Policy Response to Pandemic Influenza:

The Value of Collective Action

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Research questions

- In a world in which rich countries have stockpiles of anti-virals (AVs) sufficient to treat 10% (or more) of their populations
    - What are the benefits of rich countries donating 10% of their stocks to the outbreak country?
    - What are the benefits of rich countries providing AV stockpiles to many poor countries (either out of their own stockpiles or by expanding world AV stockpiles)?
    - Are the benefits of these actions to rich countries sufficient to justify the actions—or must they be motivated by altruism?

Answers depend on

- Infectiousness of the flu
  - R(0) = number of persons an infectious person can infect in a totally susceptible population
  - For seasonal flu: $1.3 \leq R(0) \leq 3.0$
  - Any AV control strategy will be more successful the lower is R(0)
- When and where the flu begins
  - Flu is much milder world-wide if it peaks during N. Hemisphere summer
  - AV controls more effective for a flu peaking the N. Hemisphere summer
- Nature of anti-viral administration
  - Percent of symptomatic infectious persons treated (50%? 70%?)
  - Whether treated on first day or second day of symptoms

Consider this scenario

- Flu starts in Indonesia on January 1; R(0) = 1.9
- Anti-viral stockpiles are:
  - 10% of population in countries with > $20,000 per capita GDP
  - 5% of population in countries with $10,000 - $20,000 GDP per capita
  - 1% of population in countries with $3,000 - $10,000 GDP per capita
  - Zero for the poorest countries
- 60% of symptomatic infectious are treated on second day of infectiousness
- Program begins in each country after 1,000 cases detected
- At end of year one:
  - World gross attack rate = 40%
  - Rich country gross attack rate = 27%

What are the benefits of cooperation?

- Rich countries donate 10% of their stockpiles to Indonesia after 1,000 cases detected
  - 9.15 million AV doses
- World GAR declines by 0.70% (45 million cases) by end of year one
- Rich country GAR declines by 0.73% (6.7 million cases)
- Does this pay for itself? Yes!
  - Assuming each avoided case is worth (9.15/6.7) times the cost of a dose

How robust are these results?

- With an R(0) = 1.6, donation saves more cases worldwide (105 million)
  - Reduction in cases in rich countries = 6.1 million (still pays!)
- But, with a July 1 start date, the selfish motive is weaker
  - Donation saves < 1.7 million cases in rich countries
- When rich countries have stockpiles = 20% of population
  - 10% donation strategy is even less effective in number of cases it reduces in rich countries
  - In spite of the fact that more AVs are donated

Closing questions and comments

- Benefits to donors of sending AV doses to outbreak country are small but may pay for themselves
- Will distributing a greater number of AVs doses to poor countries be more effective?
- Previous results in the literature suggest large benefits of stockpile donations of the magnitudes examined here
  - These results depend on rapid delivery of AVs to 70% of symptomatic infectious on day 1 of infection
  - Program begins three days after first case detected in each country