An SEIR model:

In the SEIR model we divide the total population N into 4 compartments S,E,I & R. Term S represents the susceptible individuals, E includes the latent phase of covid where the individual is infected but not infectious. I represent infected individuals and R represent the recovered individuals. In the below equation **β** represents how quickly susceptible population move to infectious and similarly controls how quickly infectious population move to recovery. Model includes the parameter **σ**. Threshold σ determines the outcome of the disease; if $\sigma \square 1$, the infected fraction of the population disappears so the disease dies out, while if $\sigma > 1$, the infected fraction persists and a unique endemic equilibrium state is shown, under a mild restriction on the parameters, to be globally asymptotically stable in the interior of the feasible region. i.e. N = S+E+I+R]. All four blocks can be modeled in by following equations

$$\frac{dS}{dT} = -\beta SI$$

$$\frac{dE}{dT} = \beta SI - \sigma E$$

$$\frac{dI}{dT} = \sigma E - \gamma I$$

$$\frac{dR}{dT} = \gamma I$$

Latency in the disease (delayed start of the individual's disease) is a parameter controlling this delay in the model. Inclusion of laten**γ**cy period in SEIR does not influence the Reproductive no (R0).

Parameter optimization:

We optimized parameters such as **β** (contact rate), **γ**(recovery rate) in order to fit the SEIR model. The optimization (limited-memory quasi-Newton code for bound-constrained optimization **[L-BFGS-B]**) was carried by minimizing the squared error between actual and predicted counts. Optimized parameters we then used to compute the R-nought (Reproductive number) as the ratio of **β** and **γ**.

$$R_0 = \frac{\beta}{\gamma}$$

Parameter name	Value	Remark
Susceptible	State-wise population	-
Incubation period	5 days	Average time taken to show symptoms
Recovery Time	8-32 days	Time taken to recover

Supplementary Table1: Details of Parameter in SEIR model

Modified SEIR pipeline:

The traditional SEIR pipeline was modified to serve as a basis for the gym environment we built using OpenAI. It was done to account for the effect of the vaccine on the Susceptible population. A vaccine would be responsible for a decrease in the Susceptible count and would act like a short circuit, transferring vaccinated people straight to the Recovered compartment i.e. it would immunise people against future infection without taking them through the phase of infection.
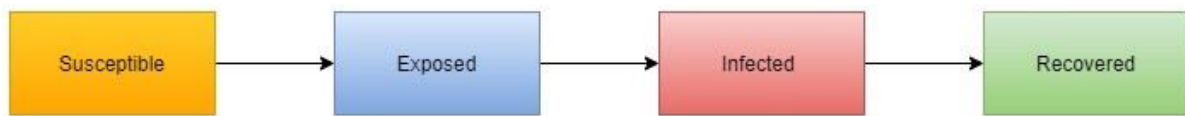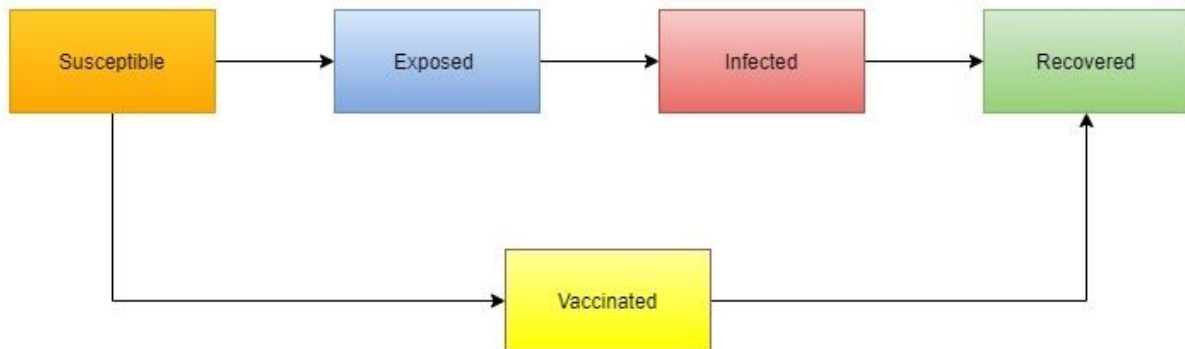
Fig : Original SEIR Model pipeline

Fig : Modified SEIR Model pipeline