction as well as mitigation of covid vaccine threats (Chen et al. 2021).

After searching some electronic databases like (Google scholar, PubMed, Science direct), descriptive studies were reported on prediction accuracy of covid- 19 analysis by applying Long short-term memory deep neural network (Shahid et al. 2020). It may therefore be advantageous to incorporate LSTM techniques along with KNN classification algorithm in the prediction to better understand the attributes responsible in deciding which vaccine will be most effective in different people.

# References:

Ahamad MM, Aktar S, Uddin MJ, Rashed-Al-Mahfuz M, Azad AKM, Uddin S, Alyami SA, Sarker IH, Liò P, Quinn JMW and Moni MA (2021) 'Adverse effects of COVID-19 vaccination: machine learning and statistical approach to identify and classify incidences of morbidity and post-vaccination reactogenicity', *medRxiv*:2021.2004.2016.21255618, <https://doi.org/10.1101/2021.04.16.21255618>

Blumenthal KG, Robinson LB, Camargo CA, Jr, Shenoy ES, Banerji A, Landman AB and Wickner P (2021) 'Acute Allergic Reactions to mRNA COVID-19 Vaccines', *JAMA*, 325(15):1562-1565, <https://doi.org/10.1001/jama.2021.3976>

Brooks NA, Puri A, Garg S, Nag S, Corbo J, Turabi AE, Kaka N, Zemmel RW, Hegarty PK and Kamat AM (2021) 'The association of Coronavirus Disease-19 mortality and prior bacille Calmette-Guerin vaccination: a robust ecological analysis using unsupervised machine learning', *Scientific Reports*, 11(1):774, <https://doi.org/10.1038/s41598-020-80787-z>

Chen J, Gao K, Wang R and Wei G-W (2021) 'Prediction and mitigation of mutation threats to COVID-19 vaccines and antibody therapies', *Chemical science*, 12(20):6929-6948.

Hatmal MmM, Al-Hatamleh MAI, Olaimat AN, Hatmal M, Alhaj-Qasem DM, Olaimat TM and Mohamud R (2021) 'Side Effects and Perceptions Following COVID-19 Vaccination in Jordan: A Randomized, Cross-Sectional Study Implementing Machine Learning for Predicting Severity of Side Effects', *Vaccines*, 9(6), <https://doi.org/10.3390/vaccines9060556>

Ong E, Wong MU, Huffman A and He Y (2020) 'COVID-19 Coronavirus Vaccine Design Using Reverse Vaccinology and Machine Learning', *Frontiers in Immunology*, 11(1581), <https://doi.org/10.3389/fimmu.2020.01581>

Shahid F, Zameer A and Muneeb M (2020) 'Predictions for COVID-19 with deep learning models of LSTM, GRU and Bi-LSTM', *Chaos, Solitons & Fractals*, 140:110212.

Tissot N, Brunel A-S, Bozon F, Rosolen B, Chirouze C and Bouiller K (2021) 'Patients with history of covid-19 had more side effects after the first dose of covid-19 vaccine', *Vaccine*, 39(36):5087-5090, <https://doi.org/https://doi.org/10.1016/j.vaccine.2021.07.047>

Wedlund L and Kvedar J (2021) 'New machine learning model predicts who may benefit most from COVID-19 vaccination', *npj Digital Medicine*, 4(1):59, <https://doi.org/10.1038/s41746-021-00425-4>