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## Compartmental Modelling for Optimal Control Strategy during Covid – 19

Simple Goyal<sup>1</sup>, Daljeet Kaur<sup>1</sup>, Madhuchanda Rakshit<sup>1</sup> and Vinod Kumar<sup>2</sup>  
Guru Kashi University, Talwandi Sabo, Bathinda, Punjab,  
India.

<sup>2</sup>Department of Mathematics, NIET, NIMS University, Jaipur, Rajasthan, India.

### Abstract

This paper derives the impact of vaccination of coronavirus with direct and indirect protection.

Compartmental modelling has been done to understand vaccine recommendations on COVID-19 transmission. The model in the paper measures the basic reproduction number for optimal control strategy at disease free equilibrium point to study disease dynamics. Local and global stability has been carried out to study stability of the model. Numerical analysis show that vaccination has reduced incident, mortality and severity of COVID-19.

**Keywords:** Compartmental Model, Basic Reproduction Number, Local Stability Analysis, Global Stability Analysis, Optimal Control.

### 1. Introduction:

COVID-19 was declared as pandemic on 11<sup>th</sup> March 2020 by WHO, creating a global economic and public health emergency. The virus may spread through respiratory droplets of infected individual when they cough or sneeze. Scientists and Doctors attempted to treat the infected people with previously developed drugs but failed to succeed. Control measures like isolation, social distancing, vaccination and masks are used to control the disease [1]. In the study of viral infections, vaccination is one of the successful control strategies to prevent the disease. Many emerging and re-emerging diseases have been combated with appropriate vaccines. Vaccination programs administer direct protection against viral infections by reducing the probability of vaccinated individuals to become infected. Indirect protection occurs by lowering the transmission rate for susceptible population and vaccinated individuals. In a classic SIR model vaccination class is included to check risk reduction of infection in susceptible population. Various vaccines like Pfizer-





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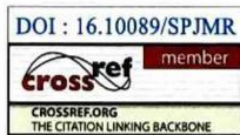
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