The Future of Epidemiology: Whither Local Health Departments?

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Disclaimer: the views presented here are mine and should not be attributed to the Los Angeles County Department of Public Health. I have no financial disclosures.

Statements in Epidemiology Literature

- Epidemiology has “exhausted its potential” and is dead
- Epidemiology generates “conflicting results” which “confuses” the public
- All basic associations have been found
- New tools/statistical methods needed
Past / Future

Tools of the “Past” Are Still Active in the Present and Future

• Case Series
• Case Control
• Population Surveillance/Reportable Diseases
• Cross Sectional Studies
**MMWR Report in June, 1981**

**Pneumocystis Pneumonia – Los Angeles**
As part of its commemoration of CDC's 50th anniversary, MMWR is reprinting selected MMWR articles of historical interest to public health, accompanied by a current editorial note.

On June 4, 1981, MMWR published a report about Pneumocystis carinii pneumonia in homosexually active men in Los Angeles. This was the first published report of what, a year later, became known as acquired immunodeficiency syndrome (AIDS). This report and current editorial note appear below.

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**Actions From That Report and Others Like It**

- Worldwide case definition developed
- Surveillance established that the syndrome was new and the number of cases was increasing
- By 1983, epidemiologists knew that AIDS was caused by an agent transmitted through sexual contact and transmitted through blood
  - the Public Health Service recommended that sexual contact be avoided with persons known or suspected to have AIDS and that persons at increased risk for AIDS refrain from donating plasma or blood
- Work was intensified toward developing safer blood products for persons with hemophilia
The Power of Epidemiology

These recommendations were developed and published only 21 months after the first cases were reported and well before the first laboratory reports identifying HIV.

Case Control Studies

Transmission of Hepatitis B Virus Among Persons Undergoing Blood Glucose Monitoring in Long-Term Care Facilities — Mississippi, North Carolina, and Los Angeles County, California, 2003–2004

Regular monitoring of blood glucose levels is an important component of routine diabetes care (7). Capillary blood is typically sampled with the use of a fingerstick device and tested with a portable glucometer. Because of outbreaks of hepatitis B virus (HBV) infections associated with glucose monitoring, CDC and the Food and Drug Administration (FDA) have recommended since 1990 that fingerstick devices be restricted to individual use (2,5). This report describes three recent outbreaks of HBV infection among residents in long-term-care (LTC) facilities that were attributed to shared devices and other breaks in infection-control practices related to blood glucose monitoring. Findings from these investigations and previous reports suggest that recommendations concerning standard precautions and the reuse of fingerstick devices have not been adhered to or enforced consistently in LTC settings (2–5). The findings underscore the need for education, training, adherence to standard precautions, and specific infection-control procedures and techniques.

**Diabetes-care procedures and techniques**

- Prepare medications such as insulin in a centralized medication area; multidose insulin vials should be assigned to individual patients and labeled appropriately.
- Never reuse needles, syringes, or lancets.
- Restrict use of fingerstick capillary blood sampling devices to individual patients.
- Consider using single-use lancets that permanently retract upon puncture.
- Dispose of used fingerstick device and lancets at the point of use in approved sharps containers.
- Assign separate glucometers to individual patients. If a glucometer used for one patient must be reused for another patient, the device must be cleaned and disinfected. Glucometers and other environmental surfaces should be cleaned regularly and whenever contamination with blood or body fluids occurs or is suspected.
- Store individual patient supplies and equipment, such as fingerstick devices and glucometers, within patient rooms when possible.
- Keep trays or carts used to deliver medications or supplies to individual patients outside patient rooms. Do...
Reportable Disease → Important Trends

Invasive Pneumococcal Disease Incidence Rates by Year of Culture
LAC, 1996–2007

Invasive Pneumococcal Disease in Los Angeles County

IPD All Ages (Per 100,000) 2002-2007
# Pneumonia and Influenza Statistics by SPA

<table>
<thead>
<tr>
<th>SPA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>% adults ≥ 50 vaccinated for influenza in past year (2005)</td>
<td>40.5</td>
<td>41.9</td>
<td>41.3</td>
<td>45.4</td>
<td>42.6</td>
<td>32.5</td>
<td>41.8</td>
<td>37.5</td>
</tr>
<tr>
<td>% adults ≥ 65 vaccinated for pneumonia (2007)</td>
<td>65.0</td>
<td>67.6</td>
<td>54.1</td>
<td>54.6</td>
<td>71.5</td>
<td>51.1</td>
<td>56.6</td>
<td>63.9</td>
</tr>
<tr>
<td>Pneumonia/Influenza Mortality Rate (age-adjusted per 100,000 population) (2005)</td>
<td>23.1</td>
<td>27.2</td>
<td>28.6</td>
<td>26.7</td>
<td>23.1</td>
<td>29.6</td>
<td>24.8</td>
<td>22.7</td>
</tr>
<tr>
<td>Incidence of Invasive Pneumococcal Disease in adults ≥ 65 (per 100,000 population) (2007)</td>
<td>17.0</td>
<td>18.6</td>
<td>21.9</td>
<td>15.6</td>
<td>14.1</td>
<td>36.9</td>
<td>19.2</td>
<td>24.7</td>
</tr>
</tbody>
</table>

## Cross Sectional Surveillance - Tobacco Use

![Graph showing trend in current smoking prevalence among high school students: Los Angeles YRBS, 1997–2003](image)
Environmental Determinants of Disease

• Over 750 retailers in Los Angeles studied
  – 40% of businesses illegally sold tobacco to children
  – Almost half were within 1,000 feet of schools

• Retailers with the highest illegal sales rate in 2003
  – Discount stores (75%)
  – Doughnut/dairy shops (59.6%)
  – Mini-markets (46.7%)
  – Gas stations (38.7%)
  – Pharmacy/drug stores (29.2%)
  – Supermarkets (27.8%)

California/LA Policy Actions

• Tobacco sellers must obtain license
• Prohibit use of tobacco related products near playgrounds or in the state parks
• Prohibit use in municipal beaches in Los Angeles
• Enhanced “sting” operations
Future Considerations for Traditional Epidemiology

- Changing Demographics
- Changing Disease Trends

Changing Demographics

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Baby Boomers
Changing Causes of Death

<table>
<thead>
<tr>
<th>1900</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pneumonia</td>
<td>1. Diseases of the heart</td>
</tr>
<tr>
<td>2. Tuberculosis</td>
<td>Malignant neoplasms</td>
</tr>
<tr>
<td>3. Diarrhea, enteritis and ulceration of intestines</td>
<td>Cerebrovascular diseases</td>
</tr>
<tr>
<td>4. Diseases of the heart</td>
<td>4. Chronic lower respiratory diseases</td>
</tr>
<tr>
<td>5. Intracranial lesions of vascular origin</td>
<td>5. Accidents (unintentional injuries)</td>
</tr>
<tr>
<td>6. Nephritis (all forms)</td>
<td>6. Diabetes mellitus</td>
</tr>
<tr>
<td>7. All accidents</td>
<td>7. Alzheimer’s disease</td>
</tr>
<tr>
<td>8. Cancer and other malignant tumors</td>
<td>8. Influenza and pneumonia</td>
</tr>
<tr>
<td>10. Diptheria</td>
<td>10. Septicemia</td>
</tr>
</tbody>
</table>

Improve Surveillance for Non-Infectious Diseases

• New York City: Hemoglobin A1c
• Consider
  – Cholesterol >300
  – High troponin levels (marker of MI)
  – New strokes on CT/MRI
  – Prescriptions of antidepressants
  – Domestic violence complaints or shelter admissions
New Challenges in Infectious Diseases

- Hospital Acquired Infections: ~100,000 deaths per year
  - Becoming reportable in California and in US
- Antibiotic resistance
- Chronic Infectious Diseases: HIV, HBV, HCV
- Preparedness/Bioterrorism

Future Uses of Epidemiologic Data/Methods

- Decision Analysis
- Cost-Utility Analysis
- Evaluating Interventions
- Disease Modeling
- Health Impact Assessments
Intervention Evaluation: Handwashing

- Diarrheal illnesses are a major cause of death in children in developing countries
- Randomized control trial of handwashing with soap in squatter neighborhoods in Pakistan

Effect of Intensive Handwashing Promotion on Childhood Diarrhea in High-Risk Communities in Pakistan. Ruby et al, JAMA 2004
Effect of Handwashing Intervention

Figure 3. Diarrhea Incidence by Week and Intervention

Diarrhea incidence is defined as number of new episodes per 100 person-weeks.

New Methods

• A Dynamic Transmission Model for Predicting Trends in *Helicobacter pylori* and Associated Diseases in the United States

Models

\[
\frac{dI}{dt} + \frac{dI}{dx} = -\lambda(a) \cdot I(a, t)
\]

\[
\frac{dS}{dt} + \frac{dS}{dx} = -[\lambda_1(a, t) + \lambda_2(a, t) + \mu(a)] S(a, t)
\]

\[
\frac{dA}{dt} + \frac{dA}{dx} = \lambda_1(a, t) \cdot S(a, t) - [\delta_1(a) + \delta_2(a)] \cdot A(a, t)
\]

\[
\frac{dG}{dt} + \frac{dG}{dx} = \lambda_2(a, t) \cdot S(a, t) - [\delta_3(a) + \mu(a)] \cdot G(a, t)
\]

\[
\frac{dU}{dt} + \frac{dU}{dx} = [\delta_2(a) + \delta_3(a)] \cdot U(a, t) - \mu_U \cdot U(a, t)
\]

\[
\frac{dCAG}{dt} + \frac{dCAG}{dx} = [\beta_2(a, t) \cdot CAG(a, t) - \beta_3(a, t) + \mu_{CAG}] \cdot CAG(a, t)
\]

\[
\frac{dGC}{dt} + \frac{dGC}{dx} = \delta_1(a) \cdot CAG(a, t) - \mu_{GC}
\]

Inputs Into a Model: Based on Descriptive Statistics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_{(a)}$</td>
<td>Death rate (per person per year) Age specific</td>
<td>18</td>
<td>Assumption</td>
</tr>
<tr>
<td>Z</td>
<td>Population size (persons)</td>
<td>200,000</td>
<td>Assumption</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Birth rate (persons per year)</td>
<td>2,962</td>
<td>Derived from disease-free equilibrium simulation</td>
</tr>
<tr>
<td>$\rho_i$</td>
<td>Proportion (%) nonsusceptible</td>
<td>20</td>
<td>Based on data from developing countries</td>
</tr>
<tr>
<td>Disease parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\rho_C$</td>
<td>Proportion (%) of children with antrum (vs. corpus) gastritis</td>
<td>5</td>
<td>Assumption</td>
</tr>
<tr>
<td>$\rho_Y$</td>
<td>Proportion (%) of youths with antrum (vs. corpus) gastritis</td>
<td>75</td>
<td>Based on simulation</td>
</tr>
<tr>
<td>$\rho_A$</td>
<td>Proportion (%) of adults with antrum (vs. corpus) gastritis</td>
<td>95</td>
<td>Assumption</td>
</tr>
</tbody>
</table>
Health Impact Assessment

Menu Labeling as a Potential Strategy for Combating the Obesity Epidemic
A Health Impact Assessment
Paul Simon, Christopher J. Jarosz, Tony Kao, and Jonathan E. Fielding


Problem

Data source: Los Angeles County Health Survey
Outcome

- 2008 California Law passed requiring restaurant chains with >15 outlets to post calorie counts
- Will take time to see effect on obesity
- Will take even longer time to see effect on health/death rates
Conclusions

• Epidemiology is alive and well in local health departments
• Need to expand its use into non-infectious diseases
• Need to study what makes people well, not just what makes them ill
• Need to evaluate interventions to efficiently use resources

Thank You