# An historical overview of pandemic influenza

Alan W. Hampson

## The History of Pandemics - Why Bother?

Influenza-this much studied and least understood of diseases-is not only a disease but for some of us a way of life.

Once challenged with its virus, the investigator, unlike the patient, is chronically stricken and is doomed to a lifetime of servitude to its whims-and endless debates with his colleagues-unless he is rescued by the early attainment of a high administrative position or seduced by the largesse of cancer virology.

A neuropathic sequel of this affliction is a delusion in which influenza suddenly becomes comprehensible. The investigator then becomes totally inaccessible to human communication until the next pandemic occurs, after which either he is restored abruptly to sanity or is led away muttering something about a "new hypothesis."

Perhaps for this reason, the student of influenza is constantly looking back over his shoulder and asking "what happened"? in the hope that understanding of past events will alert him to the catastrophes of the future.

Ed Kilbourne 1973

# Defining a Pandemic

## WHO 'description' to 2009:

"An influenza pandemic occurs when a new influenza virus appears against which the human population has no immunity, resulting in several simultaneous epidemics worldwide with enormous numbers of deaths and illness."

#### WHO 2010:

"An influenza pandemic occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity. Viruses that have caused past pandemics typically originated from animal influenza viruses."

## CDC current web page:

"An influenza pandemic is a global outbreak of a new influenza A virus. Pandemics happen when new (novel) influenza A viruses emerge which are able to infect people easily and spread from person to person in an efficient and sustained way."



# Difficulties in Determining Historical Pandemics

Accuracy of disease description - pre 16th century largely by lay people

No way of knowing that the infectious agent was influenza or novel could there have been coronaviruses or paramyxoviruses involved?

Lack of geographically representative data limits of the 'known' world limited non-Western information available

Until the mid-eighteenth century population density was restricted, travel was limited and slow – early outbreaks sometimes 'diffused' rather than spread rapidly



## Contemporary Literature (last 30-40 years)

Hist Phil. Life Sci., 13 (1991), 223-235

Sec. Sci. Mind. Vot. 21, No. 3, pp. 571-582, 1685 Printed in Cornt Belleto, All rights sesered

#### PANDEMIC AND EPIDEMIC INFLUENZA, 1830-1848\*

K. DAVID PATTINGEN

Department of History, University of North (

Abstract Four surjor influence epidemies were re may have originated in China; then and in 1835 i In 1836, 1837, inflation diffusion was largely nor the Meditersween to southern Prance and the epidemics spread rapidly and caused very high me low, each spidemic killed thousands of people, w writers have described all four outbreaks as pand new viral types, one clearly identifiable only in 18. is unclose, but facre was no pundersic in 1847-

BIA/N A definition for influenza pandemics based on

Rev. sci. tech. Off. int. Epiz., 2009, 28 (1), 187-202.

## Pandemic influenza – including a risk assessment of H5N1

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Influenza pandemics and epidemics have apparently occurred since at least the Middle Ages. When pandemics appear, 50% or more of an affected population can be infected in a single year, and the number of deaths caused by influenza can dramatically exceed what is normally expected. Since 1500, there appear to have been 13 or more influenza pandemics. In the past 120 years there were

ARERMET - Epidemies that were probably influents have been reponsed throughout securical visuous. There were 13 fairly secure epidemies during the 18th century and 13 during the 19th century. Probably 8 of close 23 were influents paradimites in the 20th century three have been 4 paradimites 139/3/19, 1397/28, 136/8/8 and 13777 due to the structure of new subsyrue of influence A struct. The great pandemies of 138/8/19 canada as evidence of mullipse deaths. Between pandemies untilly there have been epidemies of surplus executive at intervals of one to drive years and a tricitle of specialic cases every writes. The matching of an analysis of one to drive years and a tricitle of specialic cases every writes. The machiday and muraley rates have seemd greatly from epidemic to epidemic and from place to place during the same epidemic. Generally the machiday has been lowest in possile over years of age, but, recept for 1918/29, the murality has been predominarely in old people The epidenic behaviour of influence has been in create and difficult to understand than

The Chronicle of Influenza Epidemics®

WIB. Beveridge

3 Belleuw Road, Wentuureh Falls, New South Wales 2782

Australia

Asstract - Epidenies that were probably influents have been reported through

European Journal of Systematicary 28: 431–423, 1994. © 1994 Risser Analossic Publishers. Printed in the Natherlands

#### Introduction to pandemic influenza through history

Youri Ghendon World Health Organization, Geneva, Switzerland

#### SEASON STREET, STREET,

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#### The 1918 Influenza Pandemic: Insights for the 21st Century

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#### A history of influ

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- 1. Summers. 572
- femalation, ICI Lieflactus spulettes, 572 Lt. Honey, 322
- 3.2. Amprok dett., 573.
- 6. Inflamos pandonics, 174 4.1. History, 37a

- 4.2. Pandemics before 1706, 174 4.3. Pandersies from 1700 to 1000, 574
- 4.4. Pandersics since 1838-3, 178
- 4.4.1. Pandomic of 1918-29, 575. 4.6.2. Pandonic of 1997-8, 377 4.5. Features of pundersic influence, 578.
- 5. Retinence, 175

The Diffusion of Influenza

Patterns and Paradigms

Gerald F. Pyle

Rowman & Littlefield

TUBLISHES.





#### Reviewing the History of Pandemic Influenza: Understanding Patterns of Emergence and Transmission

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Academic Editor Lawrence 5 Young

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Abstract: For contages, novel strains of influenza have emerged to produce human pandentics. causing widespread illness, death, and disruption. There have been four influence pandemics in the past hundred years. During this time, globalization processes, alongside advances in medicine and epidemiology, have altered the way these pandemics are experienced. Drawing on international case

## Early Source Literature

A HISTORY OF

**EPIDEMICS** 

PANDEMIC INFLUENZA 1700-1900:

A Study to Historical Systemsology.

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MEDICAL LIBRAKY MELBOURNS

A HISTORY OF EPIDEMICS IN BRITAIN

ANNALS

INFLUENZA

EPIDEMIC CATARRHAL FEVER

GREAT BRITAIN

FROM 1510 TO 1837.

PROPERTY AND ADDRESS BY

THEOPHILUS THOMPSON, M.D. P.R.S.



LONDON: PRINTED FOR THE SYDENHAM SOCIETY.

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HANDBOOK

 $GEOGRAPHICAL\ AND\ HISTORICAL$ 

PATHOLOGY.

DR. AUGUST HIRSCH, Personnel of Hannes or the University of Berlin.

dume I.—Acute Infective Diseases.

ATES FROM THE SECOND GREENAN INCOME. RERS CREIGHTON, M.D.

LONDON



## Early Source Literature

- Webster, N. (1799). A brief history of epidemic and pestilent diseases: with the principle phenomena of the physical world, which precede and accompany them, and observations deduced from the facts stated. Hudson & Goodwin. Hartsford
- Thompson, T. (1852). Annals of Influenza or Catarrhal Fever in Great Britain from 1510 to 1837. The Sydenham Society. London
- Hirsh A. (1881). Handbook of Biographical and Historical Pathology vol 11 (translated by Creighton). New Sydenham Society, London
- Wilson, J.C. & Da Costa, J.M. (1881). Influenza. In a treatise on the continued fevers. William Wood & Co. New York.
- Thompson, E.S. (1890). Influenza. Percival & Co. London
- Creighton, C. (1894). A history of Epidemics in Britain. Cambridge University Press
- Finkler, D. (1898). Influenza in Twentieth Century Practice. Stedman, T.L. Ed.d.
  Vol XV. Sampson Low, Marston & Co London



## Criteria Used for Selection of Probable Pandemics

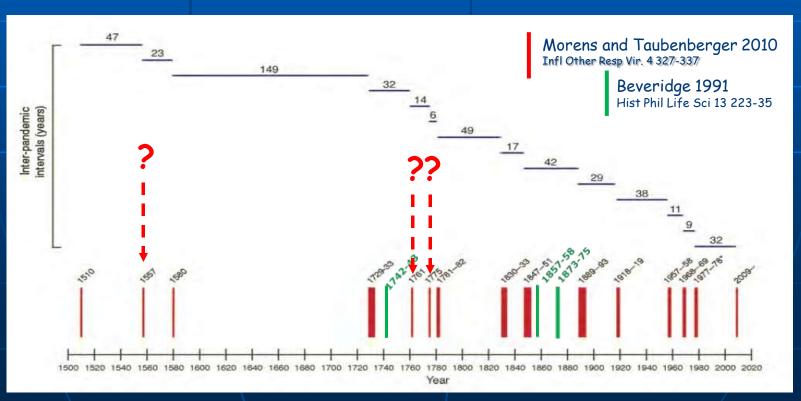
- Clinical disease with fever and respiratory symptoms lasting a few days with full recovery or death
- Sudden outbreak onset
- High morbidity
- Low overall case fatality rate but usually increased overall mortality
  - Evidence of deaths from pneumonia
- Outbreak duration 1-2 mo. in major towns
- Spread (throughout a continent or the known world)
  - · Evidence of disease in at least 2 geographically separated regions
- People of all ages, classes and walks of life affected
- Sometimes unseasonal outbreaks



## Contemporary Analysis of the Literature

First generally agreed pandemics were those of 1510 or 1580.

Most recent analysis of historical records by Taubenberger and Morens [Rev Sci Tech. 2009 Apr;28(1):187-202] describe 15 pandemics dating backto 1510.





## Sixteenth Century Pandemics

### 1510:

- Spread from Africa to Europe summer of 1510, northward spread to Baltic states.
- High attack rates, low mortality restricted to children





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#### 1557-8

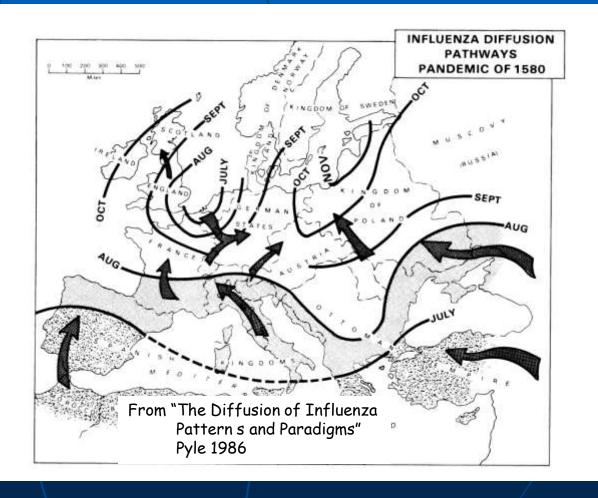
- Westward spread Asia to Europe
- High mortality (pleurisy, fatal peripneumony)
  - · High mortality in pregnant women
  - Enalish parish registries show xs deaths 1558-1560



# Sixteenth Century Pandemics

### 1580

- Global with rapid spread
- High mortality





## Influenza in the 17th Century

No evidence of pandemics recorded!

- Several large -scale European epidemics but without directional spread
- □ Development of influenza-like activity in the Americas
  - 1617 ILI outbreak in Chile spreading throughout South & North America and the Caribbean
  - Beginning of a period of semi-autonomous American Influenza
- □ 152 year absence of recorded pandemic activity (1580-1732)



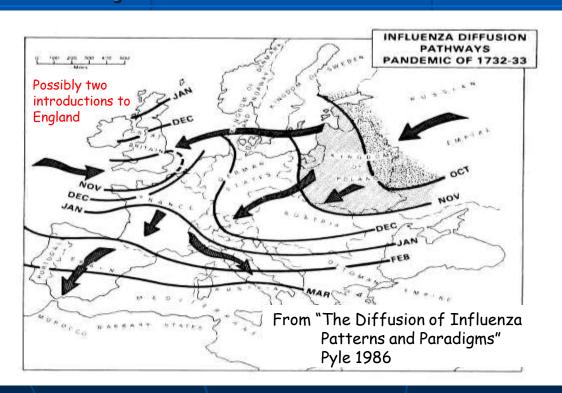
## Eighteenth Century Pandemics

#### 1732-3

- East to West spread
- May have been a second wave of 1729-30 outbreaks.
- · High morbidity and mortality
- · Period of heightened influenza activity

#### 1761-2

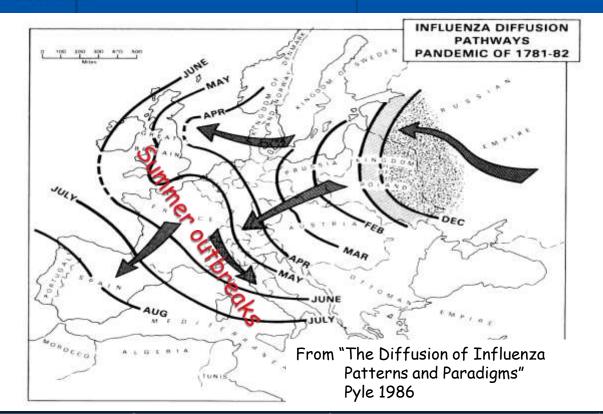
- Listed only by Taubenberger & Morens (2009)
- Possible origin in the Americas





## Eighteenth Century Pandemics

- 1781-82 (21780 origin)
  - Started in China, spread through Russia to Europe, India & North America.
  - Very high morbidity, low mortality except records from London.
- During the 1700s an association between human and equine influenza outbreaks was often recorded





## Nineteenth Century Pandemics

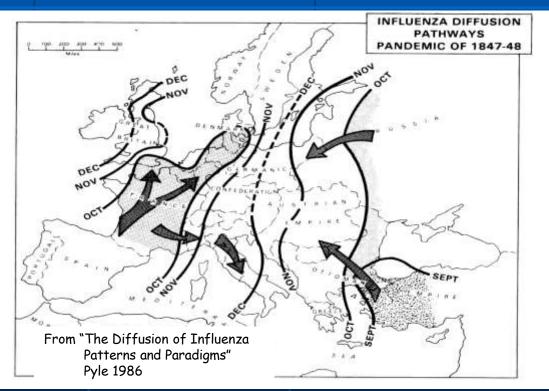
#### 1830-1833

- Originated in China then Russia to Europe and globally.
- Two waves, higher mortality in second wave, older people spaned.
- Third wave or separate pandemic 1836-7

#### 1847-8

- Pandemic recorded in Europe North America, West Indies & Brazil. Possible origin recorded as Ottoman Empire or Russia.
- High morbidity (25-50% in Paris) high mortality in the UK.

Suggestions that infection around this time may have been sparing against 1918-199 pandemic.

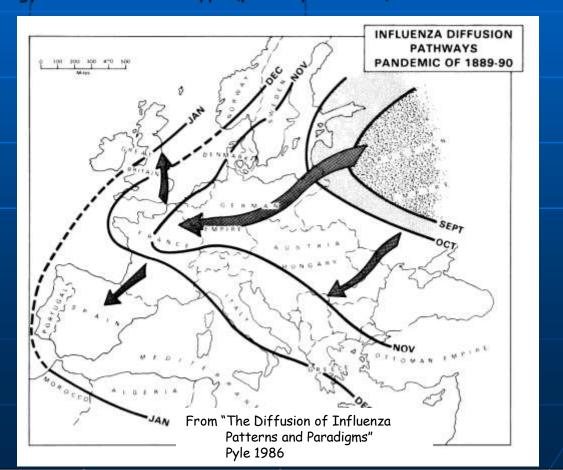




## Nineteenth Century Pandemics

#### 1889-92(93) ('Russian Flu')

- First reported in Central Asia (Uzbekistan) ~May 1889, summer lull then spread rapidly from Russia along transportation networks (rail).
- Reached the Americas December, Australia in March 1890.
- High morbidity, modest mortality in first wave
- Two or three subsequent waves, mortality higher in second wave.
- Subsequent serology indicates H3 subtype (possibly with N8)

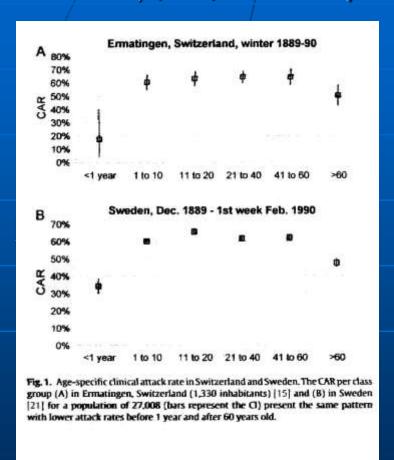


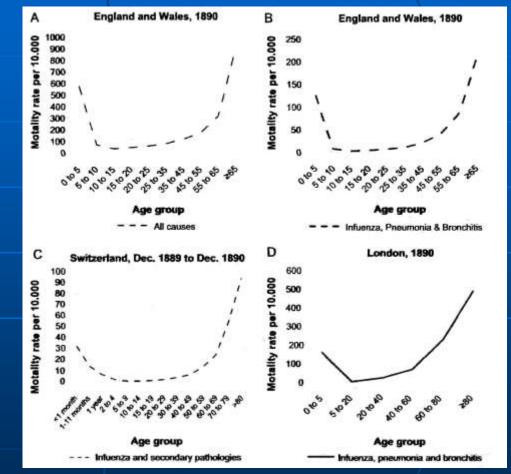


## Nineteenth Century Pandemics

## 1889-92(93) ('Russian Flu')

Recently (2010) further analysed by Valleron et al.





The authors note increasing access to web-based information such as all issues of Lancet 1823 to present

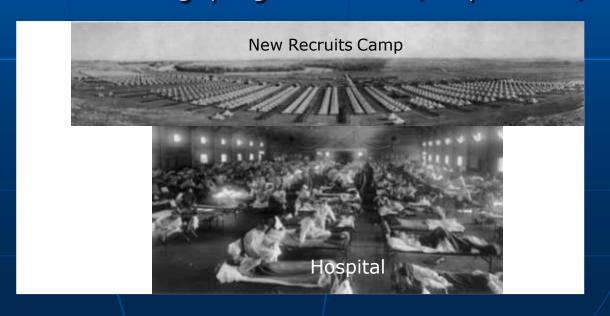


## Twentieth Century Pandemics

- 1918-19 'Spanish Flu'
- **1947** 
  - originally considered to be a pandemic but in reality a major antigenic drift variant not a change of sub-type.
- 1957-58 'Asian Flu'
- 1968-69 'Hong Kong Flu'
- 1977-78 'Russian Flu'



- Global mortality estimates continue to grow now 50-100 million
- Origins still debated
  - · Geographic
    - Clinical reports 1916 17 (UK, France) Oxford 2002
    - USA Kansas March 1918 (Crosby 1989, Barry 2004)
  - Viral
    - Taubenberger et al 2005 propose direct avian source
    - Evolutionary clock analysis (Worobey et al 2014) suggests earlier ~1907 evolution of the HA, and development by reassortment
- Initial spread commencing spring 1918 Kansas (Camp Funston)





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Initial spread commencing spring 1918 Kansas (Camp Funston)



- Unusual 'W' shaped mortality curve
  - Three waves of differing mortality
  - Sparing of older adults analysis of excess mortality suggests protection by earlier infection (Luk et al 2001) possibly 1830-33 pandemic (Worobey et al 2014.



Unusual 'W' shaped mortality curve

