Role of Mathematical Modeling in Public Health Services

Larry Svenson
Surveillance and Assessment Branch
Alberta Health

May 24, 2012
Summer School on Mathematical Modeling of Infectious Diseases
University of Alberta
Public Health

An organized activity of society to promote, protect, and improve, and when necessary, restore the health of individuals, specified groups, or the entire population. It is a combination of sciences, skills, and values that function through collective societal activities and involve programs, services, and institutions aimed at protecting and improving the health of all people.

- Last, JM. 2007; p. 306
Epidemiology

The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems.

J. Last (1995)
Functions of Epidemiology

• To discover the agent, host and environmental factors that affect health in order to provide the scientific basis for the prevention of disease and injury and the promotion of health.

• To determine the relative importance of causes of illness, disability and death in order to establish priorities for research and action.

• To identify those sections of the population which have the greatest risk from specific causes of ill health, in order that the indicated action may be directed appropriately.

• To evaluate the effectiveness of health programs and services in improving the health of the population.
Epidemiology and Health Policy

• Measuring population health
• Measuring health burden and health needs
• Assessing causation
• Assessing impact of interventions
• Informing disease control
• Modeling disease dynamics
• Informing priority setting
• Evaluation of actions
Definition of Policy

• Those public issues identified for attention by the government, and the courses of action that are taken to address them (e.g., legislation, regulation, resource allocation)

Nutbeam 2003
Public Health Ethical Tests

<table>
<thead>
<tr>
<th>Question</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Could the policy cause harmful outcomes? What?</td>
<td>Non-maleficence</td>
</tr>
<tr>
<td>Could the policy cause good outcomes? What?</td>
<td>Beneficence</td>
</tr>
<tr>
<td>Is it fair?</td>
<td>Social Justice</td>
</tr>
<tr>
<td>Does it allow people to exercise choice?</td>
<td>Autonomy</td>
</tr>
</tbody>
</table>

• Not always congruent. Some would argue “Rarely are all congruent, requires trade-off
Public Health Surveillance – The Basics

Public Health Surveillance is the ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination...to those who need to know.

CDC Surveillance Update (1988)
Public Health Surveillance – Purposes

• Estimate the burden of a health problem
• Determine the distribution of the event
• Portray the natural history of disease
• Detect outbreaks and epidemics
• Stimulate research
• Monitor changes in disease occurrence
• Detect changes in health practices
• Facilitate planning
Surveillance Framework

Period of Susceptibility
- At Risk
- Exposure / Trigger

Incubation / Latency
- Disease Onset
- Symptom Onset

Period of Clinical Disease
- Diagnosis
- Treatment / Management
- Resolution

Timeline
Different Objectives, Different Data, Different Methods

Epidemic Intelligence
- Early warning information
- Epidemic response
- Control activities
- Program Indicators
- Program Monitoring

Health Status Monitoring
- Health indicators
- Health Policy
- Resource allocation
- Administrative data
- System Monitoring
Surveillance
“you see what you look at”

- Exposed
- Infected
- Symptoms
- Seek Medical Care
- Pos. Result
- Report

- Assessments
- Seroprevalence
- Syndromic Surveillance
- Clinically-Based Surveillance
- Laboratory Based Surveillance
Setting the Context

The purpose of most investigations in community medicine, and in the health field generally, is the collection of information that will provide a basis for action, whether immediately or in the long run.

J.H. Abramson, 1984
Hipprocrates

Whoever wishes to investigate medicine properly, should proceed thus:
…when one comes into a city to which he is a stranger, he ought to consider its situation,... and the mode in which the inhabitants live, and what are their pursuits, whether they are fond of drinking and eating to excess, and given to indolence, or are fond of exercise and labor, and not given to excess in eating and drinking.

Establish Purpose for Prioritizing Process

Congruence with Health System Principles (e.g. Canada Health Act)

Assess Evidence
- Epidemiologic Information (e.g. population health status, incidence, prevalence, mortality)
- Health Services Research (e.g. cost effectiveness, efficacy, health economics)

Incorporate Values
- Social, Political & Ethical Values
- Legislation & Policy

Priorities

Strategies development and deployment
Models in Public Health – Purpose

• A model can be viewed as a simplification of a complex reality used for:
  – Description
  – Prediction
  – Causal Analysis
Use of Models in the Health System: Examples

- Infectious Disease Prevention and Control
- Non-Communicable Diseases
- Population Projections
- Disease Projections
- Economic Impact
- Role of Risk Factors and Determinants
- Health System Planning
- Impact of Interventions
Data Sources
Selected Information Systems

- Fee-for-Service
- Inpatient
- Ambulatory Care
- Central Stakeholder Registry
- Communicable Disease Reporting
- Vital Statistics
- Screening Programs
- Pharmacy Information Network
- Immunization
- Pharmacy
- Cancer Registry
Percent of the Population Having One or More Visits, by Age and Sex, to a General Practitioner, 2009/2010
Mean Number of Visits to General Practitioners, by Age and Sex, 2009/2010
Comparing Data Sources – Example

- Alberta maintains the Communicable Disease Reporting System and the Supplemental Enhanced Service Event (fee-for-service) information systems
- Both have diagnostic information that could be used
- We compared these systems for the surveillance of enteric infections associated with *Escherichia coli* O157:H7

Weekly Differences in the Proportion of Cases Identified by Two Data Sources

Clinician’s Fallacy

An inaccurate assessment of risk factors, symptoms, and diseases occurs as a result of studying a minority of cases (e.g. assuming one’s practice is indicative of the overall population)
Impacts of Sensitivity, Specificity, and Positive Predictive Value

**Sensitivity** – measures the proportion of actual positives which are correctly identified as such
  - At the case level this is the proportion of cases detected by the system
  - At the system level it is the ability of the system to detect epidemics

**Specificity** – the number of non-diseased people correctly classified as not having the disease

**Positive Predictive Value** – is the proportion of cases testing positive who are correctly diagnosed

**Negative Predictive Value** – is the proportion of cases testing negative who are truly free of disease
### 2 x 2 Table

<table>
<thead>
<tr>
<th></th>
<th>Gold Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td><strong>Positive</strong></td>
<td>True Positive</td>
</tr>
<tr>
<td><strong>Negative</strong></td>
<td>False Negative</td>
</tr>
</tbody>
</table>

- PPV = \( \frac{a}{a+b} \)
- NPV = \( \frac{d}{c+d} \)
- Sensitivity (Sen) = \( \frac{a}{a+c} \)
- Specificity (Spec) = \( \frac{d}{b+d} \)
Example

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>5%</td>
</tr>
<tr>
<td>Population Size</td>
<td>2,000</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>85%</td>
</tr>
<tr>
<td>Specificity</td>
<td>99%</td>
</tr>
</tbody>
</table>
Assuming a population of 2,000 people

- Number of Prevalence Cases is the number of people in the population (2,000) multiplied by the prevalence (5%),

\[ 2000 \times 0.05 = 100 \text{ cases of disease} \]

- Knowing the Sensitivity is 85%

  \[ \text{Cell A} = 100 \times 0.85 = 85 \]
  \[ \text{Cell C} = 100 - 85 = 15 \]

- If there are 100 cases, then 1,900 patients do not have the disease.

  \[ 1900 \times 0.99 = 1,881 \text{ patients accurately screened as negative} \]  
  (Cell D)

- Cell B is the number of false positives, \[ 1900 - 1881 = 19 \]
## Gold Standard

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Positive</th>
<th>Negative</th>
<th>PPV = ( \frac{a}{a+b} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>85 (a)</td>
<td>19 (b)</td>
<td>( \frac{85}{85+19} = 81.7% )</td>
</tr>
<tr>
<td>Negative</td>
<td>15 (c)</td>
<td>1,881 (d)</td>
<td>NPV = ( \frac{d}{c+d} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( \frac{1,881}{15+1,881} = 99.2% )</td>
</tr>
</tbody>
</table>

Sen = \( \frac{a}{a+c} \) = 85%

Spec = \( \frac{d}{b+d} \) = 99%
Example

Prevalence: 1%
Population Size: 2,000
Sensitivity: 85%
Specificity: 99%

Number of Prevalence Cases: $2,000 \times 0.01 = 20$

Cell A: $20 \times 0.85 = 19.2$
Cell C: $20 - 19.2 = 0.8$
Cell D: $1980 \times 0.99 = 1,960.2$
Cell B: $1980 - 1,960.2 = 19.8$
### Gold Standard

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>19 (a)</td>
<td>20 (b)</td>
</tr>
<tr>
<td>Negative</td>
<td>1 (c)</td>
<td>1,960 (d)</td>
</tr>
</tbody>
</table>

- **Positive**
  - PPV = \( \frac{a}{a+b} \)
  - \( \frac{19}{19+20} = 48.7\% \)

- **Negative**
  - NPV = \( \frac{d}{c+d} \)
  - \( \frac{1,980}{1,960+1,980} = 99.9\% \)

|       | 20       | 1,980    | 2,000    |
Pandemic Influenza
Importance of Influenza Surveillance

- Rapidity with which epidemics evolve
- Widespread morbidity and seriousness of the associated complications (e.g. pneumonia)
- Changes in surface proteins can lead to pandemics
Major Influenza Historical Events

- **1918 H1N1 (“Spanish Flu”)**
  - Resulted in 20-50 million deaths worldwide

- **1957/58 H2N2 (“Asian Flu”)**
  - Resulted in approximately 1 million deaths worldwide
  - Has not circulated since 1968
  - Lack of natural immunity in those under 40 years of age

- **1968/69 H3N2 (“Hong Kong Flu”)**
  - Resulted in approximately 1 million deaths worldwide
1918 “Spanish Influenza” (H1N1)

- Considered the worst natural calamity of the 20th century
- Estimated worldwide mortality between 20 and 40 million (some estimates up to 100 million)
- Came in three waves
- Initial spring wave in the spring (March) of 1918 appeared to cause illness at the same rate as seasonal influenza
- The second wave came in the fall and caused widespread disease between September and November 1918
  - Public health measures were implemented – school and church closures, restricting public gatherings, and discouraging social interactions
- The third wave came early in 1919
- Death due to pneumonia was the defining feature in the severe presentations
1976 “Swine Flu” (H1N1)

- In January 1976, four recruits at Fort Dix in New Jersey were hospitalized with one dying
- Concerns were raised given the recruits were young and healthy
- Events resulted in concerns that this would be the start of a pandemic similar to 1918
- A decision was made to immunize all Americans
- Within 10 weeks over 45 million Americans had been immunized
- Public confidence was shaken when reports of three elderly deaths following immunization occurred in Pittsburgh
- Reports were received that 1 per 100,000 individuals receiving the vaccine developed Guillain-Barré Syndrome (GBS). The expected rate was 1 per 1,000,000.
1976 “Swine Flu” (H1N1)

Lessons Learned

• Importance of communication to the public
• Long-term need to preserve credibility
• Monitoring of vaccine safety and adjusting strategies based on evidence
Alberta’s Response to Pandemic (H1N1) 2009– Goals and Objectives

- Control spread of disease
- Minimize serious illness or death
- Minimize societal disruption
- Demonstrate efficient and effective use of public resources during response
- Expedite recovery
Alberta’s Response to Pandemic (H1N1) 2009 – Planning Assumptions

- Severity of the pandemic will remain moderate
- Most Albertans will experience mild symptoms
- Most Albertans will make a rapid and full recovery without hospitalization or medical care
- Health care systems will be able to cope
- A sufficient number of immunizers will be available
U.S. Recommendations

• “The Working Group is concerned that uncertainty about the course of the 2009-H1N1 pandemic may be hampering planning. While uncertainty is inherent in pandemics, planning activities may be aided by development of a limited number of specific, shared scenarios that describe the possible evolution of the pandemic.” (p. 15)

• Scenario components:
  – Timing and magnitude of the fall epidemic
  – Peak burden on primary care providers, emergency rooms, hospital admissions, and ICUs
  – Number of doses and timing of vaccine availability
  – Dosing requirements and efficacy of vaccine
  – Efficacy and supply of antiviral drugs and medical material
<table>
<thead>
<tr>
<th>Table 3-1: A Possible (Not Predictive) Scenario to Help Plan for the Fall Resurgence of 2009-H1N1 Influenza in the United States</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak incidence date (unmitigated)</strong></td>
</tr>
<tr>
<td><strong>Peak incidence of symptomatic disease</strong></td>
</tr>
<tr>
<td><strong>Percent of U.S. population (and approximate numbers) assuming no change in virus</strong></td>
</tr>
<tr>
<td>Infected (indicated by seroconversions, with or without symptoms)</td>
</tr>
<tr>
<td>Symptomatic</td>
</tr>
<tr>
<td>Needing medical attention</td>
</tr>
<tr>
<td>Needing hospital care</td>
</tr>
<tr>
<td>Needing Intensive Care Unit (ICU) facilities</td>
</tr>
<tr>
<td>Deaths</td>
</tr>
<tr>
<td>Peak occupancy of ICU beds due to 2009-H1N1</td>
</tr>
<tr>
<td>Peak occupancy of hospital beds due to 2009-H1N1</td>
</tr>
<tr>
<td>High-risk groups for death or hospitalization</td>
</tr>
</tbody>
</table>

Source: President’s Council of Advisors on Science and Technology, 2009
Timeline of Key Influenza A(H1N1)pdm09 Events

- **April 24, 2009**: WHO declares a Public Health Emergency of International Concern (PHEIC)
- **April 25, 2009**: First cases reported in Canada
- **April 27, 2009**: USA = 40 confirmed cases, no deaths; Mexico = 26 confirmed cases, 7 deaths; Canada = 6 cases, no deaths
- **April 28, 2009**: First positive case identified in Alberta
- **April 29, 2009**: WHO moves to pandemic alert phase 5
Timeline of Key Influenza A(H1N1)pdm09 Events

- **May 4, 2009**: Alberta and Canada’s first reported ICU case
- **May 8, 2009**: Alberta and Canada’s first reported pH1N1 death
- **June 11, 2009**: WHO declares first influenza pandemic in 41 years
- **June 23, 2009**: Alberta limits laboratory testing to hospitalized cases and outbreak-related cases
Timeline of Key Influenza A(H1N1)pdm09 Events

- **October 22, 2009:** Antiviral stockpile released to community pharmacies
- **October 26, 2009:** Mass immunization clinics opened
- **October 30, 2009:** Influenza Assessment Centres open
- **October 30, 2009:** Community based specimen testing suspended
- **November 23, 2009:** Mass immunization clinics reopen
- **December 10, 2009:** Pharmacists begin to administer vaccine
Influenza A(H1N1)pdm09 Alberta Summary
(as of May 10, 2010)

Hospitalized cases
– Number hospitalized: 1,278
– Age range: <1 to 95 years
– Median Age: 34 years (35.5 for females; 29 for males)
– 77% had at least one underlying health condition

Admitted to Intensive Care
– Number admitted to ICU: 239 (44 deaths; 18%)
– Age range: <1 to 80 years
– Median Age: 41 years (40 for females; 43 for males)
– 84% had at least one underlying health condition

Deaths
– Number of deaths: 72
– Age range: <1 to 90
– Median age: 50 years (44 for females; 56 for males)
– 96% had at least one underlying health condition
## Per cent of Hospitalized, Admitted to ICU, and Deaths with a Reported Health Condition / Risk Factor

<table>
<thead>
<tr>
<th>Health Condition / Risk Factor</th>
<th>Hospital N = 1,278</th>
<th>Intensive Care Unit N = 239</th>
<th>Mortality N = 72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>23.7</td>
<td>17.6</td>
<td>20.3</td>
</tr>
<tr>
<td>COPD</td>
<td>15.9</td>
<td>18.4</td>
<td>32.8</td>
</tr>
<tr>
<td>Other Chronic Lung</td>
<td>6.9</td>
<td>6.6</td>
<td>13.0</td>
</tr>
<tr>
<td>Chronic Heart Disease</td>
<td>12.2</td>
<td>15.1</td>
<td>29.0</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>5.5</td>
<td>8.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Chronic Renal Disease</td>
<td>4.7</td>
<td>7.8</td>
<td>12.9</td>
</tr>
<tr>
<td>Diabetes</td>
<td>13.9</td>
<td>19.1</td>
<td>20.3</td>
</tr>
<tr>
<td>Neurodevelopmental Condition</td>
<td>10.9</td>
<td>12.2</td>
<td>21.1</td>
</tr>
<tr>
<td>Obesity</td>
<td>21.5</td>
<td>35.8</td>
<td>28.8</td>
</tr>
<tr>
<td>Current Smoker</td>
<td>26.2</td>
<td>30.2</td>
<td>26.3</td>
</tr>
<tr>
<td>Pregnant</td>
<td>11.0</td>
<td>7.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>17.0</td>
<td>21.7</td>
<td>24.1</td>
</tr>
</tbody>
</table>
Number of Physician Visits Attributed to Influenza-Like Illness, Alberta 2008 and 2009 (As of December 11, 2009)
Total Number of GP Visits by Month, 2008 and 2009
(as of Dec 11, 2009)
Distribution of Hospitalized and Intensive Care Unit Admissions Among pH1N1 Cases by Week (based on Hospital Admission Date), Alberta
Respiratory Panel Results: October 13-23, 2009

[Bar chart showing per cent of specimens for different test results including Negative, Adenovirus, Coronavirus, Influenza A, Influenza B, Mixed, Parainfluenza, Rhino Enterovirus, RSV]
Data Source Comparison

![Graph showing comparison of various data sources over reporting weeks.](image-url)
Review of H1N1 Deaths
Results

• Of the 72 cases reported to AHW,
  – 56 (77.8%) were directly attributed to influenza
  – 12 (16.7%) had influenza as contributory
  – 4 (5.6%) were unrelated to influenza

• Of the 124 deaths in the Alberta Vital Statistics database that were influenza A(H1N1)pdm09 positive or probable,
  – 64 (52%) were directly attributed to influenza
  – 18 (14.6%) had influenza as contributory
  – 42 (34.2%) were unrelated to influenza
Age-Specific Mortality per 100,000 Population Among Individuals Testing Positive for A(H1N1)pdm09 in Alberta
# Prevalence of Selected Health Conditions Among Individuals Dying from Influenza and the General Alberta Population, 2009

<table>
<thead>
<tr>
<th>Health Condition / Risk Factor</th>
<th>Per Cent (N = 64)</th>
<th>Alberta Prevalence (per 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>35.9</td>
<td>9.0</td>
</tr>
<tr>
<td>COPD</td>
<td>28.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Chronic Heart Disease</td>
<td>20.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>3.1</td>
<td>n/a</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>14.1</td>
<td>n/a</td>
</tr>
<tr>
<td>Diabetes</td>
<td>25.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>18.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Hypertension</td>
<td>37.5</td>
<td>14.1</td>
</tr>
<tr>
<td>Immune Suppressed</td>
<td>9.4</td>
<td>n/a</td>
</tr>
<tr>
<td>Current Smoker</td>
<td>18.8</td>
<td>22.5</td>
</tr>
<tr>
<td>Obese</td>
<td>25.0</td>
<td>19.5</td>
</tr>
<tr>
<td>Aboriginal descent</td>
<td>12.5</td>
<td>3.6</td>
</tr>
</tbody>
</table>
### Proportion of Selected Health Conditions/Risk Factors Among Cases Where Influenza was Directly Related or Contributory to the Death

<table>
<thead>
<tr>
<th>Health Condition / Risk Factor</th>
<th>Per Cent (N = 82)</th>
<th>Odds Ratio</th>
<th>95 % Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>35.4</td>
<td>1.13</td>
<td>0.68, 1.91</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disease (COPD)</td>
<td>31.7</td>
<td>1.86*</td>
<td>1.00, 3.45</td>
</tr>
<tr>
<td>Chronic Heart Disease</td>
<td>25.6</td>
<td>2.04*</td>
<td>1.07, 3.88</td>
</tr>
<tr>
<td>Chronic Liver Disease</td>
<td>2.4</td>
<td>0.26</td>
<td>0.05, 1.22</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>20.7</td>
<td>3.79*</td>
<td>1.91, 7.49</td>
</tr>
<tr>
<td>Diabetes</td>
<td>24.4</td>
<td>0.87</td>
<td>0.45, 1.66</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>17.1</td>
<td>4.88*</td>
<td>2.57, 9.30</td>
</tr>
<tr>
<td>Hypertension</td>
<td>43.9</td>
<td>0.87</td>
<td>0.45, 1.66</td>
</tr>
<tr>
<td>Immune Suppressed</td>
<td>12.2</td>
<td>2.88*</td>
<td>1.31, 6.32</td>
</tr>
<tr>
<td>Aboriginal Descent</td>
<td>12.2</td>
<td>1.48</td>
<td>0.71, 3.10</td>
</tr>
</tbody>
</table>

* * p < 0.05
Mean Age of Deaths with Influenza Coded as the Underlying Cause of Death, Alberta 1983 to 2010
Influenza A(H1N1)pdm09 Immunization
Alberta Health and Wellness H1N1 Immunization Survey

- Survey was conducted between September 5 and October 13, 2009
- \( N = 3,010 \) (response rate: 45%)
- It was estimated that \( 1.6 \text{ million} \) Albertans (44%) intended to be immunized
  - 1.1 million adults
  - 460,000 children aged 6 months to 17 years
- 27 per cent of adults were undecided about the pH1N1 immunization for themselves; and 25 per cent were undecided about children in their household getting the immunization.
- 30 per cent of adults were not intending to get immunized, and 18 per cent did not intend to have household children immunized for pH1N1.
Demographics: Intention to Immunize

• There were no substantial differences between men and women or urban and rural dwelling Albertans on intention.

• Older adults, especially those aged 55 years and older had a higher intention to get immunized than younger adults.

• Adults who were in a target/risk factor influenza group were twice as likely to plan to get immunized as those not in a target group. Those not in a target/risk group were more likely to be undecided.

• Those who were concerned about themselves or someone in their family getting pH1N1 were twice as likely to intend to get immunized as those who were not concerned.
Reasons for Not Intending to Immunize

Most common reasons to not get pH1N1 immunization:
• Not worried about getting pH1N1 influenza; not feeling at risk for serious illness
• Would not bother to get it; not a priority
• Worried about the safety of the pH1N1 vaccine
• Don’t feel they have enough information to decide
• Wait and see attitude: wait to see effects of the vaccine in those who get it first; how the epidemic unfolds in Alberta before deciding
• Confusion about messages in the media; feel like it was over-hyped in the media

Common beliefs about influenza immunization:
• influenza immunizations are not effective
• influenza immunizations can make you feel sick/can give you influenza
• it's better to fight the virus naturally without immunization
Immunization Program Planning
ALBERTA
IMMUNIZATION
STRATEGY
2007-2017

Alberta Immunization Strategy Goals

1. Enhance accessibility
2. Improve enabling technology
3. Strengthen parental education and counseling
4. Strengthen partnerships
5. Strengthen provider training and education
6. Strengthen public education and awareness
7. Strengthen research and evaluation
Planning for Immunization Delivery

- Efficacy of the vaccine
- Effectiveness of the vaccine
- Waning immunity
- History of disease
- Non-Immunizers
- Available resources (e.g. staff, facilities)
- Impact on service delivery planning
- Vaccine inventory (e.g. procurement, storage, transport)
Monitoring Impacts of Interventions – Introduction of Varicella Vaccine

Vaccine licensed in Canada Dec., 1998
Provincial immunization program – spring, 2001

Incidence per 100,000

Year

0 100 200 300 400 500 600 700
Age-Specific Incidence, per 100,000 Population, of Chickenpox, Alberta 1984 and 2008
Age-Specific Incidence of Chickenpox, Alberta 1984 and 2008
Age-Specific Incidence of Chickenpox Among Status First Nations and General Population, 2008
Chickenpox Incidence per 100,000 Population, 1995 to 2011
Incidence of Measles in Alberta per 100,000 Population, 1919 to 2011

Source: Alberta Health
MMR Immunization Rates, 2010

Local Boundaries

MMR
- Red: Under 70%
- Orange: 70% to 79%
- Yellow: 80% to 89%
- Green: 90% to 97%
- Light Green: 98% (Target)

Survey and Assessment | Alberta Health | May 10, 2012

This coverage is for children at 2 years of age. The method used in these estimates use birth cohorts and account for migration into and out of the province, as well as migration between zones. Estimates exclude First Nations and Lloydminster residents.
## Predictors of Pneumococcal Immunization Coverage

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>CI (L)</th>
<th>CI (U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Assistance (ref: no subsidy)</td>
<td>0.55</td>
<td>0.43</td>
<td>0.70</td>
</tr>
<tr>
<td>Subsidy (ref: no subsidy)</td>
<td>0.82</td>
<td>0.72</td>
<td>0.93</td>
</tr>
<tr>
<td>Rural Residence</td>
<td>0.87</td>
<td>0.79</td>
<td>0.93</td>
</tr>
<tr>
<td>No. Physician Visits (0-24 months)</td>
<td>1.03</td>
<td>1.02</td>
<td>1.04</td>
</tr>
<tr>
<td>Distance from nearest clinic (10kms)</td>
<td>1.01</td>
<td>0.95</td>
<td>1.06</td>
</tr>
<tr>
<td>Single Parent (F) (ref: two parent)</td>
<td>0.55</td>
<td>0.49</td>
<td>0.63</td>
</tr>
<tr>
<td>Single Parent (M) (ref: two parent)</td>
<td>0.14</td>
<td>0.03</td>
<td>0.71</td>
</tr>
<tr>
<td>Parent Age</td>
<td>1.01</td>
<td>1.00</td>
<td>1.02</td>
</tr>
</tbody>
</table>
Summary

• A well defined purpose is critical
• Assumptions should be well articulated and defensible
• Model multiple scenarios (e.g. scenarios based on severity and spread)
• Engage in knowledge translation
• Mathematical models should help to inform decisions
• Can view models as “what might happen” and surveillance as “what is happening”
• There is a need to revisit models and approaches to ensure new evidence is incorporated.
• Understanding the strengths and limitations of the data are critical
• Having a well described and complex model based on poorly understood systems will lead to poor decisions
“Good surveillance does not necessarily ensure the making of right decisions, but it reduces the chances of wrong ones.”

- A. D. Langmuir

Contact Information

Larry Svenson
Surveillance and Assessment Branch
Alberta Health
P O Box 1360 STN MAIN
Edmonton, AB T5J 2N3

E-Mail: Larry.Svenson@gov.ab.ca