Influenza Surveillance and Disease Burden, or... Why Burden my Program with more Influenza Data?

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## Cause of Death in Low Income Countries

<table>
<thead>
<tr>
<th>Death Cause</th>
<th>Deaths in millions</th>
<th>% of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary heart disease</td>
<td>3.10</td>
<td>10.8</td>
</tr>
<tr>
<td><strong>Lower respiratory infections</strong></td>
<td><strong>2.86</strong></td>
<td><strong>10.0</strong></td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>2.14</td>
<td>7.5</td>
</tr>
<tr>
<td>Perinatal conditions</td>
<td>1.83</td>
<td>6.4</td>
</tr>
<tr>
<td>Stroke &amp; cerebrovascular disease</td>
<td>1.72</td>
<td>6.0</td>
</tr>
<tr>
<td>Diarrhoeal diseases</td>
<td>1.54</td>
<td>5.4</td>
</tr>
<tr>
<td>Malaria</td>
<td>1.24</td>
<td>4.4</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>1.10</td>
<td>3.8</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>0.88</td>
<td>3.1</td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td>0.53</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Source:** WHO Fact sheet N° 310 / February 2007
First, let's talk about surveillance...
Influenza Virological Surveillance

- Conducted globally by WHO for >50 years
- Information used to:
  - Identify dominant virus strains
  - Choose vaccine strains
  - Detect potential pandemic viruses
- **Basis for all influenza control efforts**
Virus Surveillance Limitations

- Viral surveillance is essential. Used to:
  - Demonstrate seasonality
  - Track antiviral sensitivity patterns,
  - Provide virological information such as strain dominance, genetic markers for severity, etc.

- ... but does not provide information about health (and economic) impact of influenza on people or risk factors for severe disease
Proposal for Limited Epidemiological Surveillance

• Few well chosen sentinel sites reporting regular data: \textit{small amounts of good data are better than large amounts of bad data}
  – Hospital based
  – Epi data and virological specimens from sample of cases

• Basic components:
  – Reporting system for timely data collection
  – System for timely analysis and interpretation
    • Reporting to decision makers
    • Reporting to health care providers and public
  – System for response
Characteristics of Sentinel Sites

- Representative of population / climate regions
  - Number depends on resources available
- Ability to use for burden of disease estimates
  - Reasonable expectation of making population estimates
- Practically feasible
  - Logistics of specimen transport
  - Acceptance
- Focal point at each hospital oversees collection and reporting of data and specimens
Why SARI?

• Combined with ILI epi data, gives picture of broad spectrum of dz
• Severe disease more convincing for policy makers than mild disease
• Acute respiratory disease is number 2 cause of death in developing countries
  – It’s important and should be followed!
• SARI non-specific enough that it could be used for a variety of pathogens
  – Also will capture influenza related hospitalizations not related to pneumonia
Minimum Data Set

- A unique identifier
- Name
- Age
- Address or location
- Gender
- Date of onset
- Presence of chronic illness or pregnancy
- Temperature
- Clinical signs and symptoms
- Outcome
- more chronic illness or age groups, smoking, etc.
Disease Surveillance and Disease Burden Estimation

• Provide information on incidence and impact
  – Incidence of severe disease
  – Groups at highest risk of severe disease
  – Tool to evaluate cost/benefit
• Essential for:
  – Strategy development
  – Resource allocation
  – Implementing control measures
  – Measuring impact of intervention
• Surveillance data can provide directly observed estimates of impact
Influenza’s Impact is Difficult to Measure Directly

- Most serious health impact of influenza results from development of secondary “complications”
  - pneumonia, heart failure, exacerbation of underlying illness, etc
- However, only a fraction of diseases such as pneumonia or heart failure are related to influenza
Traditional Modeling Approach to Influenza Disease Burden Studies

• Choose a biologically appropriate group of diseases to monitor or study
  – “pneumonia & influenza” (ICD-9 480-487) or "all-cause" commonly used for death and hospital studies

• Compare disease rates between
  – the periods when influenza viruses are NOT circulating
  – the periods when influenza viruses are in circulation
Challenges

• Data often not available.
• Mortality vs. hospitalization
  – Hospitalization results in costs to health care system
• Seasonality not distinct, may be multiple annual epidemics and year-round transmission
• Impact of other factors, malnutrition, other infections, lack of adequate medical care unknown
• Model results are not entirely intuitive
  – What is "excess" mortality?
  – Why are "all-cause" deaths so much higher than "respiratory deaths"?
  – Only validation is other models
Pneumonia and Influenza Mortality for 122 U.S. Cities
Week Ending 5/19/01

Weeks
"Epidemic" Threshold
Seasonal Baseline

% of All Deaths Due to P&I
Influenza Disease burden in Singapore

Chow A et al. Emerg Infect Dis, 2006

Jan

All cause

P&I

C&R

Chow A et al. Emerg Infect Dis, 2006

Jan
Influenza Isolations and Pneumonia Admissions, Hong Kong, 1999 - 2000

Influenza Isolations, Pneumonia, and Cardio-Resp. Admissions, Hong Kong, 1999 - 2000

One solution

- Estimate impact using surveillance data
  - Directly observed, not modeled.
  - More intuitive
  - Uses data at hand
- Hospitalizations rather than deaths
  - Demonstrates impact on health care system: cost/benefit
A MANUAL FOR ESTIMATING DISEASE BURDEN ASSOCIATED WITH SEASONAL INFLUENZA IN A POPULATION
The Great Unknowns

Dogbert consults:

You need a dashboard application to track your key metrics.

That way you'll have more data to ignore when you make your decisions based on company politics.

Will the data be accurate? Okay, let's pretend that matters.
Seasonality

- What are the climactic factors that influence circulation of influenza?
- Interplay between climate and social situation, e.g. where seasonal changes that predispose to circulation don’t coincide with school season?
- When school attendance is low, how is transmission affected?
Impact of Social Structure

• In countries where
  – population density is very high?
  – extended families live together – the elderly with school kids?
  – personal space and greeting practices differ?
  – masks are commonly used?
  – spectrum of chronic illness or age distribution of population is different?
  – access to care is limited, nutrition is poor, or HIV is common?
Implications for Control Measures

• Effectiveness of vaccination:
  – If transmission is year-round and vaccine effect is less than 12 months?
  – Can we protect at risk populations (e.g. the elderly) by vaccinating their school aged contacts?

• Social distancing measures
  – Different social patterns may require different responses

• Treatment
  – Differences in health seeking behavior e.g. traditional healers
Summary

• It's likely that you have more influenza that you recognize
  – It also may be behaving differently than you think

• Sentinel Site SARI Surveillance has utility for:
  – Providing data for health care management
  – Risk factors for severe disease
  – Estimating burden of severe influenza

• Disease burden needed to put influenza in context – how does it compare to everything else happening in my country?

• Directly observed measures of burden more comprehensible and feasible
  – Models for temperate countries not validated in tropics
  – Data may not be available
  – Uncertainty about the real meaning
An alternative method

Thank you for your kind attention