



Lessons from SARS and Implications for the H1N1/09 Influenza Pandemic

Combating Global Infections

Irkutsk, Russia

September 21-24, 2009

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Global Infectious Disease Challenges

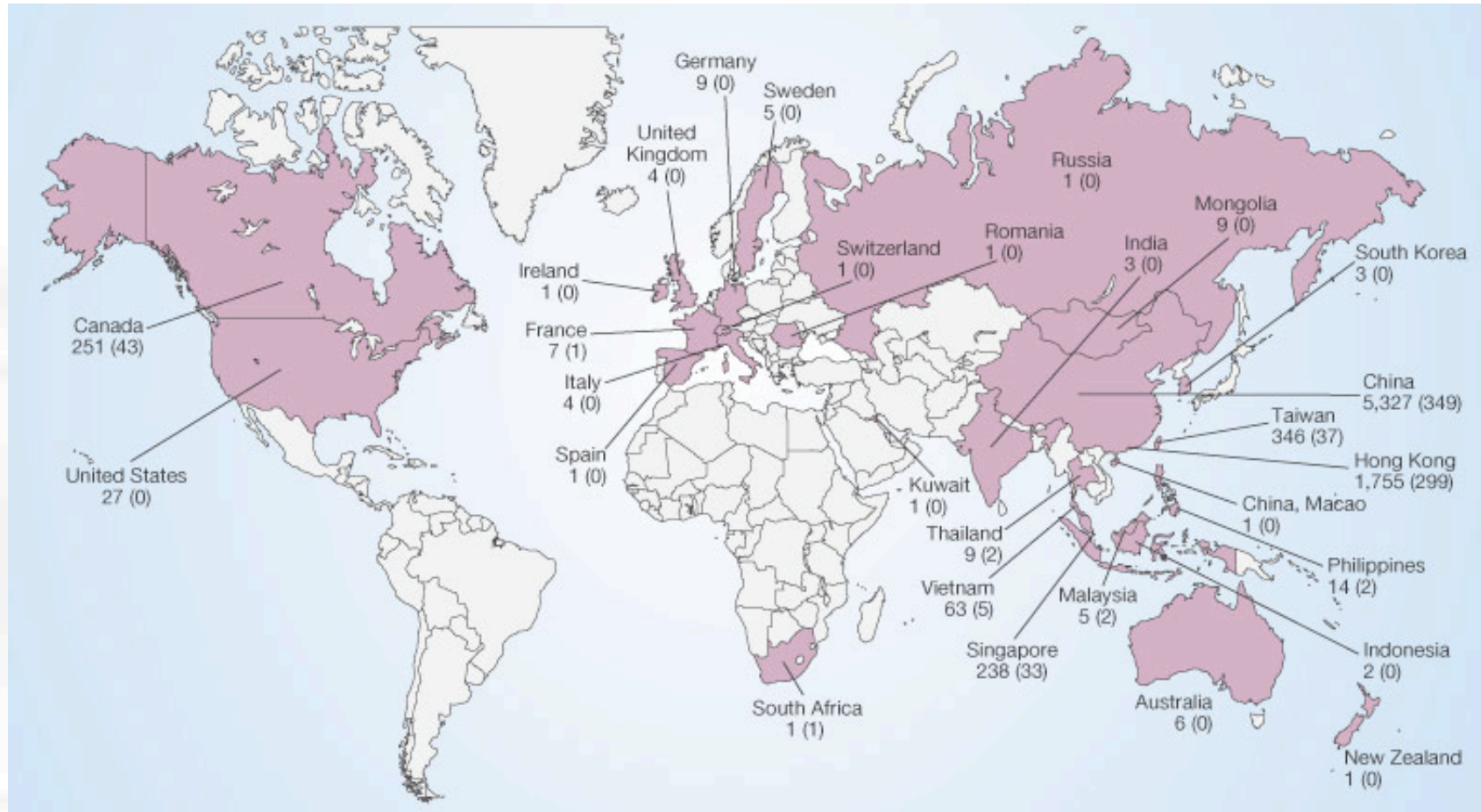
Since 2000, Canada has faced two major infectious disease outbreaks

- 2003 – Severe Acute Respiratory Syndrome (SARS)
- 2009 – H1N1/09 pandemic influenza

SARS

- Respiratory disease first identified in 2003
- Probable zoonotic origin and transmission
- 800 deaths worldwide
- Transmission in health care system

SARS Globally



Source: WHO

SARS Research Timeline

November 16	First case in Guangdong, China
February 26	First cases of unusual pneumonia in Vietnam
March 5	First death in Canada
March 12	WHO issues global alert
April 10	CIHR Institute of Infection and Immunity launches SARS RFP
April 12	Canadian researchers announce sequencing of SARS coronavirus
April 29	SARS Vaccine Initiative (SAVI) launched by BC
April 23	WHO issues travel advisory: Toronto is listed with SARS hot zones
May 15	Results of SARS RFP peer review announced
June 10	Canadian SARS Research Consortium announced
June 17	CIHR launches second SARS research RFA: Public Health and Health Care System Preparedness and Response to SARS, Funding Nov. 2003
July 2	WHO drops Toronto from SARS-affected area list
October 7	Naylor Committee report released
????	Development of vaccine for SARS

SARS in Canada



- Hardest hit country outside of Asia
 - 438 cases
 - 43 deaths
- 42% of cases in health care workers
 - Highest rate in the world
- International travel advisory
 - Major economic implications
- No diagnosis, no treatment, uncertainty as to cause
- Time lag between design and impact of public health measures

Public Health & Research Challenges in Canada



- Canada had limited capacity to coordinate a national public health response to infectious disease outbreaks and other health challenges
- Canadian Institutes of Health Research (CIHR), created in 2000, had no existing mechanism to fund public health research emergencies
- Massive strain on hospitals and public health system

Public Health Research

- Low surge capacity for training and developing international links and exchange
- Difficult to provide contingency funds for rapid research response
- Introduction of new technologies
- Few links between public health and research outcomes
- Time constraints on making evidence-based policy decisions

CIHR Outbreak Research Response

CIHR Institute of Infection and Immunity (CIHR-III) assumed a leadership role and quickly formed research partnerships with stakeholders and public health organizations

- Created Canadian SARS Research Consortium (CSRC) to engage stakeholders and partners
- Launched Request for Proposals in one week, full peer review and funded proposals within 3 weeks

Rapid SARS Research Response

Two models of funding emergency research

- Request for Proposals model used by CIHR-III with quick launch, preferably with partners, open application process, rapid peer review, periodic progress reports
- SARS Accelerated Vaccine Initiative (SAVI) model for providing funding to a qualified leader to mobilize research engaging selected researchers, no open call, limited peer review, periodic progress reports

Lessons Learned



Public Health Coordination



PHAC – created in 2004

Mission: Through research, programs and services, it aims to bring about healthier Canadians, reduced health disparities, and a stronger capacity to deliver on and support public health activities.



OAHPP – created in 2008

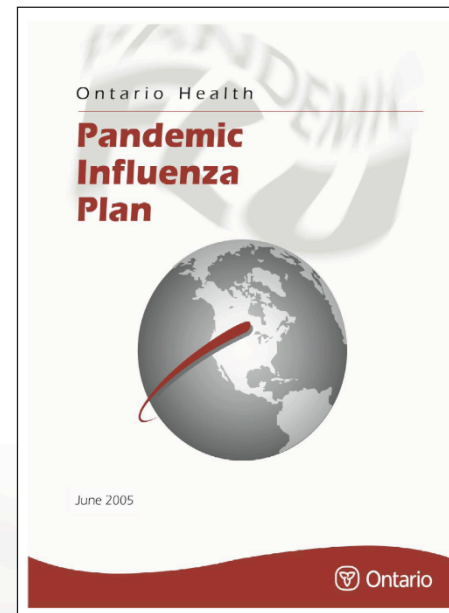
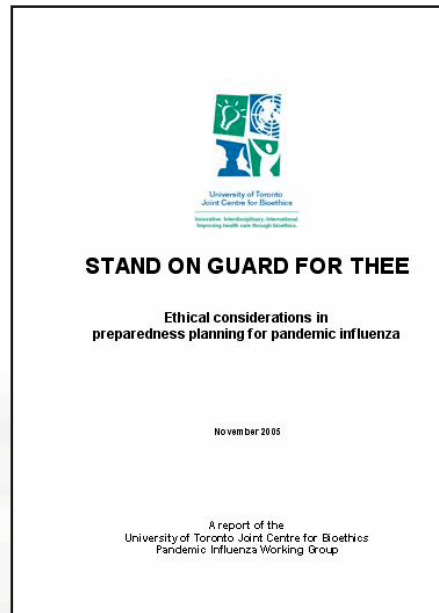
Mission: To support health care providers, the public health system and partner Ministries in making informed decisions and taking informed action to improve the health and security of all Ontarians through the transparent and timely provision of credible scientific advice and practical tools.

Creation of New Knowledge

Research publications starting in 2003

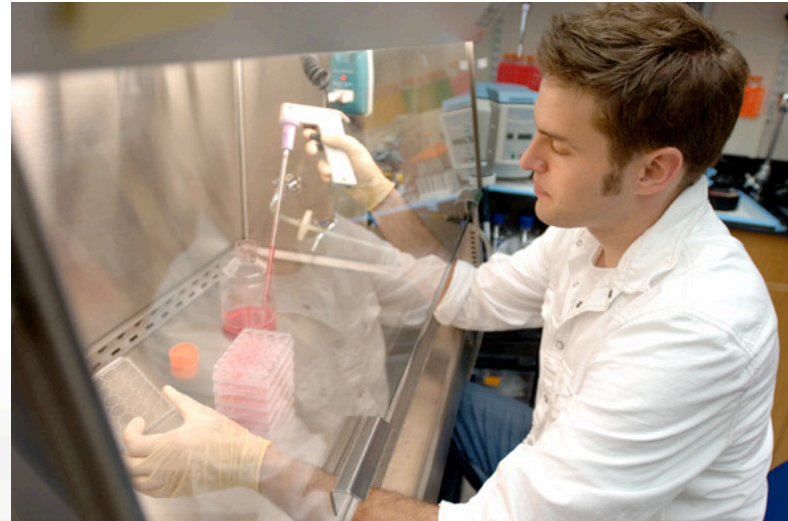
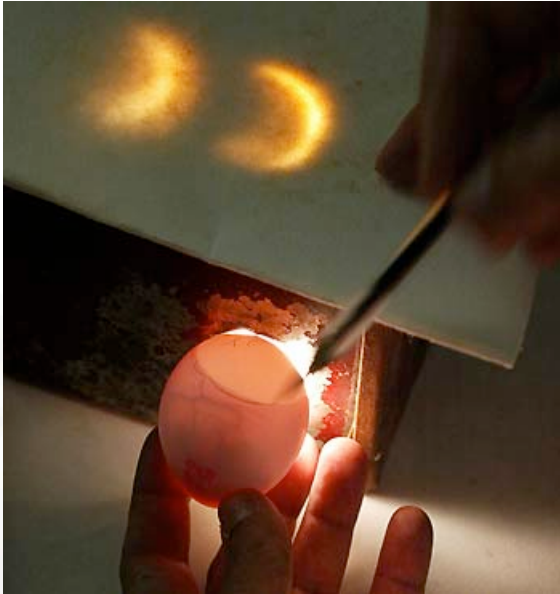
- Majority in clinical medicine & biomedical journals
- High throughput screening assay identified novel antiviral candidate
 - *Biological Chemistry*
“Paper of the Year Award” 2006
 - Led to discovery and adaptation of new hepatitis C protease inhibitors
- Determined structure and catalytic mechanism of SARS peptidase
- New multinational investments in technology
 - Developed new DNA chip on plastic

Informed Decision Making



- Developed as a moral compass to guide difficult decisions that will have to be made in the context of a pandemic
- “Stand on Guard for Thee” adapted by WHO and incorporated into pandemic plans for US and Europe

Build Capacity



- Invested in trainees, experts and new technologies to expand infectious disease research capacity

Frontlines



- Research showed that health care workers experienced less distress and were more willing to work when trained and supported during the SARS outbreak

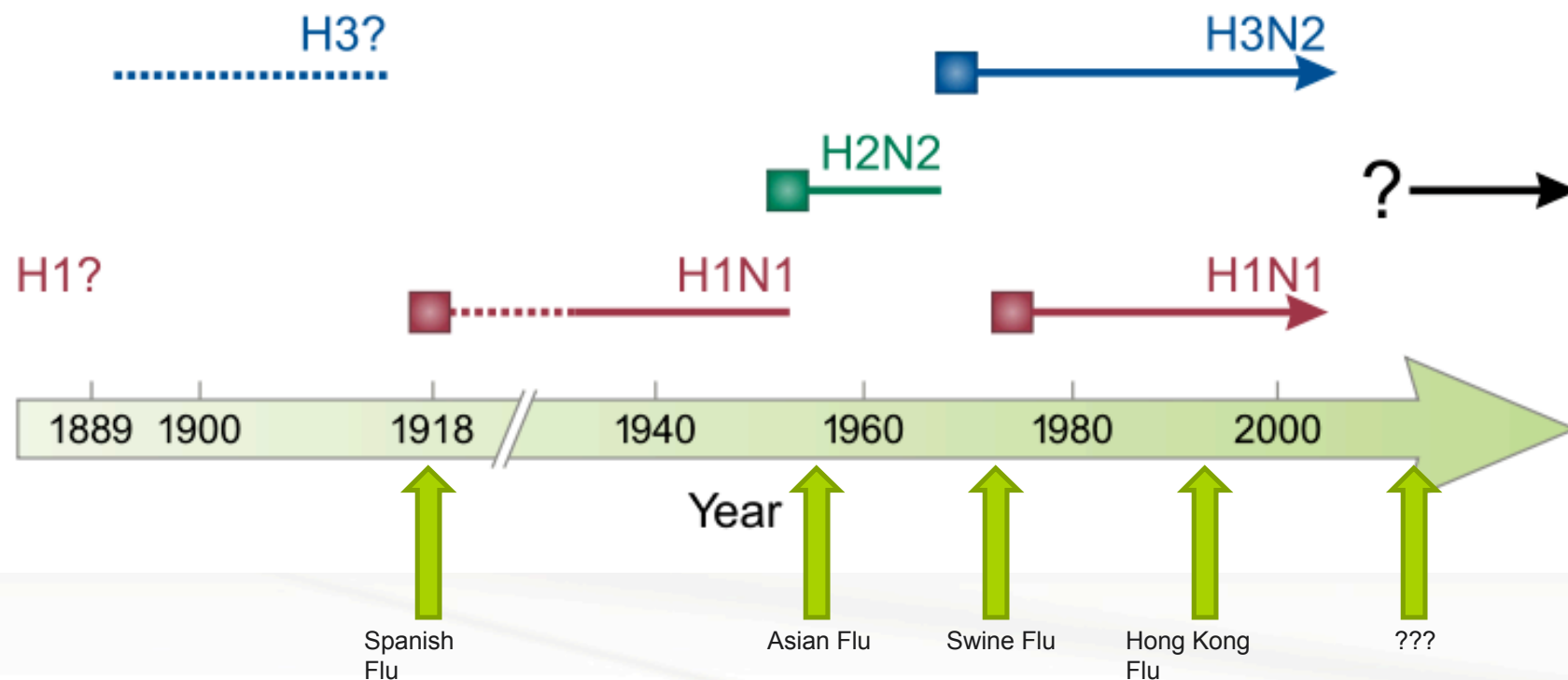
What next?

- Continue to prepare for the unexpected
- Develop strategic research priorities based on review of scientific data
- Work closely with the newly formed PHAC in developing a public health emergency research response plan
- Build research capacity for future outbreaks

“The past is behind, learn from it.
The future is ahead, prepare for
it...” Thomas S. Monson

Impending pandemic?

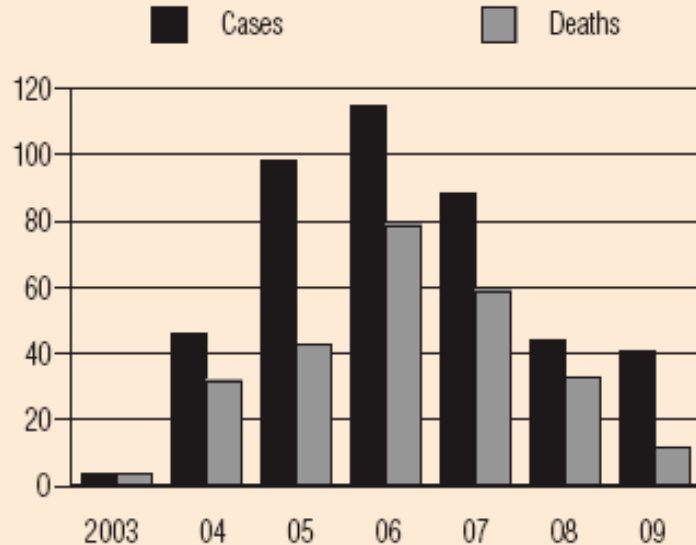
Influenza A virus subtypes in the human population



H5N1 Avian Influenza Concern

Chart 1

Human Cases* and Deaths from H5N1 (Avian) Influenza Reported to the World Health Organization, 2003–09 (July 1, 2009)



*Total number of cases includes number of deaths; WHO reports only laboratory-confirmed cases. All dates refer to onset of illness.

Source: World Health Organization.

2006

- Growing concern about an avian flu outbreak
- Research showed relatively high virulence and death rate with signs of local transmission and possible pandemic potential
- WHO began to coordinate global response to contain avian flu in isolated regions

Source: Ready or Not Effective Pandemic Response.
Conference Board of Canada

Applying Lessons from SARS

Preparing for an avian flu outbreak

- CIHR created the Pandemic Preparedness Strategic Research Initiative (PPSRI)
- Provided national leadership in coordinating pandemic research
- Collaborated and partnered with other national organizations
 - Public Health Agency of Canada
 - Canadian Food Inspection Agency
 - Consulted with Task Group composed of experts conducting pandemic/influenza research
 - Set research priorities and develop relevant funding opportunities
 - Facilitated uptake of research results

Applying Lessons from SARS

Outcomes

- Developed ethical decision-making framework
- Built pandemic-related research capacity
 - Engage trainees, redirect researchers
- Prepared infrastructure that can be applied to future influenza pandemics and infectious disease outbreaks

Canadian Pandemic Influenza Preparedness Plan

Government of Canada in 2006 provided funding to build:

- Public health capacity
- Surveillance capacity
- Research capacity
- Regulatory capacity
- Antiviral stockpile
- Advance market commitment to pandemic vaccine

Pandemic Preparedness Strategic Research Initiative

Goal: Support and build capacity in pandemic influenza research and support uptake of results to those who will use them in pandemic planning and control

- Created by CIHR Institute of Infection and Immunity in 2006 after Influenza Research Priorities Workshop in September 2005
- Originally allocated \$21.5 million over 5 years in 2006 federal budget, contributions from partners and stakeholders has increased available funds to over \$43 million
- Supports research in priority areas as suggested by Task Group to help prevent or mitigate a flu pandemic and help protect the health of Canadians

PPSRI Task Group 2006

Mark Loeb, Chair, McMaster University

epidemiology, clinical trials, health services, population health

Earl Brown, University of Ottawa

influenza virus, viral pathogenesis and genetics

Robert Brunham, University of British Columbia

epidemiology, immunology of infectious diseases, public health, population biology, mathematical modeling

Theresa Tam, Public Health Agency of Canada

influenza, immunization/vaccines, epidemiology, outbreak response, emergency preparedness

Ross Upshur, University of Toronto

epidemiology, primary care research, public health and clinical ethics

PPSRI Research Priorities 2006

- Build capacity for Pandemic response
- Biology and diagnostics of influenza
- Ethics, legal and social issues in an outbreak
- Transmission and prevention of influenza
- Vaccines and immunization for pandemic influenza

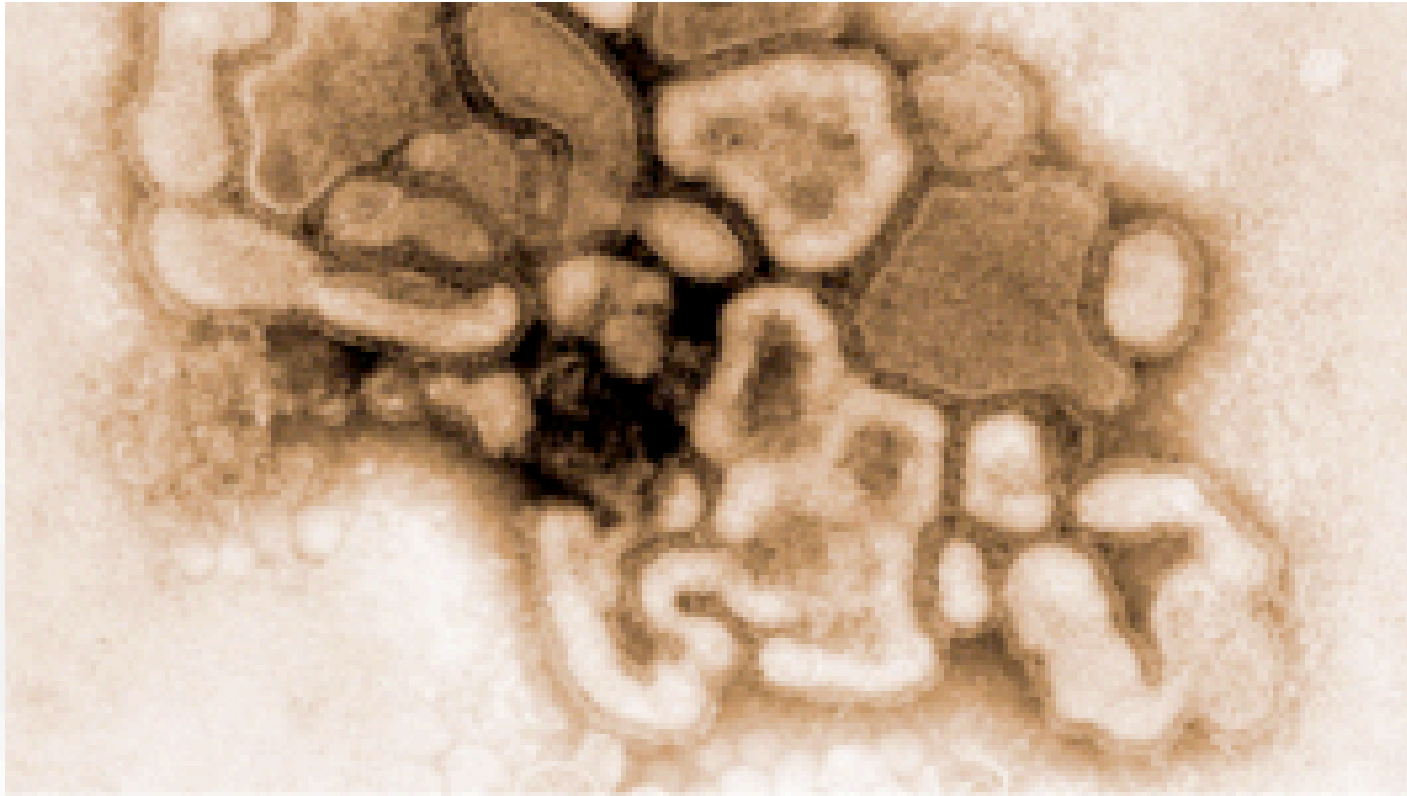
Research Preparedness Outcomes

PPSRI by Numbers	
Research priorities	5
Partners with formal partnership agreements	4
Amount contributed by partners	\$20 million+
Funding opportunities launched	30
Applications received	149
Funded applications	71
NPI supported	53

Infrastructure

- Rapid research response formula developed during SARS outbreak in place for accelerated research funding
 - Identified team leaders for outbreak research
- CIHR formed strong partnerships with national organizations such as PHAC to fund coordinated research
- PPSRI Task Group in place to guide and respond to changes in influenza and pandemic issues
- Application development workshop February 2006, PHAC/CIHR Influenza Research Network begins to organize

H1N1 Influenza Outbreak



H1N1 Influenza Outbreak

- April 2009 first reported deaths in Mexico and the United States



Map shows states and provinces in North America with confirmed swine flu outbreaks



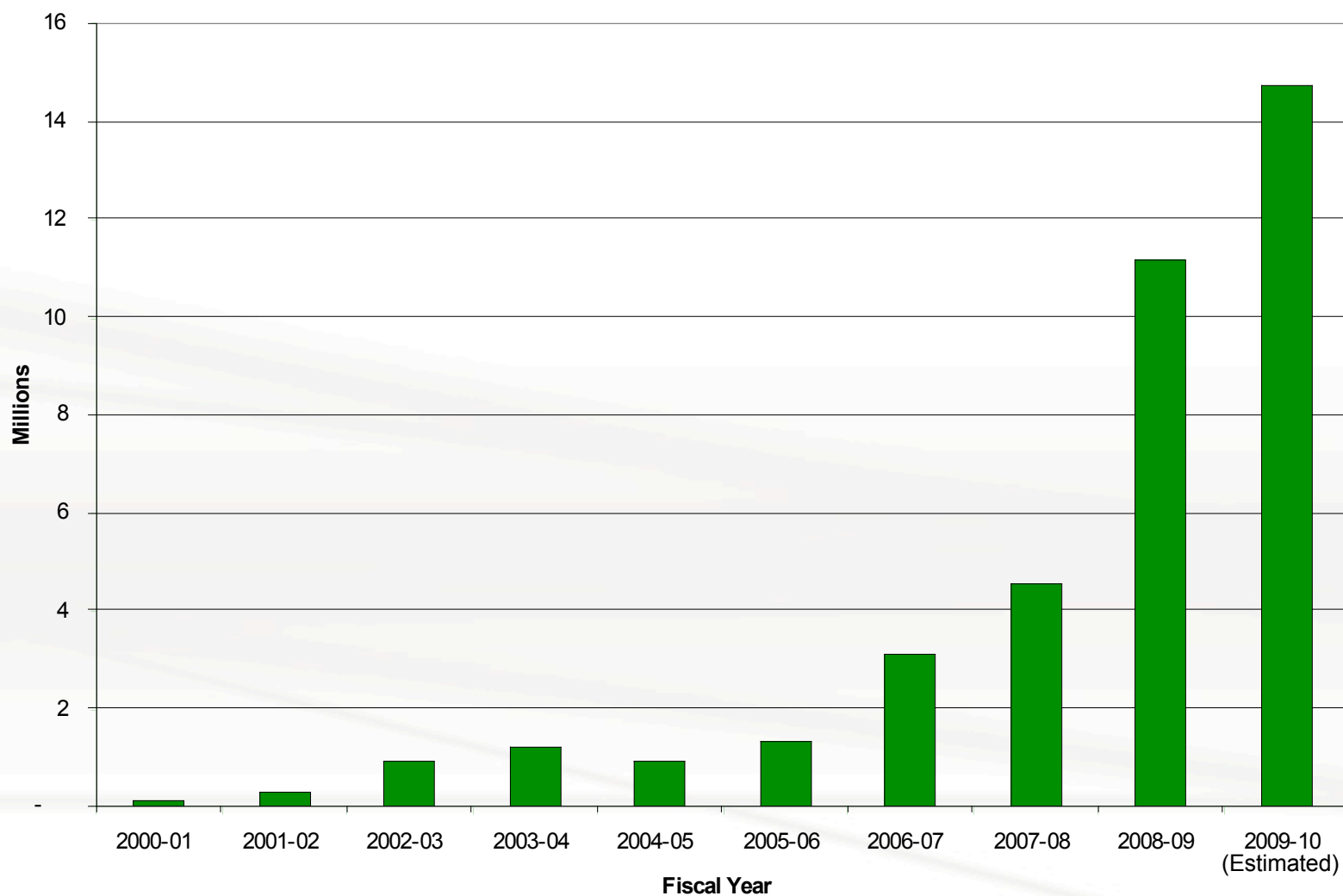
H1N1 Outbreak Timeline

18 March 2009	Mexico begins to pick up cases of influenza-like illness
28 March 2009	Earliest onset date in US
21 April 2009	Two cases in California
23 April 2009	Mexico closes school, limits public crowds
25 April 2009	WHO calls the flu "a public health emergency of international concern"
27 April 2009	Canada reports six cases <ul style="list-style-type: none">➤ 40 confirmed cases in US➤ 26 confirmed cases in Mexico with 7 deaths➤ WHO raises pandemic alert to 4
28 April 2009	Seven countries reporting confirmed cases of H1N1
29 April 2009	WHO raises pandemic alert to 5 <ul style="list-style-type: none">➤ First death outside Mexico
27 April 2009	Identified Outbreak Research Priorities
30 April 2009	Approved funding for IRN
22 May 2009	Approved funding for Outbreak Team Leaders
11 June 2009	WHO declares Phase 6 global pandemic flu alert
6 July 2009	94,512 confirmed cases of H1N1; 429 deaths worldwide
6 August 2009	177,457 confirmed cases of H1N1; 1462 deaths worldwide (note that countries are no longer required to test and report individual cases)

The Virus

- Influenza A/H1N1 causes seasonal outbreaks of flu in humans on a regular basis
- This virus strain is a new subtype that has never been detected before in swine or humans
- It contains genetic material from
 - North American swine influenza
 - Asian and European swine influenza
 - North American avian influenza
 - Human influenza A

CIHR Investment in Pandemic and Influenza-related Research



PHAC/CIHR Influenza Research Network (PCIRN)

Focused on vaccine evaluation

- \$10.8 million over 3 years starting April 1, 2009
- 80 researchers from 30 academic and public health institutions across Canada
- Rapid clinical trials with pandemic vaccine
- Rapid implementation of immunization programs
- Assess vaccine
 - safety
 - effectiveness
 - coverage
- Required to be able to shift its focus rapidly in the event of a pandemic and to collect and communicate data in an outbreak situation

PPSRI Outbreak Strategy

- Meet regularly with Task Group to review research strategies and respond to evolving issues
- Request updates on funded projects, outbreak research plans and results for KT
- Organize teleconferences on priority areas to facilitate research collaboration, coordination and sharing of specimens/reagents
- Support outbreak research
 - Supplement PCIRN funding to accelerate activities
 - Expedited peer review of team leaders brief project summary and budget for outbreak
- Respond to media requests

H1N1 Outbreak Priorities

Research

- Epidemiology, natural history
- Biology of the virus and antivirals
- Immune response
- Vaccine development and evaluation
- Ethical issues
- Health services and policy research

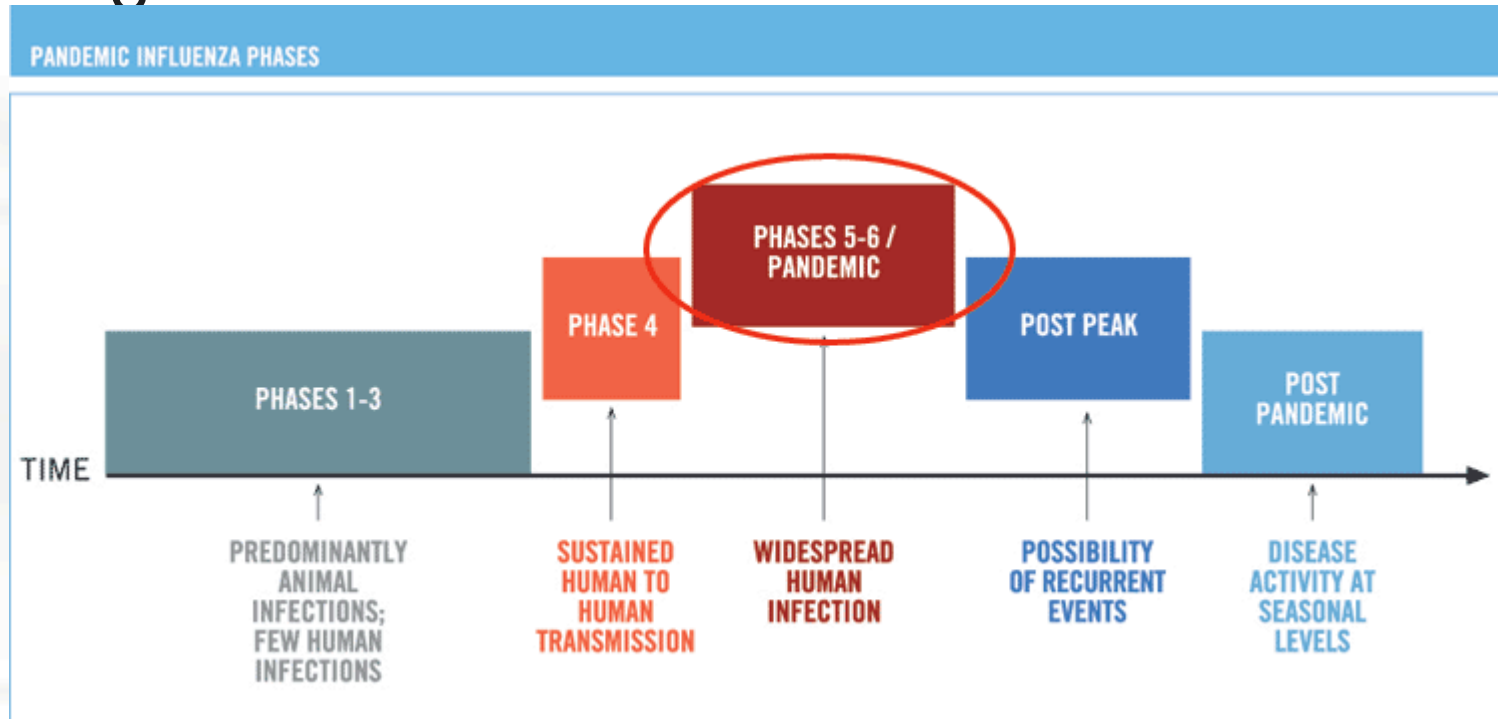
Facilitation

- Sample and reagent sharing
- Networking of research groups
- Researcher/research user collaboration

H1N1 Pandemic

June 11, 2009

- WHO raises pandemic alert level to Phase 6



Responding to a Pandemic

- Focus the research community on conducting rapid pandemic research
- Facilitate current pandemic research
 - Reagent, sample and information sharing
 - Networking and collaborations among researchers and stakeholders
 - Catalyst grants to mobilize research teams
- Provide updates to the research community and the media

Research conducted during an outbreak is essential to effective response measures and ultimate control of the epidemic

Seasonal nature of these diseases means that research capacity must be poised and ready to respond as cases appear

Requirement for a profoundly multidisciplinary nature of effective research targeting an outbreak or epidemic

- Epidemiology, Biostatistics, Mathematics
- Medical microbiology, Clinical Medicine. Laboratory Science
- Health systems research, Social Sciences, Health policy
- Effective Communications

Canadian Pandemic Preparedness Meeting:



H1N1 Outbreak Research Response



Health Research Foundation
H R F R&D F R S
Fondation pour la recherche en santé


CIHR IRSC
Canadian Institutes of Health Research
Instituts de recherche en santé du Canada



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

H1N1 Outbreak Research Response Meeting

July 8, 2009

- Toronto, Ontario
- Over 180 influenza and pandemic experts

Goals

- Facilitate information sharing among influenza experts
- Network and develop collaborations – focus Canadian pandemic research response
- Discuss research progress and next steps

Fall 2009 H1N1 Vaccine Strategy

- Testing and production of vaccine
 - GlaxoSmithKline
- Regulatory approval of vaccine
 - Health Canada
- Safety and efficacy of vaccine
 - PCIRN
- Delivery of vaccine
 - Provincial and federal governments
- Communication issues relating to vaccines
 - all sectors

Better prepared for H1N1

- Coordinated a national research response to the H1N1 pandemic
- Accelerated funding cycles to provide emergency funds following the outbreak
- Built research capacity
 - Engaged >150 trainees in pandemic and influenza research
- Integrated public health organizations into setting research priorities
- Facilitated research uptake with annual meetings and fostering collaboration
- PHAC/CIHR Influenza Research Network evaluating pandemic vaccine

Looking Back, Moving Forward

- Ready to act
 - Unexpected disease outbreaks like SARS revealed where we needed to improve
 - We were better prepared for H1N1
 - Will be ready for future infectious disease outbreaks
- Research response infrastructure can be adapted to apply to other infectious disease outbreaks
 - Consult with relevant experts and develop priorities for research
 - Build research capacity in the area
 - Accelerate funding cycles and form partnerships in the event of an outbreak

Further Information

1. **Singh B.** Innovation and challenges in funding rapid research responses to emerging infectious diseases: Lessons learned from the outbreak of severe acute respiratory syndrome (**SARS**).

Canadian J Infect Dis Med Microbiol 15:167-170; 2004.

2. French MB, Loeb MB, Richardson C, **Singh B.** Research preparedness paves the way to respond to pandemic **H1N1 2009 influenza virus**. *Canadian J Infect Dis Med Microbiol* 20: (3); 2009.