Impact of Cocooning vs. Social Distancing (although note that cocooning is essentially social distancing targeted at a small vulnerable group)

Simple SEIR model with 2 groups: N = 64m and V = 2m. N are general population and V are vulnerable group. General population mix equally (betaN) and the vulnerable group have a slightly lower mixing within and between (betaV). Latent period 3d and infectious period 5d. Two control variables pi and sigma, which respectively are the impact of social distancing (SD) in general population and vulnerable population.
Mixing matrix:
[pi*betaN, min(sigma,pi)*betaV; min(sigma,pi)*betaV, min(sigma,pi)*betaV]

Just considering the impact of sigma and pi separately on the epidemic in the vulnerable group.

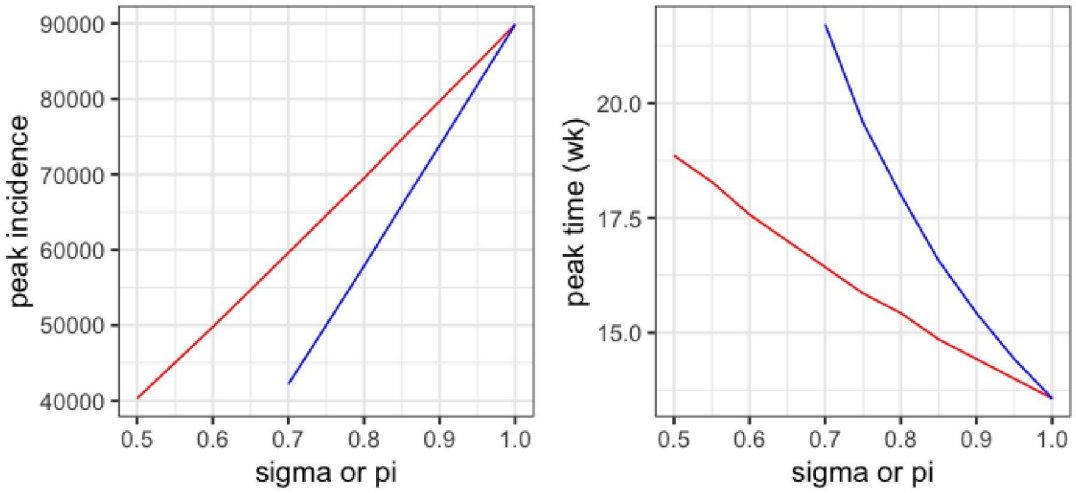

Figure 1. Plots of epidemic outcomes in the vulnerable population with varying SD in the general population (blue) and vulnerable population (red). The peak daily incidence (left) is reduced and peak time (right) is increased with more SD. Sigma=1 and pi=1 are no SD.

SD in the general population is more effective. Reducing the incidence in the vulnerable population by half is achieved at pi=0.72 or sigma=0.55. Similarly for the timing of the peak. The general population is much bigger and drives the epidemic.

Policy implications

- SD can have major impact, reducing incidence by ½ and shifting peak by several weeks
- Achieving the same outcome in the most vulnerable population requires less SD in the general population (it might be easier to achieve) but the economic/psychological/educational l impact will be much smaller.

Additional questions/issues:

- The mixing assumptions are data-free. A more detailed consideration will require inclusion of demography of older people (e.g. the number and size of HH, and

number and size of care facilities) to understand both the role that they play in transmission and their risk of infection.

- Some disease will arise in the general population so the impact should be a weighted mean of epidemics in the two groups.
- More groups could be added (but the mixing assumptions might prevent it practically)
- The cocooning (sigma) can be achieved by both a reduction in the number of people who contact, and the type of contact (including the use of PPE). It's not clear whether these two are equal (i.e. is halving the number of people equal to the halving the probability of transmission at each contact – might be worth considering a simple probability model to see which of these is more important.