Mapping interventions to model terms

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The exercise

We have been reading and learning about "compartment" epidemic models (i.e., the S[E]IR-type models), but they can seem a bit abstract. So let's try to make things a bit more concrete.

I will posit that any intervention we might want to make to minimize or prevent an epidemic can be mapped on to a term describing the gains and losses of infections in a population. Here is that equation, which is really the heart of the model, with all of the terms expanded:

$$\frac{dI}{dt} = c(N)\frac{I}{N}\pi S - \phi\gamma I - (1-\phi)\gamma I$$

Recall the meaning of the terms:

- $c(N)$ is the contact rate between individuals, which may be some function of host number or density (N)
- I/N is the proportion of (randomly made) contacts that are with infectious individuals, which is the number or density of infected individuals (I) out of the whole population (N)
- π is the probability one of those contacts with an infectious individual leads to transmission
- S is the number or density of susceptibles making all of these potentially infectious contacts
- γ is the rate at which infections end, and so $1/\gamma$ is the average length of the infectious period
- ϕ is the proportion of infected hosts that die, and so $1-\phi$ is the proportion that survive and recover

These are the interventions I would like you to consider:

- Vaccination with an immunizing vaccine
- Vaccination with a vaccine that reduces severity of disease, but does not prevent infections and only reduces infectiousness a bit
- Contact tracing & quarantining those who had potentially infectious contacts
- Isolating[1] those testing positive for infection
- Social distancing (i.e., reducing close contacts)
- Mask wearing (i.e., reducing the amount of airborne pathogen particles exhaled by an infected or inhaled by a susceptible, or the distance those particles move)
- Providing convalescent serum to those with severe cases
- Providing Tamiful to those testing positive
- Hand washing

[1] Yes, isolation is for those known to be infected, quarantine is for those who might *become* infected

For each of these interventions I would like you to determine which term(s) it is working on.

$$\frac{dI}{dt} = c(N)\frac{I}{N}\pi S - \phi\gamma I - (1-\phi)\gamma I$$

Which are the purview of doctors vs. public health officials? Are there other patterns or ways to group interventions?