Vaccination Impact: Modeling Infections, Hospitalization, and Mortality

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Motivation

Motivation i

The prevention of hospitalizations, deaths, and the spread of infections all depend on vaccination rates. By getting vaccinated, people safeguard not only themselves but also those in their immediate vicinity who could be more susceptible to illnesses.

The first COVID-19 vaccine was delivered outside of a clinical trial setting on Dec 8, 2020. By Dec 8, 2021, 55·9 percentage of the global population was estimated to have received at least one dose of a COVID-19 vaccine, 45·5 percentage estimated to have received two doses, and 4·3 percentage estimated to have received a booster dose.[2] Despite the incredible speed with which COVID-19 vaccines were developed in 2020 and subsequently distributed during 2021, more than 3·5 million deaths due to COVID-19 have been reported globally since the first vaccine was administered.[1][2]

Motivation ii

Disease modeling facilitates to analyze the impact of vaccination coverage on infections, hospitalizations, and mortality. We can assess disease transmission reductions, analyze the indirect effects of vaccination, and compare alternative vaccination techniques by modelling disease dynamics. Disease modeling improves evidence-based decision-making, directs resource allocation, and aids policymakers in understanding the cost-effectiveness of immunization programs. Finally, disease modeling is critical in developing effective techniques to limit the burden of infectious illnesses through vaccine programs.[3]

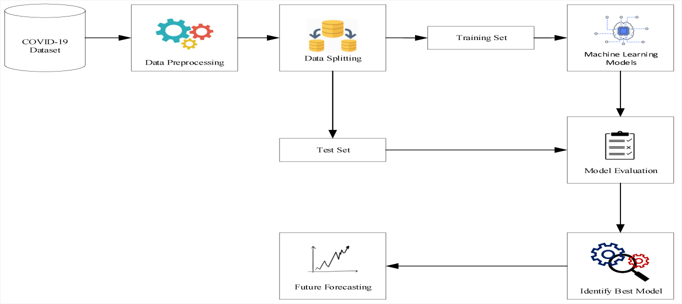
`Our project involves the implementation of a machine learning model to assess the impact of vaccination.`

Idea and Methodology

Idea

Developing a machine learning system to empirically examine the impact of vaccination on infections, hospitalizations and mortality of the COVID-19 pandemic might potentially improve vaccination strategy.[4]

Model and Programming language: The machine learning aspect of the project will involve the implementation of a regression algorithm, using the R programming language.



Modeling Process

Data Preprocessing and splitting: The project will utilize data from a specific population, including information on infection rates, hospitalization details, and mortality rates, both before and after vaccination. Additionally, it will consider various essential factors such as age, underlying health conditions, and susceptibility. The data will be divided into training, validation, and test sets to perform regression analysis.

Model Training: Using the training data, train the chosen machine learning model to discover the link between vaccination and infection, hospitalization and mortality outcomes.

Model Evaluation: Using validation data to assess the model's performance and evaluate how well it predicts outcomes depending on vaccination coverage.

Interpretation and Analysis: To acquire insights into the influence of vaccination on lowering infections, hospitalizations, and death, the trained model will get interpreted to identify influential

Expected Results

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o The model provides the percentage of infection, hospitalizations, and deaths that may be avoided with vaccination.

o The regression model identifies key factors that influence the impact of vaccination and the sensitivity analysis further validates the robustness of the findings.

Well, this is just a preliminary concept of our project, and we plan to expand and refine our approach through further research and model development.

References

References

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[4] Magazzino, C., Mele, M., Coccia, M. (2022). A machine learning algorithm to analyse the effects of vaccination on COVID-19 mortality. Epidemiology Infection, 150, E168.

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Unraveling the Patterns, Predicting the Future: Disease Modeling at its Best!