COVID-19 IN THE UNITED STATES

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The covid-19 model is represented by a system of ordinary differential equations shown here 1.

$$
\begin{aligned}
\frac{dG}{dt} &= \Lambda - \beta_1 \frac{N}{O} G - \mu G \\
\frac{dS}{dt} &= \beta_1 \frac{N}{O} G - \beta_2 \frac{(E + kC)}{N} S - \mu S \\
\frac{dE}{dt} &= \beta_2 \frac{(E + kC)}{N} S - \gamma E - \mu E \\
\frac{dC}{dt} &= \gamma E - \theta_C C - \mu C \\
\frac{dR}{dt} &= \theta_C C - \mu R
\end{aligned} \tag{1}
$$

where:

$$
\begin{aligned}
N &= S + E + C + R \\
O &= G + N
\end{aligned}
$$

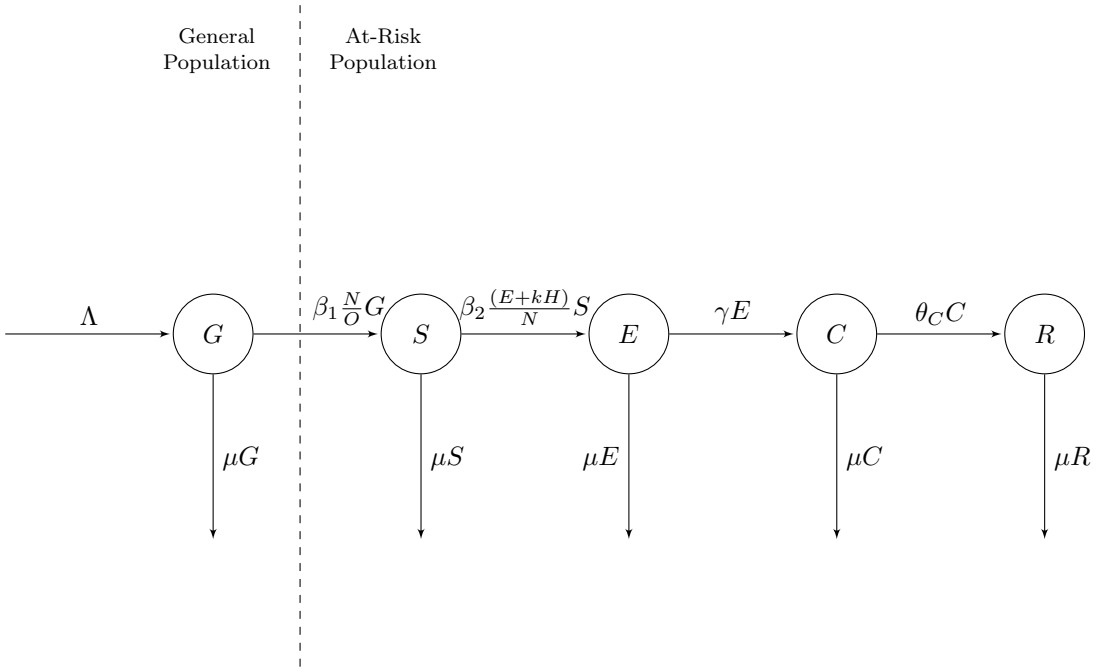

Figure 1. COVID-19 Model

Variables	**Description**	**Initial Value**[a]	**Source**
G	General Population of US	330,511,531	[?]
S	susceptible	79,834,735	[?] [?]
E	Expected population of individuals infected with virus	20,000	derived
C	Confirmed cases of Coronavirus	100,000	derived
R	Recovered	100	est
N	at-risk population	79,834,735	derived
O	total population	330,511,531	derived
Parameter	**Description**	**Values & Units** [b]	**Source**
Λ	birth rate	435,722 people per year	[?]
μ	mortality rate	$\mathcal{U}[0.012, 0.013]$ [c] per person per year	[?]
ψ	release rate	$\mathcal{U}[0.124, 0.164]$ [c] per person per year	[?]
γ	rehab admissions rate	$\mathcal{E}(0.304)$ [d] per person per year	[?]
θ_H	quitting rate (due to rehab success)	0.33 per person per year	[?]
η	relapse rate	0.1894 per person per year	[?]
β_1	growth factors of at-risk population	0.245 dimensionless	[?]
θ_U	quitting rate (on their own)	$\mathcal{U}[0, 0.33]$ [c] per person per year	est
p	proportion released that successfully quit	$\mathcal{U}[0.8, 0.9]$ [c] dimensionless	est
k	reduction in transmission intensity of H	$\mathcal{U}[0, 1]$ [c] dimensionless	est
β_2	transmission intensity rate	$\mathcal{N}(\mu = 0.75, \sigma = 0.47)$ [e] interactions per person per year	[?]

TABLE 1. Brief Summary of State Variables & Parameters

[a] total count

[b] 1 time unit = 1 year

[c] parameter sampled from the Uniform distribution in the given range

[d] parameter sampled from the Exponential distribution with the given rate parameter

[e] parameter sampled from the Normal distribution with the given mean and standard deviation