What’s Going On

- 1993 - Acute respiratory illness in New Mexico
- 1995 - Acute “hemorrhagic dysentery” (?) in Democratic Republic of the Congo (formerly Zaire)
- 1996 - “Bankers’” shrimp in Hawaii
- 1997 – 1st H5N1 virulent “chicken flu” in Hong Kong
- 2003 - SARS
What’s Going On

- HIV
- Nipah Virus
- Hepatitis C
- Drug resistant malaria
- Drug resistant tuberculosis
- Drug resistant *S. aureus*
- And the list goes on . . . . . . . . . . . . . . . .
Microbes

- In every conceivable ecological niche
- Essential to human, plant and animal life
- Adaptable
- Socially destabilizing
- Emerging, re-emerging, and persisting
Emerging and Re-emerging Infectious Diseases

• "New" organisms for humans
  - HIV – 40 million infections
  - SARS

• New ecological niches
  - West Nile Virus

• "Old foes in new clothes"
  - Drug resistance
Epidemic Curve of a SARS Outbreak in Canada, February 23 to 2 July, 2003 (N=250*)

*Excludes 1 for whom onset date is unknown
Ecological

- West Nile Virus - 2000
# Factors in Emergence

<table>
<thead>
<tr>
<th>1992</th>
<th>2003</th>
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</thead>
<tbody>
<tr>
<td>Adaptation and change</td>
<td>Adaptation and change</td>
</tr>
<tr>
<td>Economic development</td>
<td>Economic development</td>
</tr>
<tr>
<td>Human demographics and behaviour</td>
<td>Human demographics and behaviour</td>
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<tr>
<td>Travel and commerce</td>
<td>Travel and commerce</td>
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<tr>
<td>Technology and industry</td>
<td>Technology and industry</td>
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<tr>
<td>Public health breakdown</td>
<td>Public health breakdown</td>
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<tr>
<td></td>
<td>Human susceptibility</td>
</tr>
<tr>
<td></td>
<td>Climate change</td>
</tr>
<tr>
<td></td>
<td>Changing ecosystems</td>
</tr>
<tr>
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<td>Poverty and inequality</td>
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<td>War, famine, intent to harm</td>
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Stopping Infectious Disease at the Border?

1850

2003
Influenza
Avian Influenza Reaches Disney World!
Outline

• What is an influenza pandemic?

• How will a pandemic strain of influenza behave in a population?

• What assumptions on the impact of a pandemic should be used for planning purposes?

• What has been done to increase our preparedness?
Influenza – The Virus

- **3 types: A, B and C**
  - Influenza A and B viruses cause annual outbreaks
  - Only influenza A viruses cause pandemics

- The viruses mutate or mix resulting in new strains

- **2 spike proteins on its surface**
  - Haemagglutinin “H”
  - Neuraminidase “N”
Influenza A Viruses

- Wild aquatic birds form a large natural reservoir
  - 16 different haemagglutinins
  - 9 different neuraminidases
How are Annual, Pandemic and Avian Flu Different?

• **Annual (Seasonal) Flu**: The flu is a contagious respiratory illness in humans caused by influenza viruses that occurs every year.

• **Pandemic Flu**: An influenza pandemic is a global outbreak that occurs when a new influenza A virus to which virtually no-one is immune spreads easily from person to person and causing serious human illness.

• **Avian (bird) flu**: Bird flu is an infection caused by avian influenza viruses, which occur naturally among wild birds but can cause illness in domestic poultry.
Influenza Affects Us Each Year

- Influenza A (H3N2, H1N1) and influenza B viruses circulate in humans causing annual outbreaks
  - up to 10%-25% of a population ill with flu
  - Average of 4000 deaths and 20,000 hospitalizations due to flu or its complications per year in Canada

- Fever and cough, sore throat, unwell, muscle aches, headaches (up to 1 week)

- Pneumonia, exacerbation of underlying chronic illnesses, encephalitis

- Most severe in the very old and very young
How Does Influenza Spread?

• Influenza is spread primarily via infected respiratory droplets and also via contact with contaminated hands and surfaces.

• The onset of clinical illness after the initial exposure (the incubation period) is usually short: 1 to 3 days (range 1-7 days).

• An infected person may shed the virus one day before the onset of symptoms and continue for 5 days after symptom onset, however, transmission is most efficient during the first 3 days of illness when symptoms, such as cough and fever, are present and viral shedding is highest.
How do Flu Pandemics Occur?

1. Avian virus adapts to humans through genetic mutations

2. Avian virus adapts to humans through genetic mixing
What are We Preparing For?

• Rapid arrival of the pandemic virus (<3 months)
  – 1st peak in illness 2 to 4 months after the arrival of the virus in Canada

• Outbreaks will occur simultaneously in multiple locations, although different areas of the country may experience peak activity at different times.

• In a local community a pandemic wave will generally last 6-8 weeks but this can vary

• A pandemic may last 12 to 18 months and more than one wave may occur within a 12 month period
Impact of a Pandemic

• Depends on multiple factors, including
  – Virus effects (age-specific attack rates, rates of adverse outcomes/complications; speed of spread)
  – Characteristics of the population (elderly, chronic medical conditions)
  – Effectiveness of response
  – Psychologically induced impacts / public behaviour
Each Pandemic is Different

1918: “Spanish Flu”  40-50 million deaths  
1957: “Asian Flu”  1 million deaths  
1968: “Hong Kong Flu”  1 million deaths

H1N1  H2N2  H3N2

Credit: US National Museum of Health and Medicine

Source: WHO
The 1918 pandemic was unusual in that those aged 20 to 40 experienced high mortality rates.

Deaths per 100,000 Population

Age (Years)

Health Impacts of Pandemics

Assumptions for planning:

• 15%-35% of the population will be clinically ill over the course of the pandemic and of these:
  – assume that the majority of cases occur in the first wave (e.g. for a clinical attack rate of 35%, plan for 25% illness rate over 6 weeks in the first wave)
  – 50% will not require clinical care
  – up to 50% will seek outpatient care
  – 1% will be hospitalized
  – 0.4% will die

U.S. Meltzer Model adapted
Health Impacts of a Pandemic in Canada

Moderate severity and no vaccines or antivirals scenario:

- 11,000 to 58,000 deaths
- 34,000 to 138,000 hospitalizations
- 2 to 5 million outpatients
- 4.5 to 10.6 million clinically ill but no formal care
- Economic costs
  - Health care: $330 million to $1.4 billion
  - Societal (lost productivity): $5 to $38 billion

U.S. Meltzer Model adapted
Impact in the Workplace

• Impact on workforce may vary depending on setting

• Plan for staff absenteeism of 20%* on any given day during the peak week of the outbreak in a community, with lower rates during the weeks before and after the peak
  – due to illness/death, caring for ill family, fear of infection, public health interventions

• Asking sick staff to stay at home for 5 days or until symptoms have resolved will help reduce the spread and impact

*Dept. Finance Model
What has been done to increase our preparedness?
Canadian Pandemic Influenza Plan – Feb 2004

- National framework focused on the health sector
- Nationally agreed upon goal
- Preparedness, response and recovery sections and key components

- New edition in 2006
  - New WHO pandemic phases
  - Emergency management and coordination
  - Update guidelines, including Public Health Measures

Pandemic Planning Components

- Surveillance and Laboratory Testing
- Public Health Measures (non-pharmaceutical)
- Vaccine
- Antiviral drugs
- Health Services Planning
  - Infection control
  - Clinical care and triage
  - Resource Management
  - Non-Traditional Sites and Workers
  - Mass Fatalities
- Communications
Routine Surveillance

**FluWatch** weekly year-round surveillance

- Laboratory network
- Sentinel physicians network for influenza-like illness
- Paediatric hospitalizations (IMPACT)
- Provincial/territorial reporting of influenza activity

**Intelligence gathering and verification**
- Regular scanning of international activity
- Media scanning – Global Public Health Intelligence Network (GPHIN)
- Web-based and e-mail alerts to P/Ts and other stakeholders (“CIOSC”)
Secure web-based system accessible to registered public health officials across Canada

Provides public health alerts by email, outbreak mgmt tools, communication facilitation
Strengthening Surveillance and Laboratory Testing

- Enhance capacity to detect novel influenza viruses and antiviral resistance testing
  - Laboratory testing protocols
- Strengthening animal–human health interface for zoonotic diseases
  - Wild bird surveillance pilot (coordinated by CCWHC)
- Enhance surveillance capacity in Asia
- Outbreak response (domestic and international)
Public Health Measures

• Public Education
  - respiratory hygiene
  - stay home if sick

• Case and contact management
  - isolation, quarantine
  - antiviral use

• Community based strategies to reduce transmission

• Travel and border issues

Public education and non-pharmaceutical interventions will be key to the pandemic response
Community-Based Interventions

Recommended

- Stay home from public events/locations if you have fever and new onset of respiratory symptoms
- Consider school and daycare closure
- Restriction of indoor public gatherings other than schools if “high-risk” settings can be identified

Not Recommended

- Broad restrictions on indoor public gatherings
- Use of masks by well individuals (not including care-providers)
Vaccine and Antiviral Strategies

• Develop strategy options and establish security of supply
  – Pandemic readiness vaccine contract
  – National antiviral stockpile

• National guidelines on use in short supply

• Program implementation and evaluation

• Regulatory preparedness

• Safety monitoring

• Communication and education strategy

• Research
Vaccines are the Cornerstone of Public Health Response

BUT

• Specific pandemic strain cannot be developed until the pandemic virus has emerged

• Detection and receipt of novel virus strain by WHO takes days to months

• Virus characterization and vaccine seed production takes 3 weeks or more using reverse genetics

• Manufacturers require another 3 months to produce first vaccine lot

• Rapid regulatory approval and release
Pandemic Vaccine Readiness

• **Objectives:**
  - Provide a safe and effective vaccine to all Canadians as rapidly as possible
  - Ensure security of supply by having sufficient infrastructure and capacity to produce 100% of domestic supply needs

• **Pandemic protection -10 yr contract (2001-11)**
  - Domestic manufacturing capacity
  - Manufacturer’s contingency plan: availability of raw materials and supplies (fertilized hen eggs)

• **Prototype pandemic vaccine clinical trials**
Antiviral Strategy

• The current joint F/P/T national stockpile consists of 55 million doses of oseltamivir
  – All doses pre-allocated to Provinces and territories based on population size
• Treatment of the sick as early as possible is the priority
• Use for prophylaxis requires further broad consultation
• Ongoing review of indication, amount and composition of the national antiviral stockpile
Communications

• Cascading and coordinated FPT communications response.
• Communications roles and responsibilities defined by pandemic phase and by jurisdiction
• Activities described in three stages: before, during and after a pandemic
• Activities intensifying in alignment with WHO phases
• National, NGO and international communications coordination established in advance

www.influenza.gc.ca
Understanding Pandemic Influenza

L'essentiel sur l'influenza (grippe) pandémique

Understanding Pandemic Influenza

Most of us have heard about the flu (or “influenza”), but what is hard to see here is the pandemic difference. During seasonal times, normal seasonal flu is widespread and affects many. Pandemic Influenza epidemics can be deadly, spread rapidly and can cause a pandemic. During seasonal times, normal seasonal flu is widespread and affects many. Pandemic Influenza epidemics can be deadly, spread rapidly and can cause a pandemic.
Flu Prevention Checklist

- Get an annual flu shot
- Wash your hands frequently
- Cover your nose and mouth when you cough or sneeze
- Keep shared surfaces clean
- Talk about staying healthy

Aide-mémoire pour la prévention de la grippe

- Faites vos vaccins à l’avance
- Nettoyez-vous souvent les surfaces partagées
- Parlez de l’importance de la santé
- Faites vos lessives à la main
- Nettoyez-vous souvent les surfaces partagées
Provincial/Territorial and Local Preparedness

- All Provinces and Territories have developed plans for pandemic influenza
- Some provinces and territories are testing their plans
- Local level planning is occurring but at different rates
Next Steps:

- Publish updated Canadian Pandemic Influenza Plan 2006
- Produce prototype H5N1 pandemic vaccine and conduct clinical trials – 2006 to 2007
- Optimizing the national antiviral stockpile
- Public and key stakeholder consultations on the use of antivirals (2006)
- National consensus meeting on masks and other infection control precautions for influenza (Fall 2006)
- National integrated (animal health, public health) avian influenza preparedness meeting (July 2006)
- Multi-sectoral pandemic influenza preparedness and response
- Ongoing support for international activities
Future Challenges for Infectious Disease Control

• **A highly mobile population.**
  – Entering Canada – 18,000,000 international airline passengers enter Canada annually.
  – Leaving Canada – 30-40,000 per day from Toronto.

• **100,000,000 US – Canada land border crossings per year.**
Future Challenges for Infectious Disease Control

- Travel time to Canada from anywhere in the world is less than the incubation period for nearly all infectious diseases.
- SARS incubation period – up to 10 days or more
- 5 imported SARS cases – all imported SARS cases in Canada became ill after arrival; so, not detectable at border.
Future Challenges for Infectious Disease Control

• Detection of infectious diseases “at the border” is difficult, if not impossible.
  - Non-specific clinical case definitions
  - Lack screening tests that provide results in seconds or minutes.
  - Serious illness is rare among travellers
  - Positive predictive value of screening tests: nearly 0.
Future Challenges for Infectious Disease Control

• We suspect that nearly all persons with serious infections will be asymptomatic when they travel to Canada.

Conclusion: Importation of infectious diseases will be a reality for some time to come.
Ultimate Strategy

• Recognition that:
  – Highly mobile global population means rapid movement of infectious diseases to any part of the world;
  – Traditional geo-political borders no longer provide “protection”

1. The new “border” for infectious diseases in Canada is the health care system, not the airport.
2. Rapid detection, diagnosis and response capacity
References

http://www.influenza.gc.ca/ai-ga_e.html

THANK YOU!