Reimagining the 1918 pandemic

Ashley Campbell
RMS LifeRisks

November 2018

Agenda

1. Influenza Characteristics

2. The 1918 Pandemic

3. Reimagining the 1918 Pandemic

Influenza Characteristics

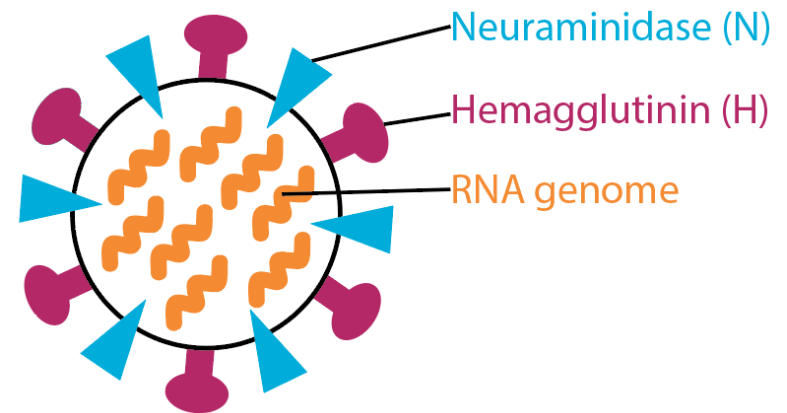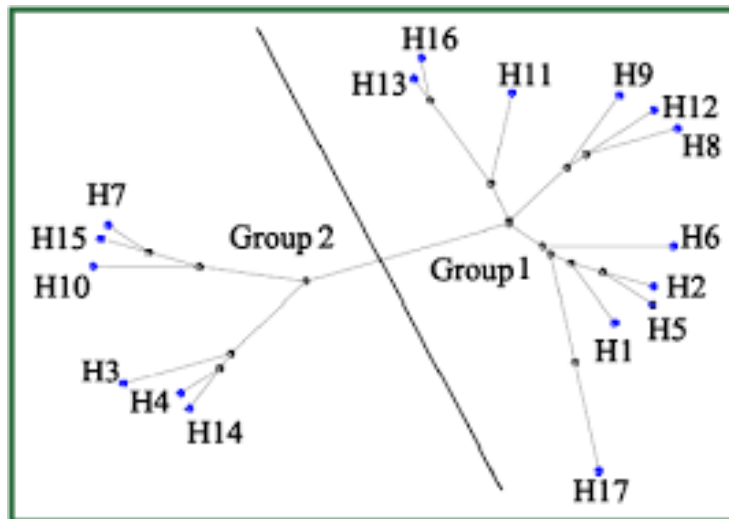# Types of Influenza

- **Type A**
  - Zoonotic
  - Drifts frequently
  - Shifts cause pandemics
  - <u>Group 1</u> & <u>Group 2</u> strains
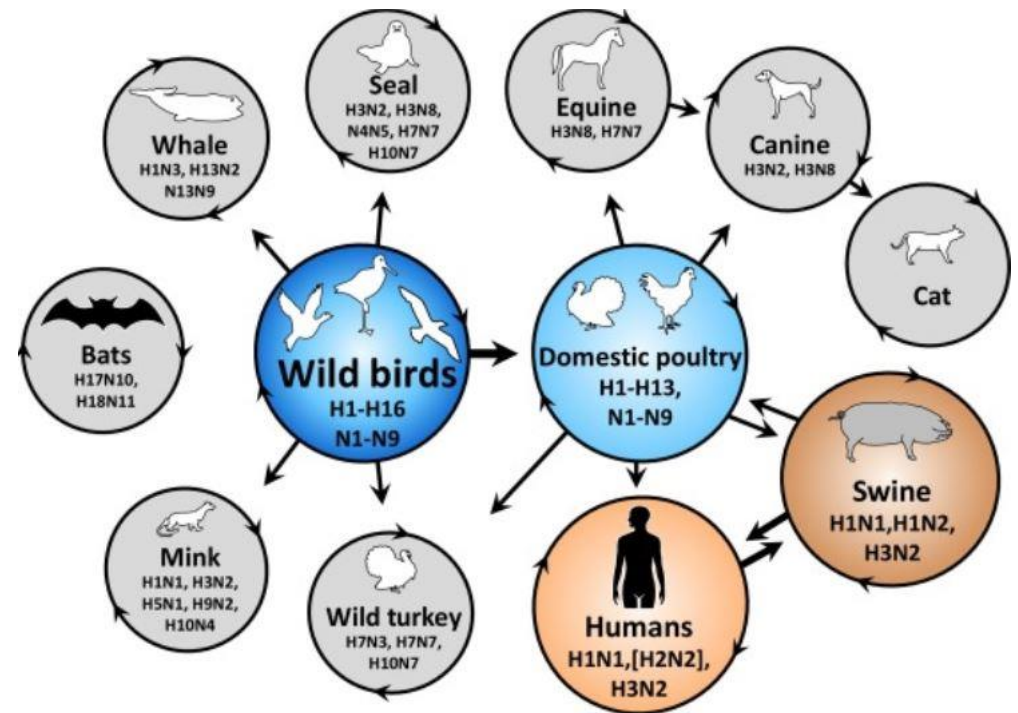
- Type B – Human-to-Human & Seals; Not associated with pandemics

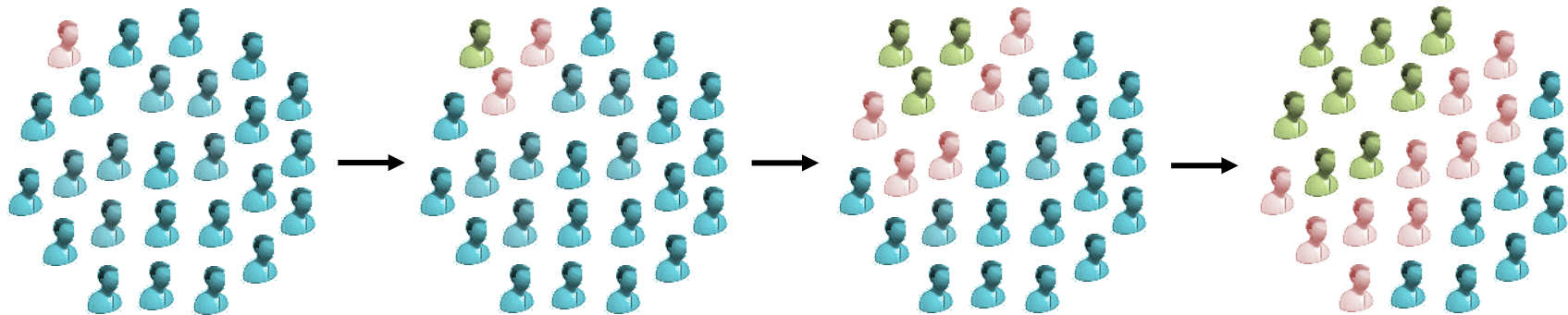- Type C – Humans & Pigs; Not associated with pandemics

Two phylogenetic groups of influenza
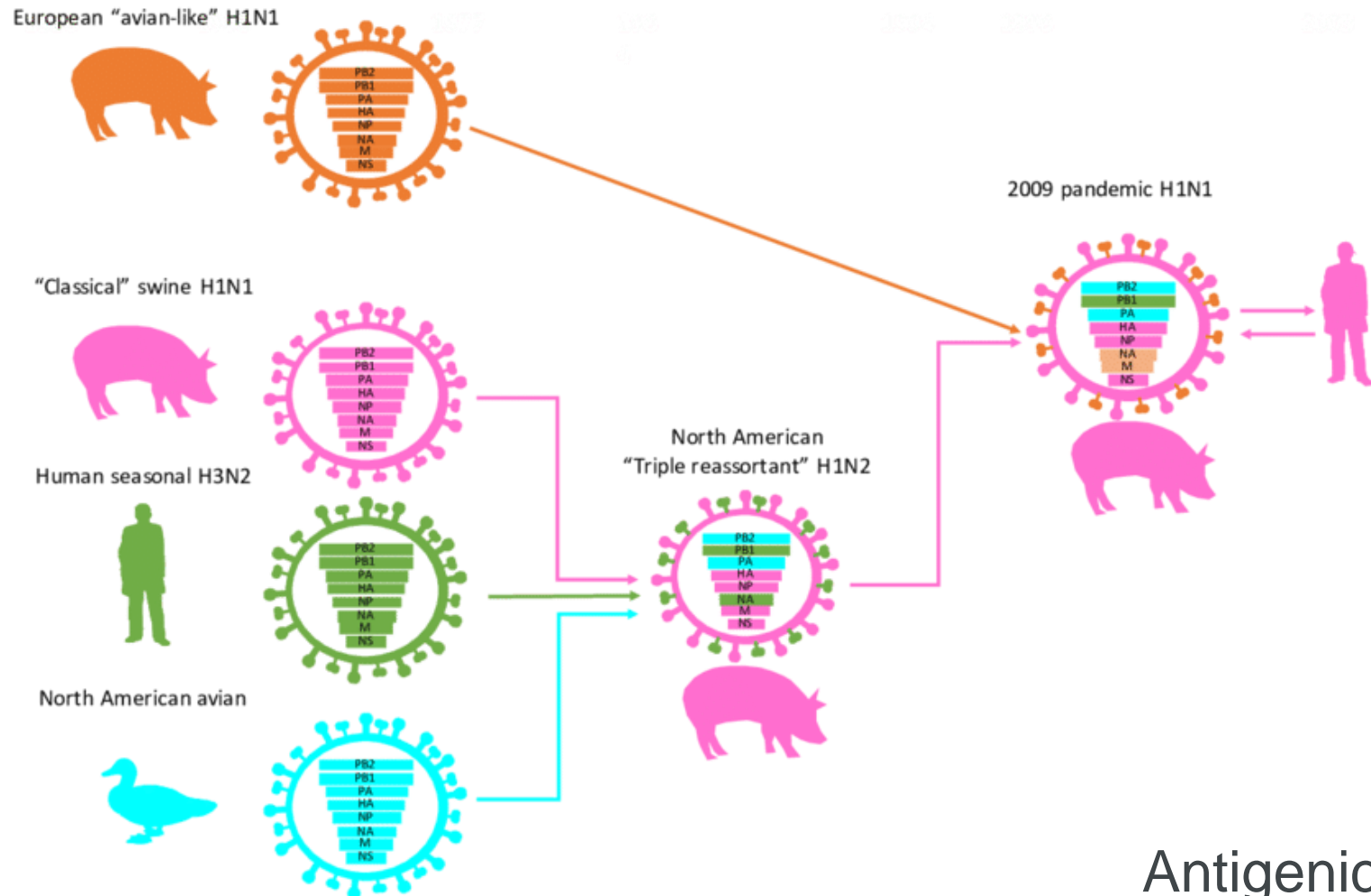

Neuraminidase (N)

Hemagglutinin (H)

RNA genome

… e.g. H1N1

Contagion characteristics of an influenza virus

- Human-to-human contact

- Virus attaches to upper respiratory tract

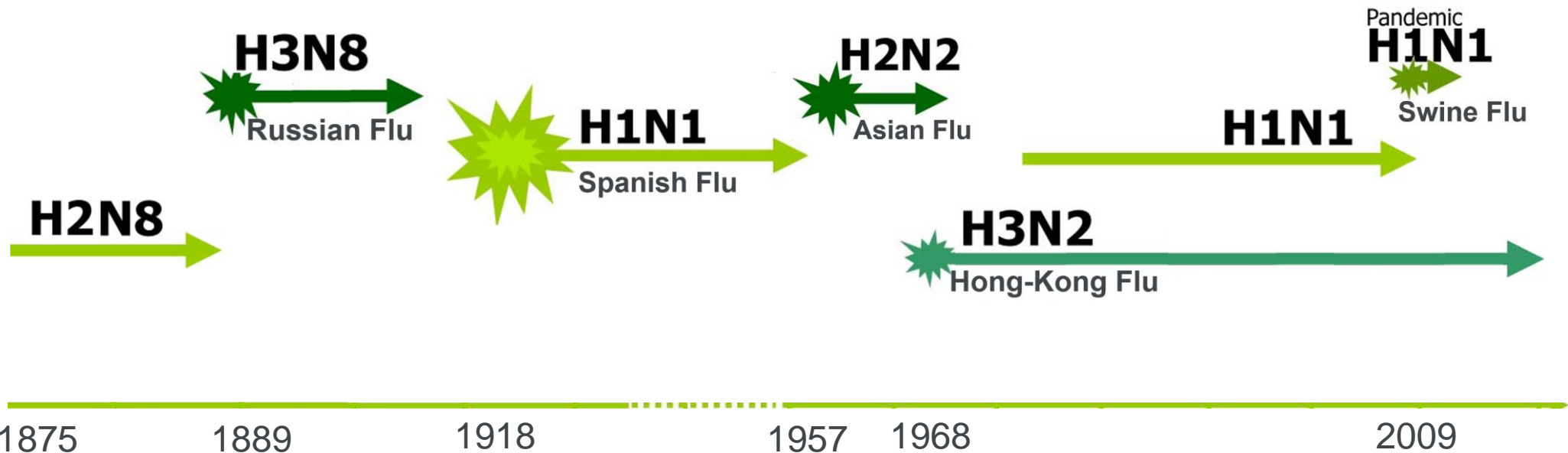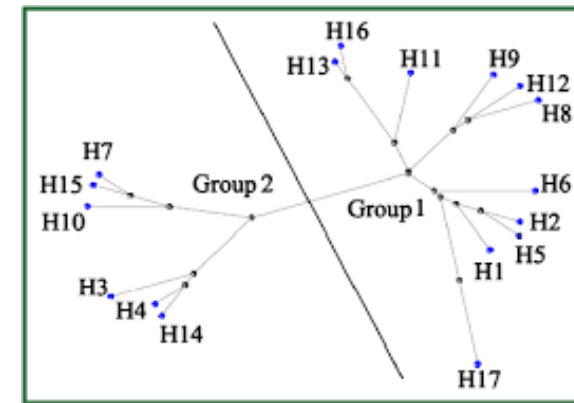- Social Network is crucial for determining contagion

Shifts Cause Pandemics

Most recent influenza pandemics

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The1918 Spanish Influenza – What happened?

Military hospital ward at Camp Funston, Kansas
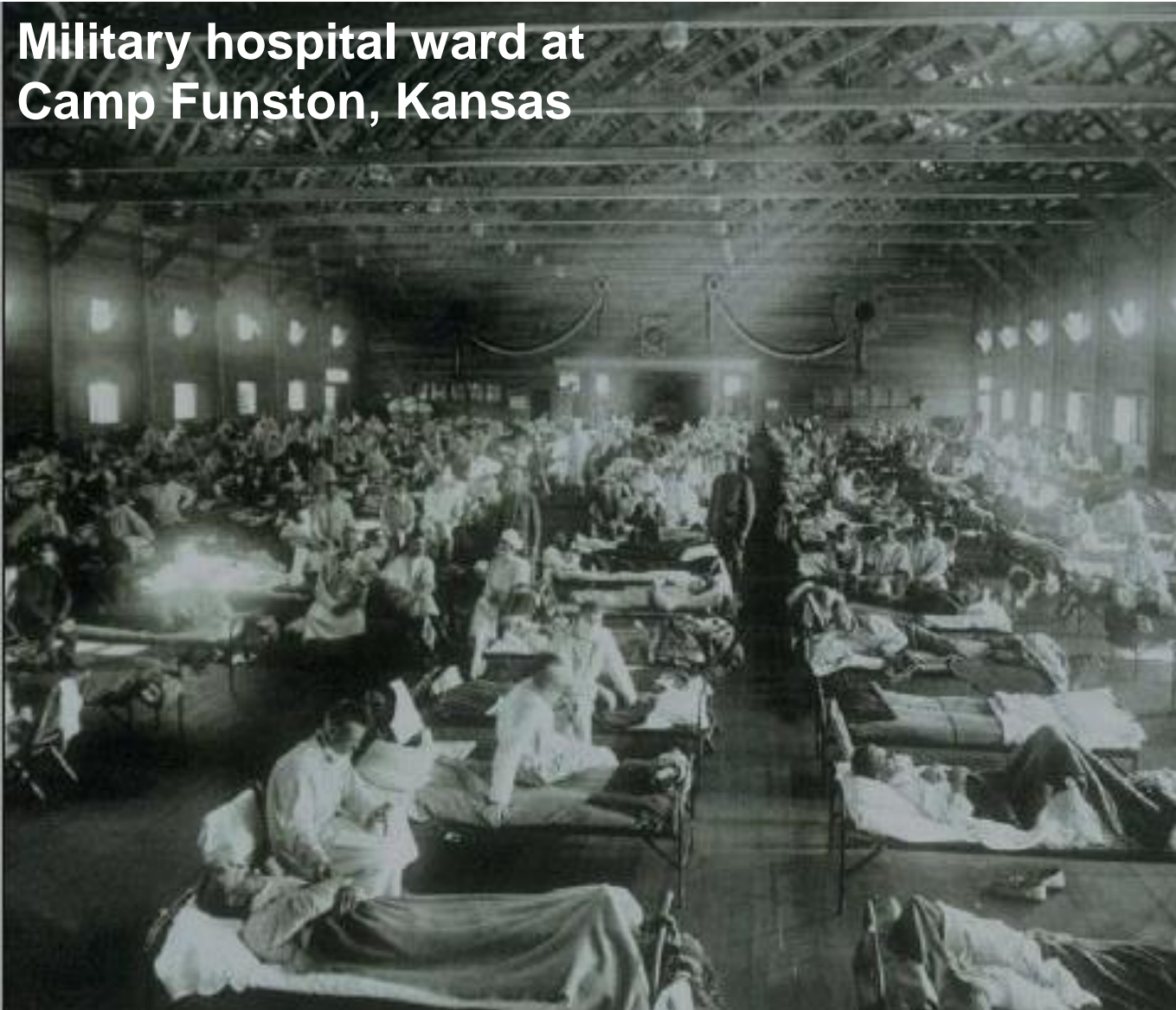
The influenza pandemic of 1918 to 1919 is the deadliest in modern history.

~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
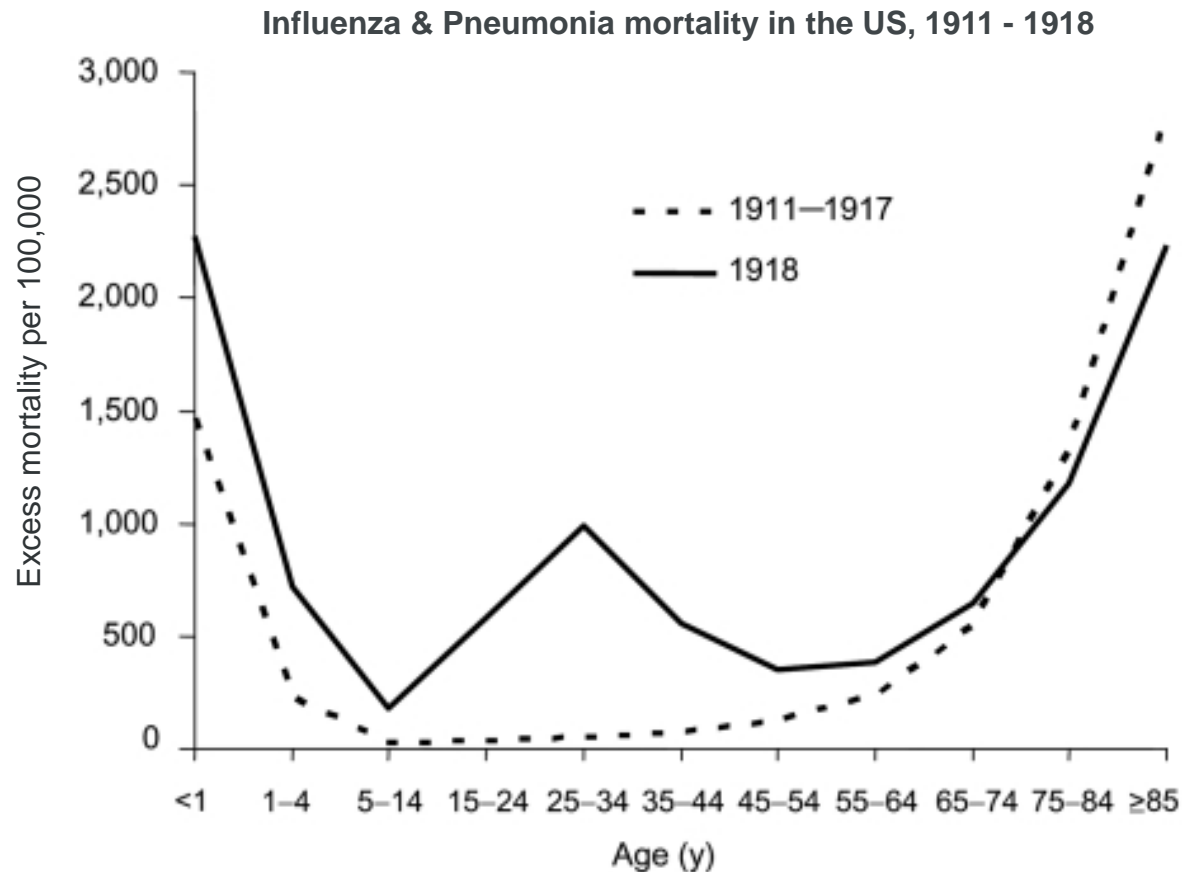
Antigenic imprinting
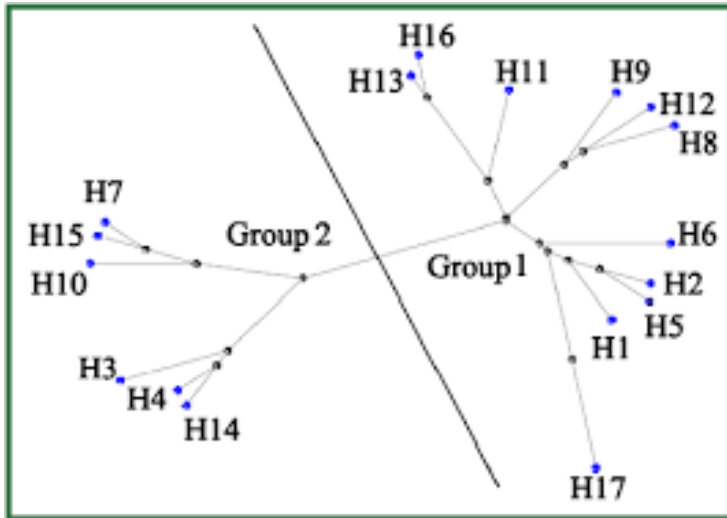
- Child imprints on the HA group of their first flu exposure

- Reduced risk of severe disease from flu strains within that same phylogenetic group

- More vulnerable to other HA group strains

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Emerg Infect Dis. 2012 Feb

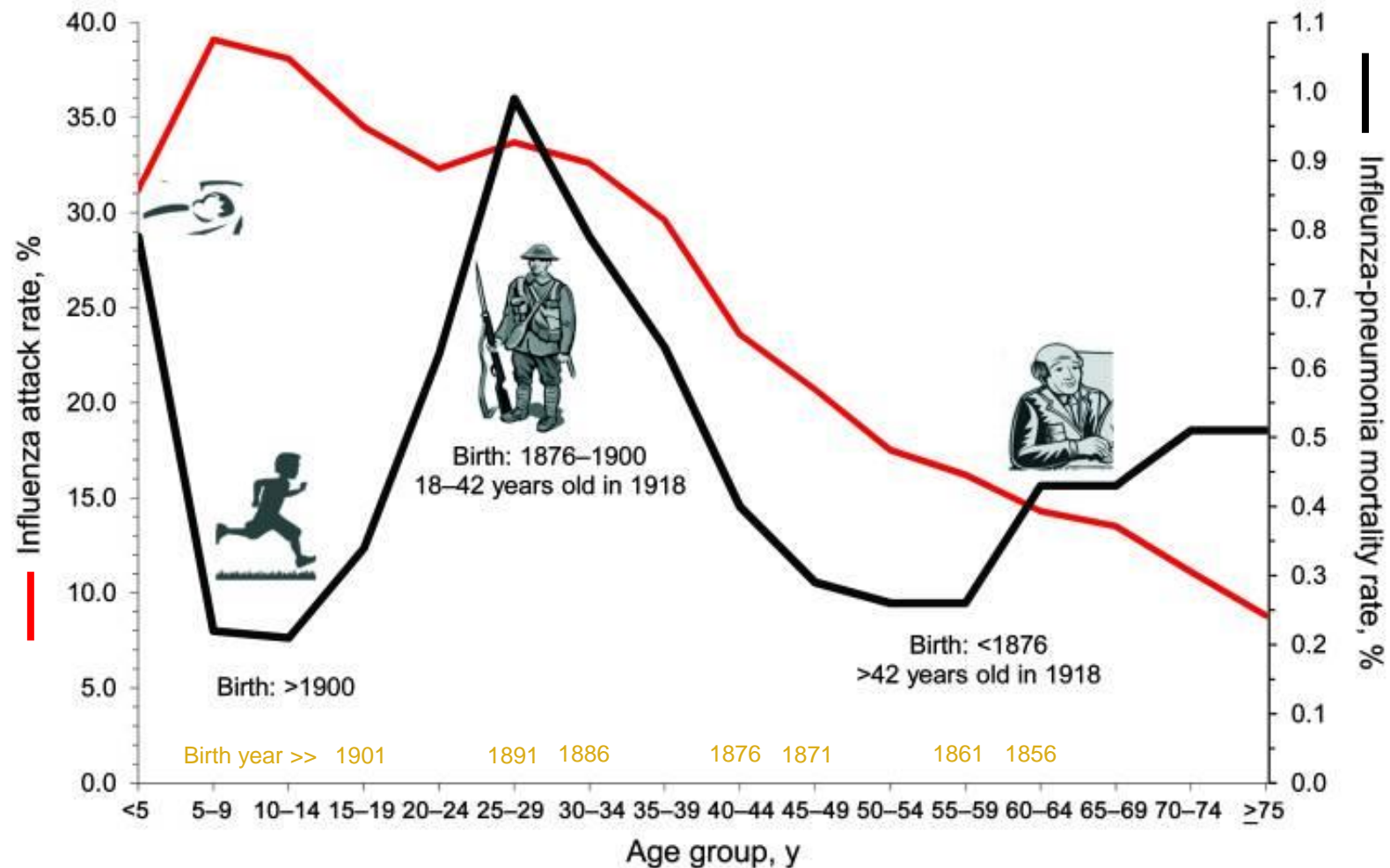# Antigenic imprinting: 1918 Pandemic

Antigenic Imprinting: 2009 "Swine-Flu"
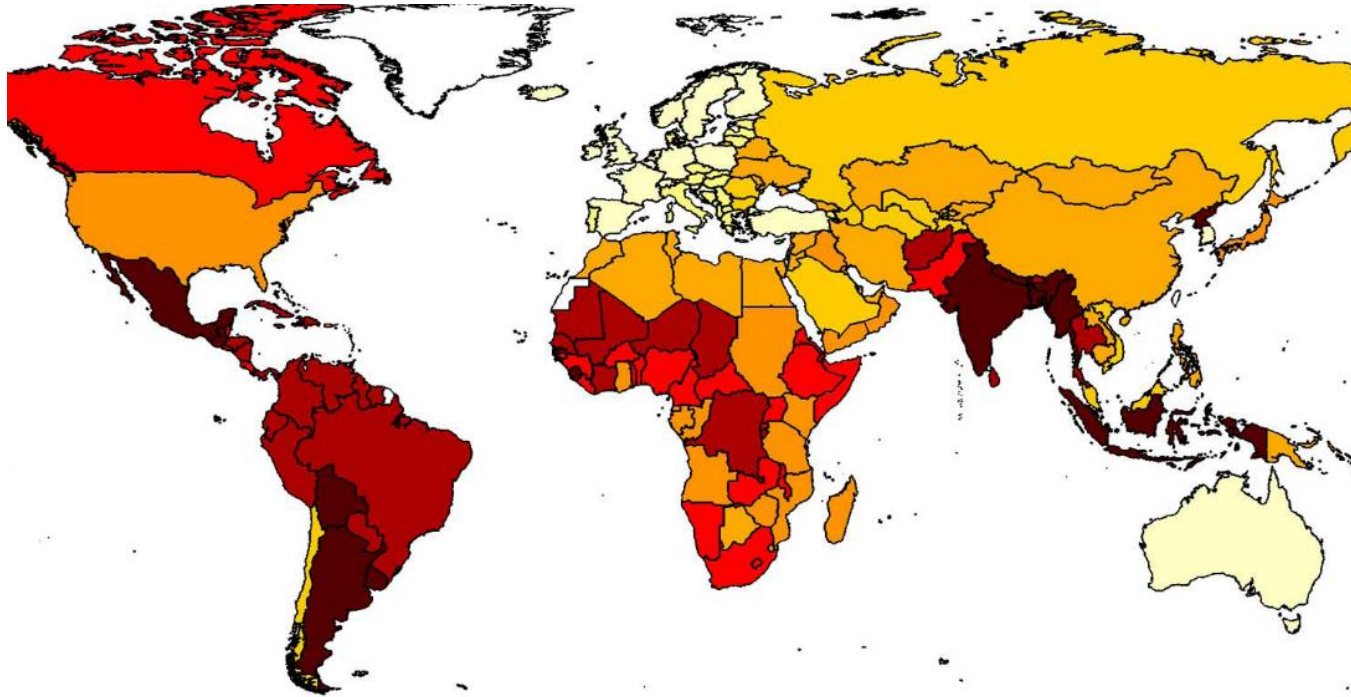
- 151,700 – 575,400 respiratory pandemic deaths Globally

Antigenic Imprinting: 2009 "Swine-Flu"

2009 Pandemic age shift
Pneumonia mortality in Mexico

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Antigenic imprinting: "Bird-Flu" Epidemic

Time line of influenza HA antigen circulation
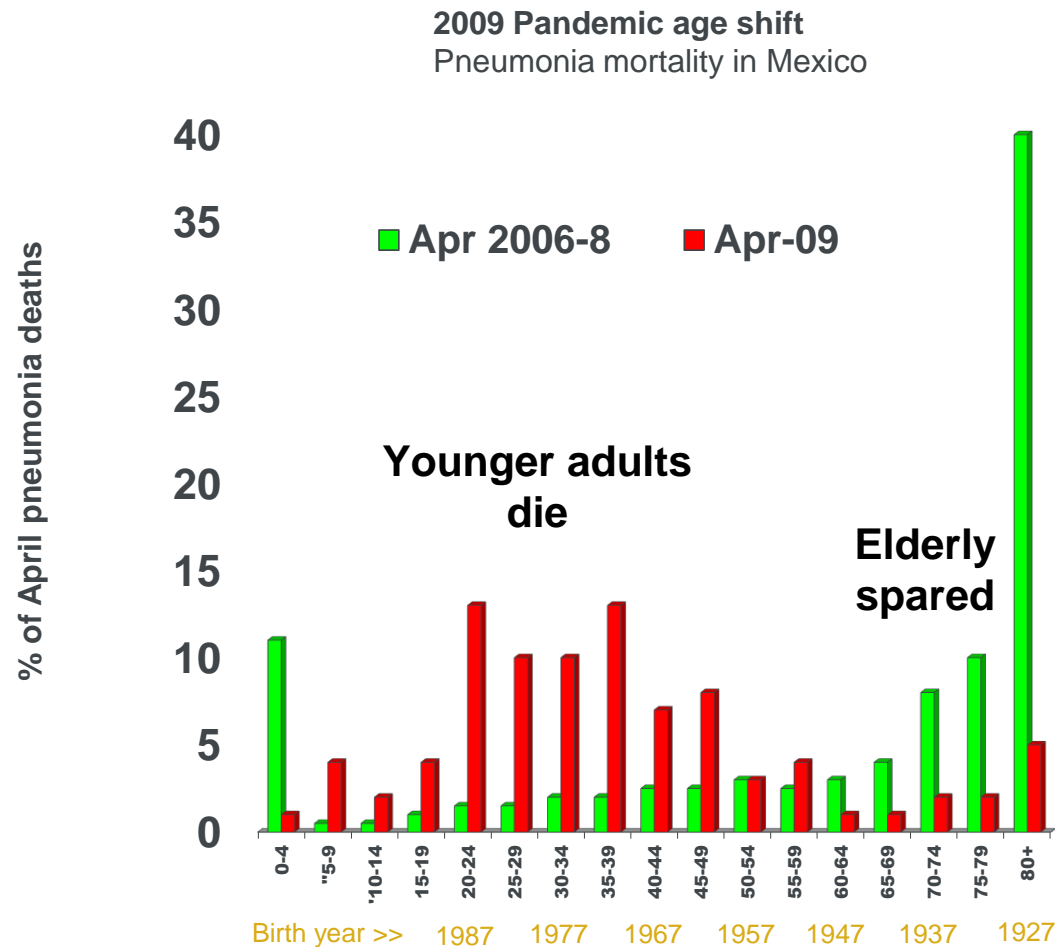
Group 1 HA antigens
Group 2 HA antigens

1918   1968   1977

Calendar year   1900   1950   2000   2016

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

1918   1968   1977

H5 cases

Birth year   1900   1950   2000   2016

Antigenic imprinting: "Bird-Flu" Epidemic

Time line of influenza HA antigen circulation

1918   1968   1977

Group 1 HA antigens
Group 2 HA antigens

Calendar year   1900   1950   2000   2016

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

1918   1968   1977

H7 cases

Birth year   1900   1950   2000   2016

Reimagining the 1918 pandemic
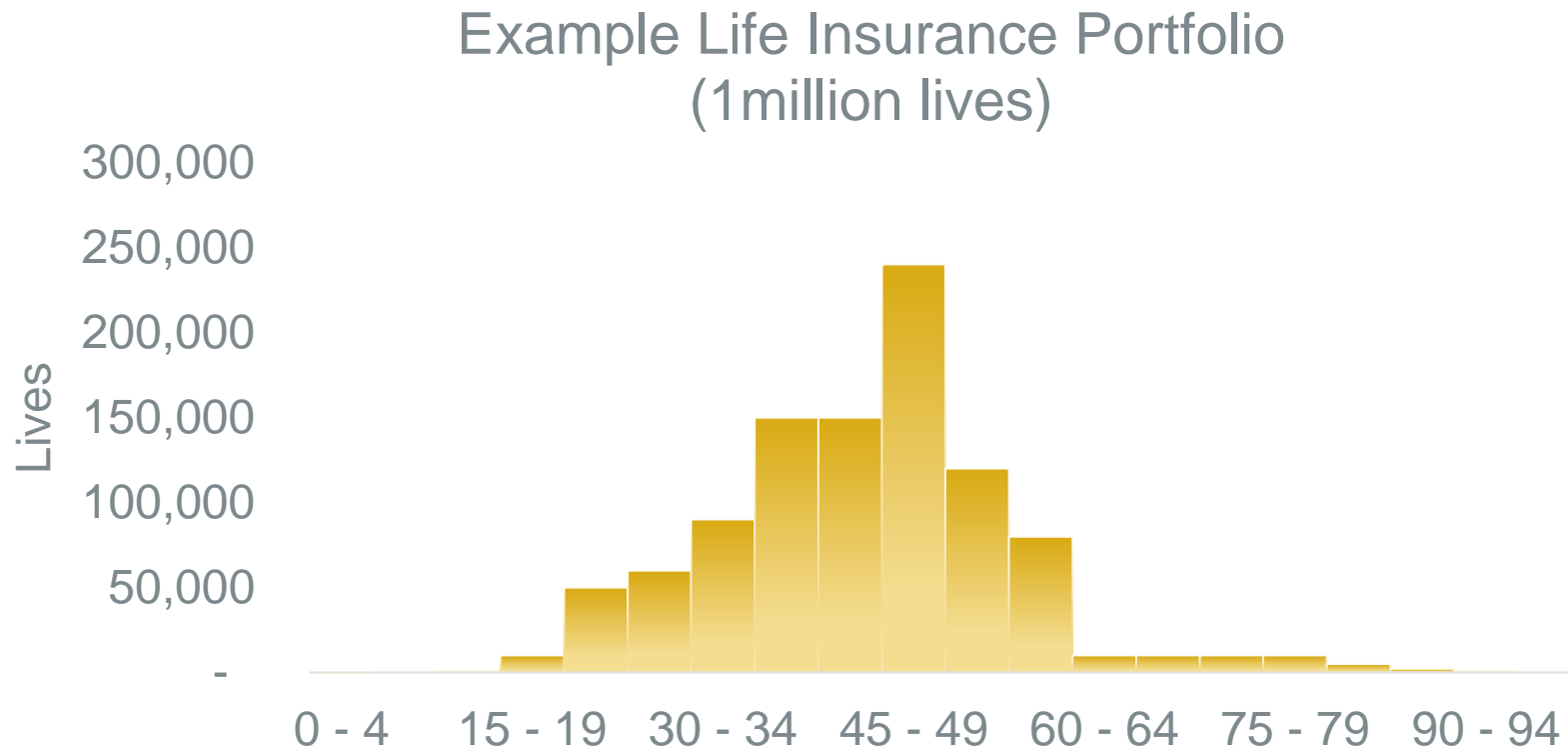
Scenario Structure

- Transmissibility = 2

- Lethality = 2.5%

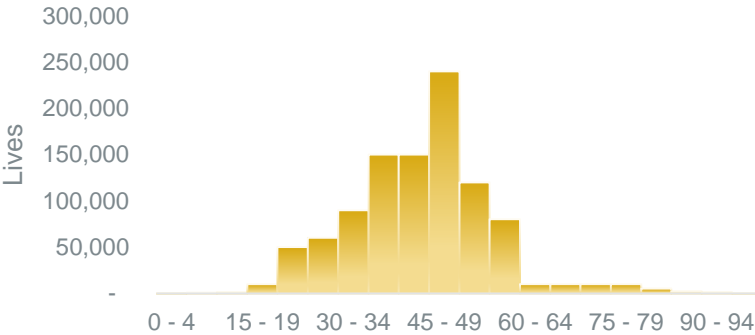- Assume vaccine available after 6 months

- Assume ineffective Pharmaceuticals
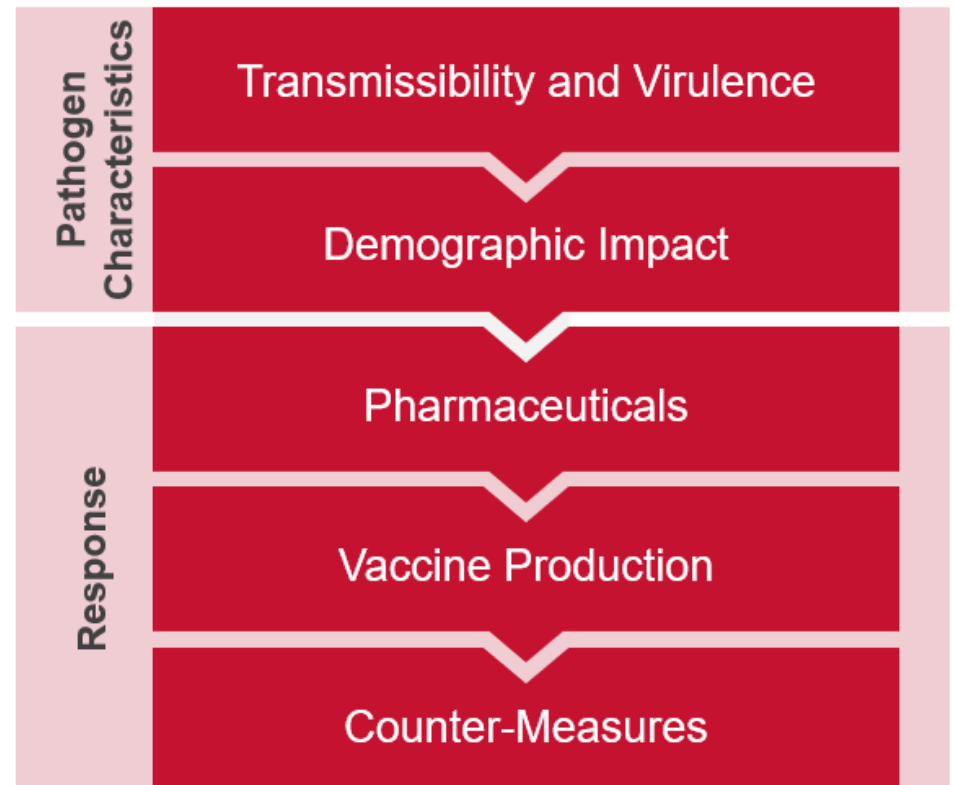
RMS Infectious Disease Model Structure

Demographic profile
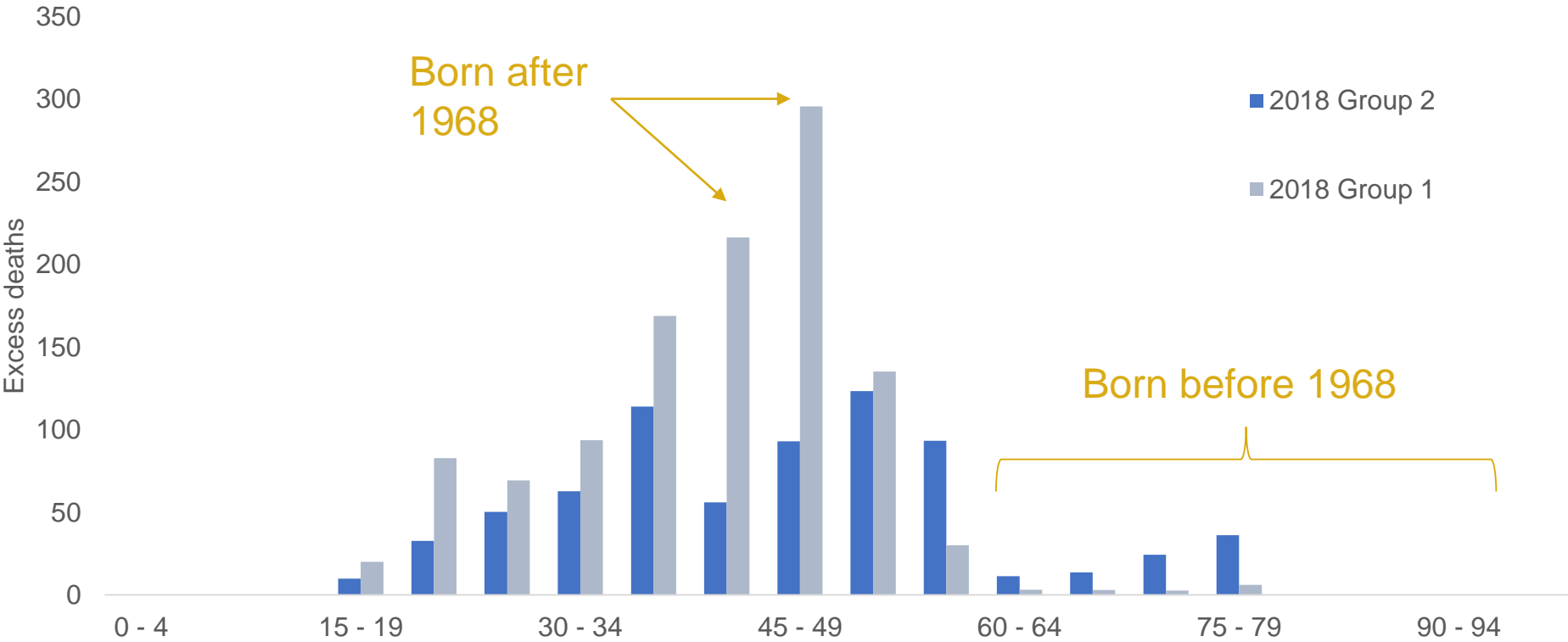

Example Life Insurance Portfolio
(1million lives)

Results

Example Life Insurance Portfolio
(1million lives)

1918 Pandemic Scenario in 2018
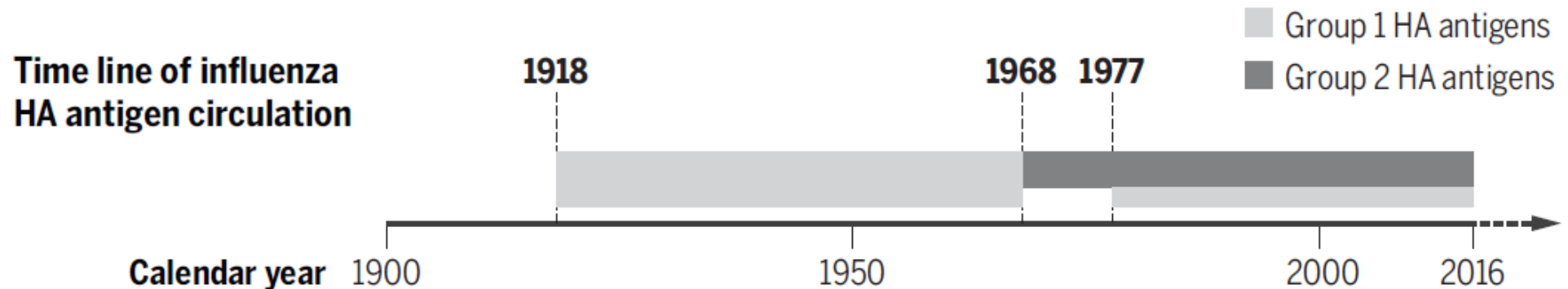
Born after 1968

Born before 1968

2018 Group 2

2018 Group 1

Excess deaths

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Results

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

Example Life Insurance Portfolio
(1million lives)

Variability of Experience due to Influenza group

+50% more deaths
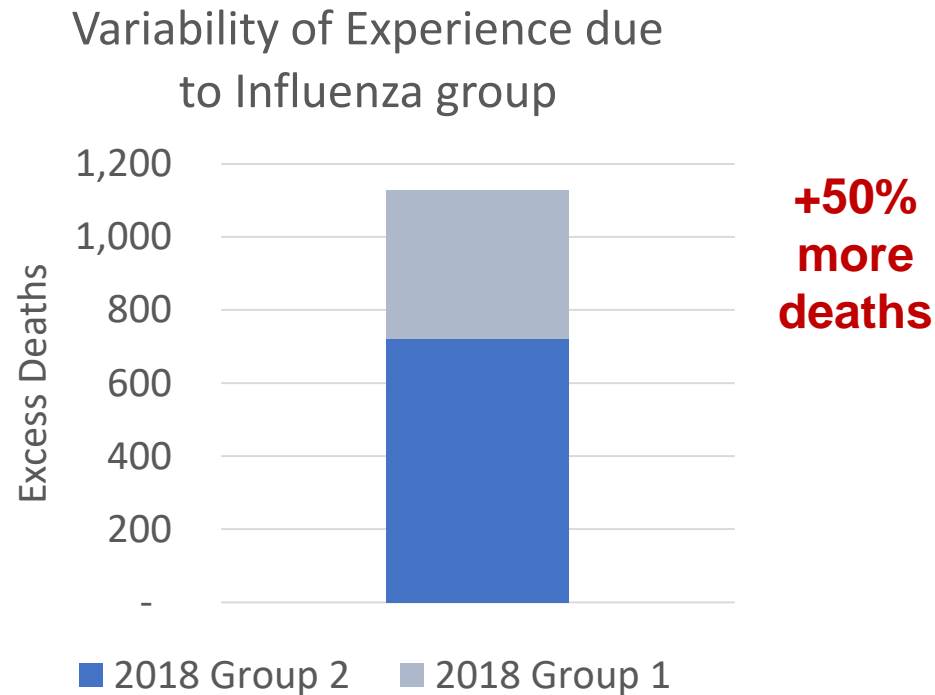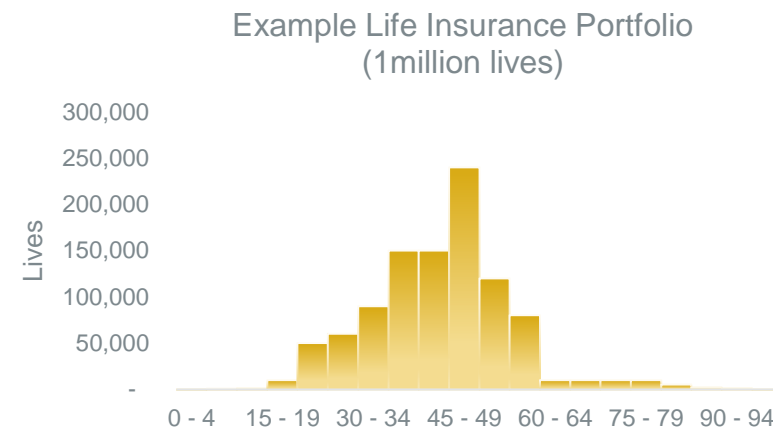
Conclusions

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

Time line of influenza HA antigen circulation

Group 1 HA antigens
Group 2 HA antigens

1918   1968 1977

Calendar year 1900   1950   2000 2016

- Most life insurers will be more vulnerable to Group 1, e.g. H1, H2, H5, H6

Questions **Comments**

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.

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