

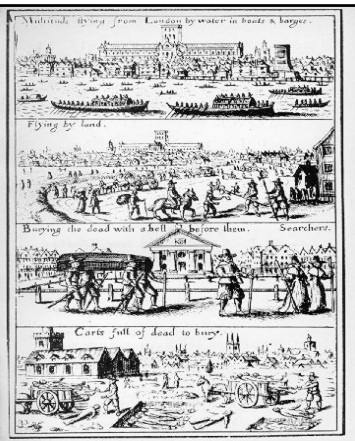


# Emerging Threats to Public Health

## Dr. Paul Sockett, Public Health Agency of Canada

### A Webber Training Teleclass

Organised (and disorganised) response to "Plague"



...”Of lessening ye Plague of London”  
William Petty, 7<sup>th</sup> October 1667

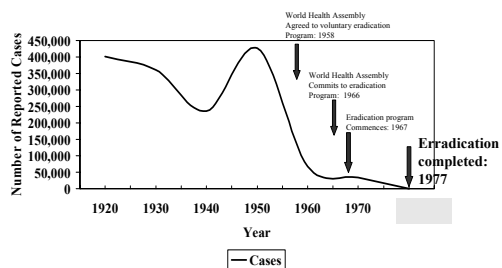
“given the value of an individual and the cost of transporting people outside of London and caring for them for three months, thus increasing the probability of survival, every pound expended would yield a return of £84.”

#### Distribution of Cholera cases: London 1849



John Snow's map of cholera deaths, originally published in 1855 in his book *On the Mode of Communication of Cholera*, led Snow to propose that cholera is a water-borne illness.

#### Number of Reported Smallpox Cases Worldwide, 1920-1979



Source: The Global Eradication of Smallpox: Final Report of the Global Commission for the Certification of Smallpox Eradication, WHO, 1980

#### Convergence of Factors Leading to Emerging Public Health Threats (19<sup>th</sup> – 20<sup>th</sup> Centuries)

- Increased size of the population
- Increased concentration of the population in urban settings, and the rates of that increase.
- Poorly planned and regulated building of homes leading to crowding and poor living conditions
- Increased poverty in many urban concentrations
- Poorly regulated working conditions
- Increased international trade

#### Early Economic Assessment of Public Health

- Calkins (1891) commenting on the value of lives saved (\$650m) compared with costs of sanitary improvements (\$584m) between 1880 and 1890: *“Thus in ten years the country has more than regained the sum spent for sanitary improvements... and in this calculation nothing figures for maladies avoided... spared grief, better health and happier life.”*
- Chave (1980s) commenting on Chadwick’s promotion of the MOH... *“The principal reason in Chadwick’s mind in bringing the MOH to birth was not humanitarian, but economy, because it promised to be cost effective.”*

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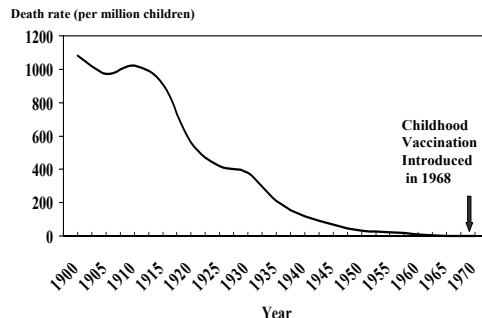
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#### Convergence of Factors Leading to the Public Health Revolution (19<sup>th</sup>-20<sup>th</sup> Centuries)

- Realization that specific preventative measures could be effectively applied to protect populations
- Growing understanding of the microbial cause of disease and the link between disease and poverty
- Systematic collection of population mortality and morbidity statistics
- Economic imperatives to increase the life expectancy of the working population and maintain the health of the military
- Political accountability

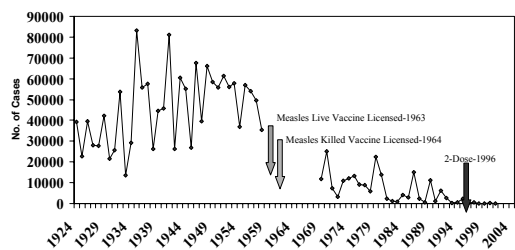
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#### Measles: Approximate Death rates per million in children under age 15 England and Wales 1900 to 1970



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#### Measles Nationally Reported Cases, Canada, 1924-2001



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#### Public Health Mistakes

- To under-estimate and under-value the impact of public health approaches leading to a comparatively greater focus on individual health care delivery
- To assume that, in our “developed” society, the impact of infectious agents is contained

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#### “Emerging” Diseases of the late 20<sup>th</sup> Century

1970s	1980s	1990s
Rotavirus	HTLV I, II	Guanarito virus
Parvovirus B19	HIV (AIDS)	Hantavirus
Ebola virus	Human Herpesvirus –6	Sabiá virus
Hantaanvirus	Hepatitis C	Influenza viruses
<i>Campylobacter</i> sp	Staphylococcal toxin	<i>Vibrio cholerae</i> O139
<i>Legionella</i> sp	<i>E. coli</i> O157:H7	<i>Bartonella henselae</i>
	<i>Borrelia burgdorferi</i>	
<i>Cryptosporidium</i>	<i>Helicobacter pylori</i>	vCJD
	<i>Ehrlichia chaffeensis</i>	
		<i>Cyclospora</i> sp

Plus numerous multiple antibiotic resistant strains (e.g. staphylococcus aureus, tuberculosis, salmonella, etc).

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#### Key Areas of Threats to Public Health

- The microbe, plus
- Human Environment
- Physical Environment
- Technological Environment
- Political/Public Sector Environment

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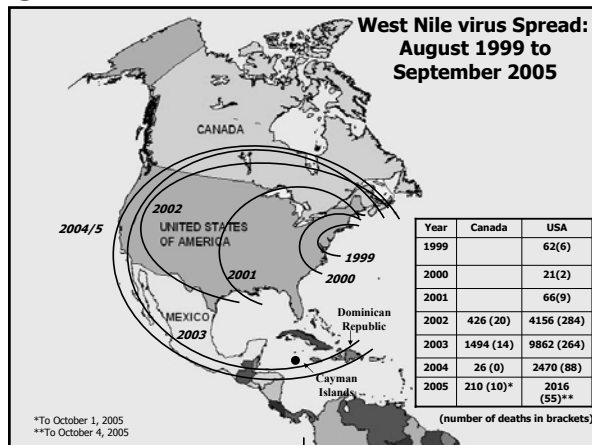
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#### The Microbe: Mechanisms for Microbial “Emergence”

(Microbial Adaptation and Change)

- Recognized disease – new environment
- Reemergence or reintroduction of previously controlled disease
- Diseases linked to a specific artificial environment
- Greater exposure to animal reservoirs
- Linkage between a known microorganism and a specific pathology
- Genetic recombination/selective pressures

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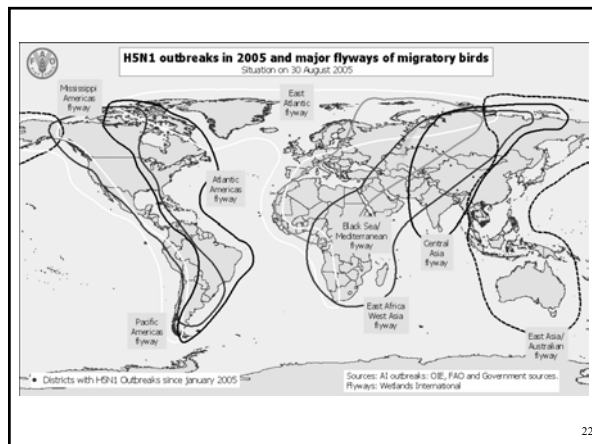


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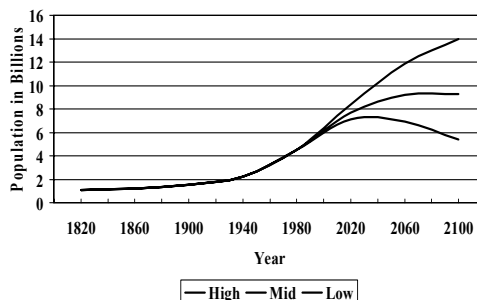
#### Human Environment: Social and Demographic Change

##### Five Factors:

- Population growth
- Population age
- Population movement
- Population prosperity
- Population education

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#### World Population Growth Projections



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#### Human Environment: Population of Canada Proportionate Distribution by Age Groups for Census Years: 1951 to 2001

Year	Total (millions)	Age Groups (Years)			
		0-14	15-34	35-59	60+
1951	14.009	30	31	27	12
1961	18.238	34	28	27	11
1971	21.568	30	32	27	11
1981	24.900	22	37	27	13
1991	28.753	20	32	31	16
2001	31.002	19	28	37	17

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#### Human Environment: International Contact and Commerce

- International travel
  - Tourism
  - Business
- Immigration
  - Region of birth
- Globalization of food supply and other commodities of biological origin

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#### Human Environment: Significant Human Pathogens Imported in North America in the last Six Years

West Nile virus	(imported mosquito or bird)
SARS	(traveller from Hong Kong)
Monkeypox	(imported African rodents)
Cyclospora cayetensis	(imported soft fruit from S. America)
Various Salmonella spp.	(imported fruits, fruit juice, salads, nuts, etc).

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#### Factors Influencing the Smallpox Epidemic in Montreal (1885)

- Index case arrived from another country (USA) by means of mass transportation (train)
- Initial focus of spread was in a hospital environment
- Containment in the community was hampered by lack of public cooperation and compliance with quarantine orders
- Insufficient public health and infectious disease infrastructure to cope with the epidemic
- Controversy over the safety of the vaccine led to suspension of its use at a critical point
- A large proportion of children were unvaccinated, and anti-vaccination hysteria resulted from poor communication on adverse reactions.

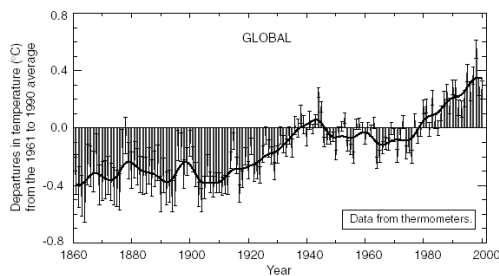
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#### Human Environment: Immigrant Population of Canada Region of Birth and Period of Immigration (% Distribution)

Place of Birth	Before 1961	1961-1971	1971-1980	1981-1990	1991-2001
USA	3	6	7	4	3
Central/ S. America and Caribbean	1	8	16	16	11
Europe	73	69	36	26	19
Africa	<1	3	6	6	8
W. Central Asia and M. East	<1	2	3	7	9
Other Asia	2	10	30	40	49
Oceania and Other	<1	1	1	1	1

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#### Climate Change: Global Temperature Increase

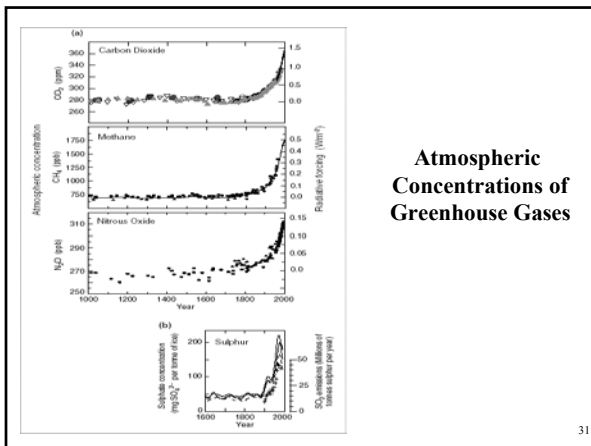


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### Physical Environment: Climate Change Potential Effects

- Change in the range of disease reservoirs and vectors (altered vector migration patterns)
- Introduced species can establish and become endemic
- Extreme weather events/natural disasters resulting in re-emergence of “disaster” diseases (typhoid, cholera, dysentery, typhus, TB).

### Physical Environment: Climate Change Infectious Disease Priorities

Diseases which are possible priorities for Canada

- Diseases we have now that could contribute to increased burden of illness (enteric and waterborne diseases)
- Diseases we have now that are severe, or have the potential to create a large burden of illness (Lyme disease, WNv)
- Diseases we don’t have yet, but that occur nearby (Eastern Equine Encephalitis, St Louis Encephalitis)
- Diseases that are completely exotic but which we might see emerge or re-emerge here in focal or more widespread occurrences (Malaria, Dengue)
- Surprises!!

### Physical Environment: Economic Development and Land Use

- Encroachment
- Agriculture
  - Husbandry practices
  - Land management
- Water source protection
  - Dams and droughts
  - Deforestation/re-forestation
- Pollution

### Technological Environment: Technology and Industry

- Medical technology
  - Tissue and organ transplantation
  - Laboratory diagnostics
  - Widespread use of anti-microbial drugs
- Developments in Industrial/Agricultural practices
  - New food processing technologies (scales of production)
  - Air conditioning: a micro-environment for Legionnaire’s disease
  - Occupational exposure

### Political/Public Sector Environment

- Political/public perception of the importance of Public Health
  - Health care vs public health
  - All it takes is Walkerton, North Battleford, SARS, bioterrorism...
- Public Health infrastructure
  - Resources (people, \$, technology)
  - Legal frameworks
  - Quality of data
- International perspective
  - Contribution to international analysis of risk

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#### Focus for the Future

- Research
  - Mechanisms of emergence
  - Climate impacts
  - Wildlife reservoirs
- Resources
  - Recognition of the breadth of public health expertise
  - National plan for development of human resources (Naylor) – enhance training Public Health Planning and Evaluation
  - Financial (Naylor)
- Surveillance
  - Clear rationales for surveillance
  - Networks for surveillance
  - Innovation in analysis

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#### November 2005 Teleclasses

For more information, refer to  
[www.webbertraining.com/schedule.cfm](http://www.webbertraining.com/schedule.cfm)

**November 8** – Benefits of CIC Certification and How to Become Certified

**November 10** – Infection Control in Doctors' Offices

**November 15** – UK Teleclass – ESBL Management in Healthcare Facilities  
(Rebroadcast on New York Bridge Line)

**November 17** – Bloodborne Pathogen Control

**Questions? Contact Paul Webber [paul@webbertraining.com](mailto:paul@webbertraining.com)**