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# The Value of Pandemic Preparedness

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# Outline

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- Estimate
  - the frequency and costs of previous pandemics
  - expected losses from future pandemics (\$800bn a year, \$130bn for EU)
  - value of investments that reduce severity of next pandemic
- Different ways to incentivize innovation to prevent pandemics

# Estimating frequency and severity of pandemics (Marani et al 2021)

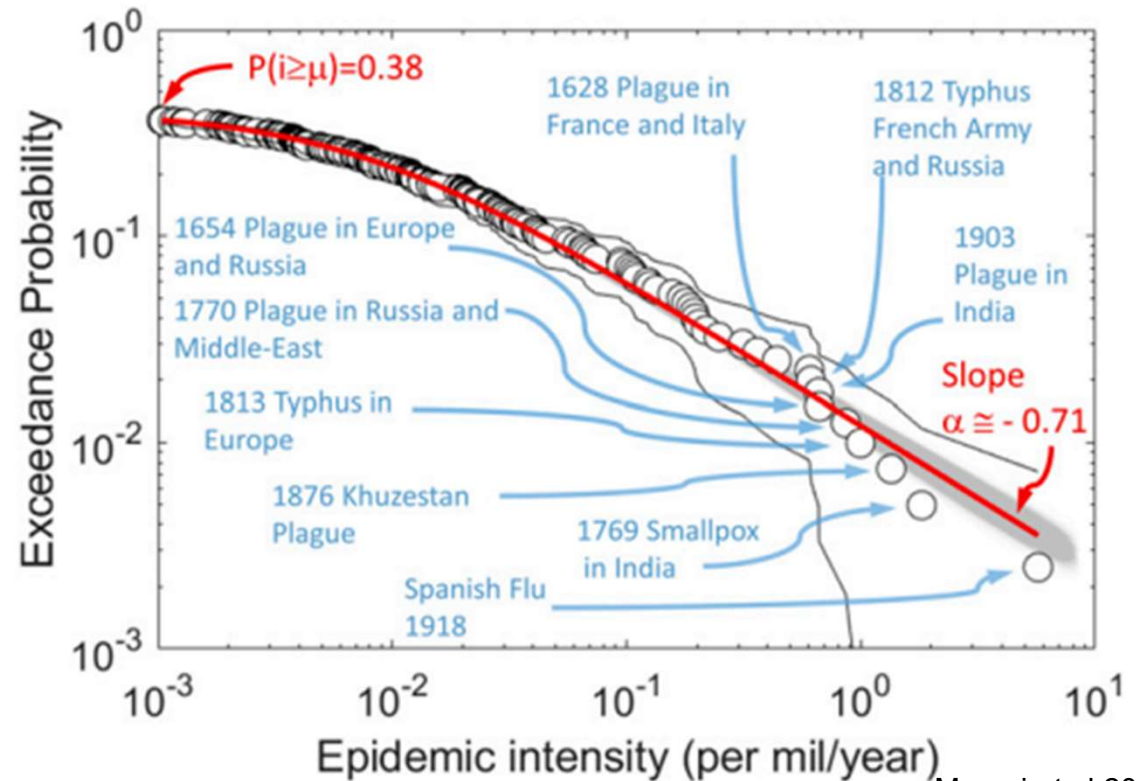
Challenge in estimating frequency and severity of future pandemics:

- Need long time horizon as infrequent
- But frequencies change (eg antibiotics)

Marani et al use data from 1600 and find a stable relationship between smaller and larger epidemics

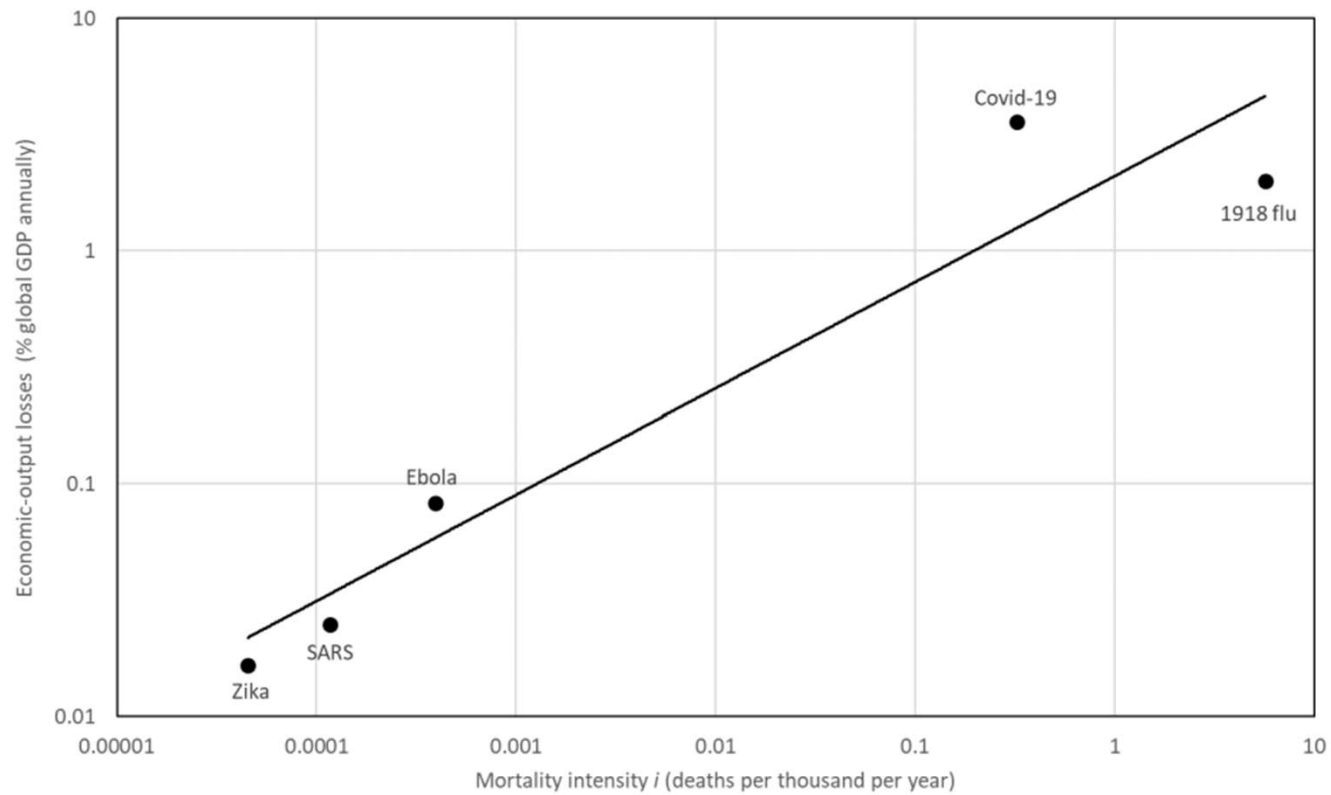
Then use data from last 20 years to estimate current frequency and severity

We build on this approach.



Marani et al 2021

**Figure 1.** Relationship Between Epidemic Intensity Economic Losses in Historical Pandemics.



Notes: Data points from Table 1. Regression line given by equation (6). Log scales used for both axes.

Scenario	Expected annual pandemic losses (billion dollars)			
	Mortality $AV(\overline{ML})$	Economic output $AV(\overline{OL})$	Learning $AV(\overline{LL})$	Total $AV(\overline{TL})$
Baseline	505	176	127	808
Half probability of pandemic arrival	252	88	64	404
Truncating intensity distribution				
• Double upper truncation	633	180	130	944
• Remove upper truncation	1812	193	140	2144
Add HIV to epidemic frequency data	1327	450	326	2103
YLL per death				
• Reduce to 20	344	176	127	646
• Increase to 40	687	176	127	990

# Value to accelerated response to pandemics

## Covid-19

- IMF estimated \$1-\$1.4 trillion loss of GDP per month,
- Jan 2021, capacity to produce one vaccine a year worth \$5,800 (Castillo et al 2021), price \$6-\$40
- \$13bn Operation Warp Speed paid for itself if accelerated widespread US vaccination by 12 hours
- But took 2 years from vaccine approval to enough supply to vaccinate 70% world population

## Implication

- Investment now that would speed up widespread protection against worst effects of future pandemic would generate high returns
- Social pressure to keep prices down in pandemic reduces private sector investment, requires government support

Costs and benefits of program to undertake vaccination campaign in next significant pandemic (billion \$)			
	With advance investment	Without advance investment	Difference
<b>Current value of expenditures</b>			
• Initial advance investment	60	0	60
• Annual maintenance of advance capacity	5	0	5
• Additional expenditures in pandemic	22	53	-32
<b>Present value of program outcomes</b>			
• Expected program costs (net of rental income)	48	21	27
• Expected gross benefits	636	199	437
• Expected net benefits	587	178	409

For EU cost and benefits, multiply by 0.16.

# Ways to incentivize broad spectrum antivirals

- Fund particular research teams (push)
  - Assumes you know who is most likely to succeed
  - Does not incentivize large production
  - Good for early-stage research (if given to multiple groups), not for production
- Advance market commitment
  - Commit to buy a large (prespecified) quantity at prespecified price if meets technical requirements
  - Open to whoever develops the best product fastest
  - Incentivizes large scale production (market incentives are to produce small quantities)