Reimagining the 1918 pandemic

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Agenda

1. Influenza Characteristics
2. The 1918 Pandemic
3. Reimagining the 1918 Pandemic
Influenza Characteristics
Types of Influenza

- **Type A**
  - Zoonotic
  - Drifts frequently
  - Shifts cause pandemics
  - Group 1 & Group 2 strains

- **Type B** – Human-to-Human & Seals; Not associated with pandemics

- **Type C** – Humans & Pigs; Not associated with pandemics
Two phylogenetic groups of influenza

... e.g. H1N1
Contagion characteristics of an influenza virus

- Human-to-human contact
- Virus attaches to upper respiratory tract
- Social Network is crucial for determining contagion
Shifts Cause Pandemics

Antigenic Shift

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Most recent influenza pandemics

- 1918: Spanish Flu (H1N1)
- 1957: Asian Flu (H2N2)
- 1968: Swine Flu (H1N1)
- 2009: Pandemic (H1N1)

Timeline:
- H2N8 (Russian Flu)
- H3N8 (Swine Flu)
- H3N2 (Hong Kong Flu)

Dates:
- 1875, 1889, 1918, 1957, 1968, 2009

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The 1918 Spanish Influenza – What happened?
The influenza pandemic of 1918 to 1919 is the deadliest in modern history.

~1/3 of world infected
~50 million deaths

High excess mortality in young people
Origin

• The 1918 influenza pandemic is mistakenly called ‘The Spanish Flu’

• In late 1917, a virulent respiratory disease of unknown origins erupted in the interior of northern China

• China mobilized 95,000 labourers from to support the war effort
Demographic response – Excess Mortality

Influenza & Pneumonia mortality in the US, 1911 - 1918

Excess mortality per 100,000

Age (y)

<1 1-4 5-14 15-24 25-34 35-44 45-54 55-64 65-74 75-84 ≥85

From Taubenberger & Morens (2006): 1918
Influenza: the Mother of All Pandemics
Antigenic imprinting

- Child imprints on the HA group of their first flu exposure
- Reduced risk of severe disease from flu strains within that same phylogenetic group
- More vulnerable to other HA group strains
Antigenic imprinting: 1918 Pandemic
Antigenic Imprinting: 2009 “Swine-Flu”

- 151,700 – 575,400 respiratory pandemic deaths Globally

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Antigenic Imprinting: 2009 “Swine-Flu”

2009 Pandemic age shift
Pneumonia mortality in Mexico

% of April pneumonia deaths

Younger adults die

Elderly spared


Chowell et al, NEJM, August 2009
Antigenic imprinting: “Bird-Flu” Epidemic

Time line of influenza HA antigen circulation

Calendar year

1900  1950  2000  2016

1918  1968  1977

Group 1 HA antigens
Group 2 HA antigens

Level of immunity against group 1
(including bird flu H5)

Birth year

1900  1950  2000  2016

1918  1968  1977

H5 cases

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Viboud and Epstein, 2016: First Flu is Forever
Antigenic imprinting: “Bird-Flu” Epidemic

Time line of influenza HA antigen circulation

Calendar year

1900 1950 2000 2016

1918 1968 1977

Group 1 HA antigens
Group 2 HA antigens

Level of immunity against group 2 (including bird flu H7)

Birth year

1900 1950 2000 2016

1918 1968 1977

H7 cases
Reimagining the 1918 pandemic
Scenario Structure

- **Transmissibility** = 2
- **Lethality** = 2.5%
- Assume vaccine available after 6 months
- Assume ineffective Pharmaceuticals
Demographic profile

Example Life Insurance Portfolio
(1 million lives)

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Results

1918 Pandemic Scenario in 2018

Born after 1968

Born before 1968

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Results

- Most exposures were born after 1968. Vulnerable to group 1

Variability of Experience due to Influenza group

+50% more deaths

2018 Group 2  2018 Group 1
Conclusions

- Cohort effects exist and can change over time depending on circulating flu strains at birth

- Most life insurers will be more vulnerable to Group 1, e.g. H1, H2, H5, H6
Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.