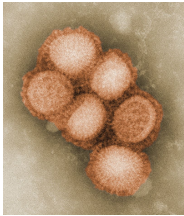


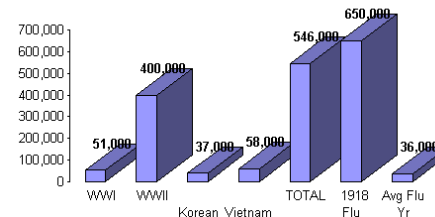
Influenza- 1918-2018. Are we ready for another pandemic?



Christopher Whitty
Foundation for Science and Technology 2018

1918-20 H1N1 influenza pandemic ('Spanish flu') probably killed 50-100 million people globally. Seasonal 'flu can cause 250-500,000 deaths (WHO).

US Deaths 20th Century - Flu and War



In planning for any infectious epidemic we need to consider:

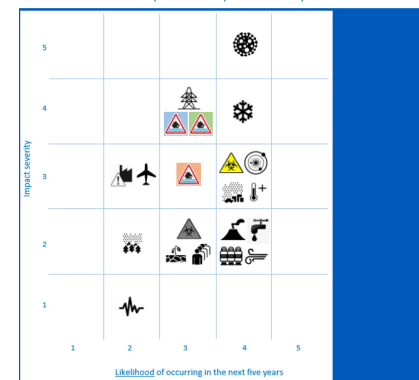
- Speed of spread.
- Mortality/virulence.
- Force of transmission (R).
- Geographical limits.
- Public health countermeasures.
- Medical countermeasures: transmission.
- Medical countermeasures: mortality.
- Workforce protection.
- Societal impact.
- Behavioural science, communications and panic.
- Recovery.



3

There is a reason pandemic influenza remains the highest risk on the UK National Risk Register.

Matrix A - Hazards, diseases, accidents, and societal risks



KEY

Natural hazards

Coastal flooding

River flooding

Diseases

Pandemic influenza

Emerging infectious disease

- Airborne disease.
- The speed of an influenza pandemic is rapid.
- High proportions of the population would be affected.
- The last pandemic we had (2009) relatively low virulence, but could be much higher.
- Main risk influenza A (B, C and D exist).

4

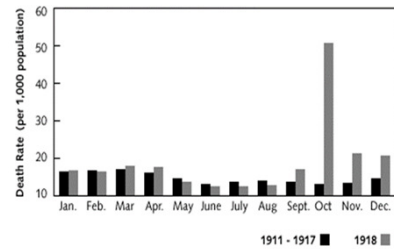
Influenza pandemics can be very sudden and spread rapidly: H1N1 1918, US data.

Spread of the epidemic.



before sept. 14 | between sept. 14 - 21 | between sept. 21 - 28 | between sept. 28 - oct. 5 | after oct. 5
 Source: America's Forgotten Pandemic - The Influenza of 1918 - 1989

Death rate/1,000 population



5

It is easy to make a case we are increasingly vulnerable to 'flu pandemics. This is wrong- but we do remain vulnerable.

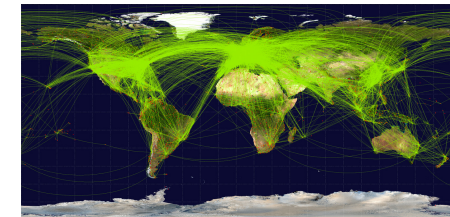
Non-specific hardening of richer societies against epidemics include:

Agriculture

- Better nutrition

Engineering

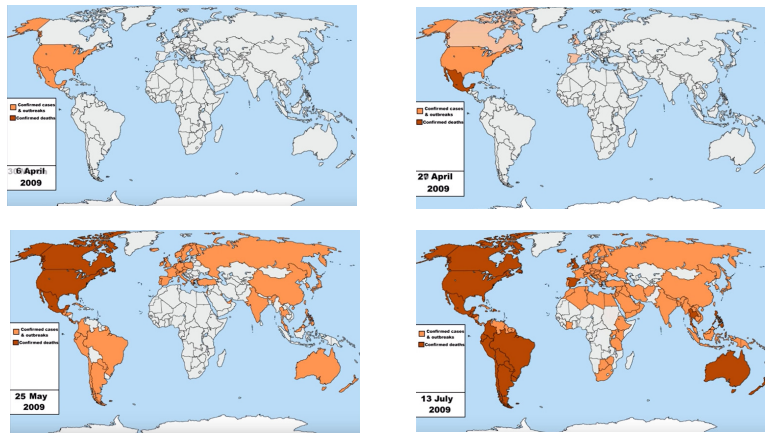
- Better housing
- Clean plentiful water
- Cleaner heating



Flights data- Openflights

6

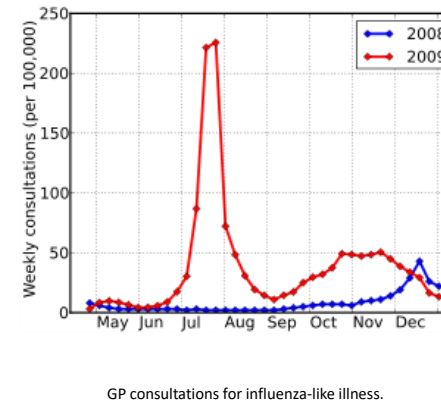
H1N1 2009 pandemic 2009-10. 43-89 million cases, 8-18 thousand deaths (CDC). April-July.



Mark Honigsbaum

7

The peak of reports of 'flu, 2009 in the UK.



GP consultations for influenza-like illness.

- Officially 457 deaths.
- Two/three waves.
- Vaccine available, but well after the main peak.
- Pandemics not restricted to 'flu season'.

8

	Low mortality	High mortality
High transmission	<p>2009 Swine 'flu (H1N1). 0.3% mortality. 10-200 million cases.</p>	<p>1918 'Spanish' 'flu (H1N1). Around 3% mortality.</p>
Low transmission	<p>Not worth worrying about.</p>	<p>2013-18 (H7N9) avian 'flu. 30% mortality. <2000 confirmed cases.</p>

9

Societal impact depends on who is affected; particular groups, occupations or agegroups.

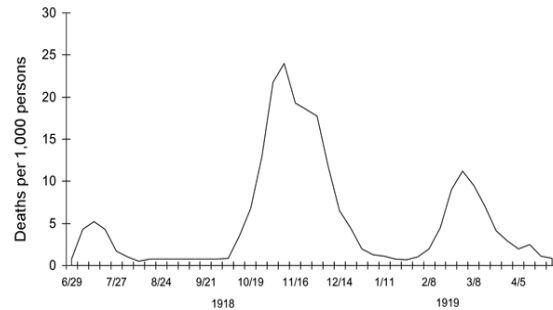
- No particular occupation (although healthcare workers likely to get it early).
- Generally influenza mortality concentrated at the extremes of life, pregnant women and the chronically unwell.
- The 1918 pandemic had a major peak in young adults.

1918 H1N1 influenza and age (CDC).

10

The first wave is not always the most serious.
1918 pandemic, UK data.

- A vaccine may come to our rescue.
- But we should not bank on it.



11

Ever since Jenner, the assumption is get a vaccine....

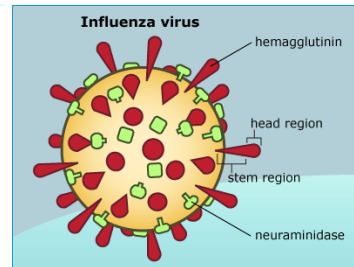
- Not all epidemics are amenable to a vaccine countermeasure- eg HIV. Influenza usually is.
- Influenza pandemic lead time currently 4 months- at least.
- Influenza vaccine efficacy varies for seasonal 'flu.
- Pan-flu vaccine probably is possible- but not imminent.



12

Current and possible vaccines.

- Current vaccines mainly produce antibodies to hemagglutinin head (protein).
- Rapid antigenic drift.
- Hemagglutinin stem and neuraminidase examples of more slowly-evolving targets.
- Pan-flu vaccine has been a target for some time...
- Move from egg-based to cell-based production. Faster.



13

Antiviral drugs for influenza. May reduce severity and duration of symptoms.

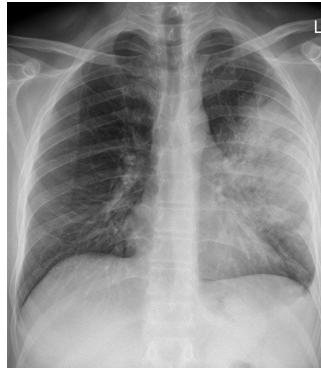
- Examples: Oseltamivir (Tamiflu®), zanamivir (neuraminidase inhibitors). Amantadine and rimantadine (Baloxivir/Faviparivir).
- It taken early may reduce severity, duration.
- Size of effect may be modest.
- Efficacy unknown in a pandemic.
- Resistance can occur early.
- Controversy in the 2009 pandemic.



14

A high proportion of deaths (probably most) in 1918 were secondary bacterial pneumonia.

- Typical and atypical bacteria.
- Antibiotics were not available in 1918-19.
- There will be a global demand...



15

Supportive treatment- in a pandemic may not be substantially better than 1918.

- Basic nursing care remains important. Does not need nurses.
- Oxygen may be available for some.
- Intensive care units will quickly be overwhelmed.



J van Rosmalen

16

We can put the building blocks in place for a pandemic influenza response.

No plan survives contact with the enemy...

- Mathematical models to predict global and national course from early data.
- Global virus identification network.
- Pre-decide which bits of the health system to turn off.
- Optimise vaccine production- but 4 months shortest current lead time.
- Antiviral and antibiotic stockpile.
- Communication.
- Minimise societal impact.



CDC, wiki