Public Health Surveillance: Policy Case Studies
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Why Track the Leading Indicators of Public Health?

• Monitor status and trends of health and conditions that impact health
• Develop interventions to promote health
• Build core capacity to respond to problems
HEAT RELATED MORTALITY
Number of heat-related deaths, and heat index, by date — Chicago, July 11–27, 1995

* n=465.

MMWR: Vol. 44 / No. 31, 1995
Rate of heat-related deaths, by age group — United States, 1979–1998

(CDC MMWR)
CHILDHOOD LEAD POISONING
Lead Levels of Children 1-5 Years of Age in the United States with Blood Lead Levels ≥ 10 μg/dL, 1974-1992
Prevalence of Childhood Lead Poisoning in the United States by Housing and Demographic Characteristics, 1991 - 1994

Source: NHANES III, Phase 2
TOXIC SHOCK SYNDROME
Toxic Shock Syndrome Cases
United States, 1979-1996

*FDA, Food and Drug Administration; includes definite and probable toxic shock syndrome cases

CDC
ASTHMA
Asthma

• Rates have increased 75% since 1980

• Affects about 17 million people - including nearly 5 million children

• Cost the economy $14.5 billion last year
Asthma Prevalence and Mortality for Children and Young Adults, 1960-1995

National Health Interview Survey

[Graph showing trends in asthma prevalence and mortality from 1960 to 1995 for different age groups (0-4, 5-14, 15-34) and years.]
Asthma Prevalence and Mortality for Adults 35+ years: 1960-95

National Health Interview Survey
Asthma projected rates of increase, 1995, 2010, 2020

Projected increase in rate of self reported asthma: 1995-2020

Rate

1995
2010
2020
Asthma by poverty, 1987-95
(Blue=below poverty line)

National Health Interview Survey
Asthma NHIS Data (1987-95)

Asthma Prevalence, Logistic Regression, Age 0-5

Odds Ratio and 95% CL

Hispanic, Black, Other, MSA,other, Non-MSA, Southeast, Midwest, West, Q2, Q3, Q4, Female, <Poverty, Age, Famsize, <HS, <College, Year
DIABETES
Prevalence of Diabetes Among Adults
United States, BRFSS, 1993–1994
Prevalence of Diabetes Among Adults
United States, BRFSS, 1999

Map showing the prevalence of diabetes among adults in the United States in 1999, with states colored in red, yellow, or blue to indicate different prevalence ranges.
Why an increase in diabetes?

- Increased diagnosis
- “Thrifty genotype” theory (e.g., “fat” mouse
- Thrifty phenotype (low birthweight, early deprivation, possibly arsenic and dioxins)
- Epidemic of obesity and sedentary lifestyle (which in turn relates to land use)
- Environmental agents (dioxins and arsenic)
more verbage

dzerbe, 1/20/2005
REYE’S SYNDROME
Reye’s Syndrome, US, 1974-1985

(Source: CDC)
I guess this is about giving children aspirin

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LOW BIRTHWEIGHT
Trends: Low Birthweight

- Since the 1980s, rates of low birthweight (LBW) and preterm birth have been increasing steadily in the US
- Among singleton births, LBW has increased 4% and very low birthweight (VLBW) 7% since 1989
- Among 20-34 year old mothers of singleton births, LBW increased 2.2% and VLBW 5.9% from 1990-97

NCHS data
Trends: Preterm Birth

- Among singleton births, rates of moderately preterm births (32-36 weeks) have increased 14% since 1989
- CDC reported that after taking into account a number of risk factors (age of mother, prenatal care, marital status) there was a 4.6% increase in preterm birth in white non-Hispanic infants between 1989-96
comments on why
dzerbe, 1/20/2005
BIRTH DEFECTS
Trends: Birth Defects

• Atrial Septal Defect
  – Prevalence of ASD for all states combined rose 148% from 1989 to 1996
  – Of the 13 states with at least four years of data, nine showed statistically significant positive linear trends
Atrial Septal Defect
Trends: Birth Defects

• Obstructive Genitourinary Defect
  – Prevalence of OGD for all states combined rose 60% from 1989 to 1996.
  – Of the 14 states with at least four years of data, eight showed statistically significant positive linear trends
Obstructive Genitourinary Defect

OBSTRUCTIVE GENITOURINARY DEFECT

PREVALENCE per 10,000

YEAR

AK

AR

AZ

CA

CO

CT

GA

HI

IA

IL

MA

MO

NC

NE

NJ

NY

OK

TN

VA

WI

89 90 91 92 93 94 95 96
What does it mean?

- Are these true increases or related improved ascertainment and diagnostic techniques or some other factors?
- Do the current surveillance systems in place give us the information to come up with an answer?
Surveillance Efforts

• No national system exists to track and report trends in birth defects
• As of 1999, 33 states had birth defects registries with different structures
Assessment of Surveillance System Components

• Comparison of birth defect prevalences stratified by follow-up, active and passive ascertainment, and inclusion of stillbirths.

• The results suggest that more than 50% of anencephaly cases may be missed due to failure to count fetal deaths.
## Follow-up

Table 7: Average state birth defect rates (per 10,000 births) 1989-1996 by follow-up category for selected birth defects.

<table>
<thead>
<tr>
<th>Birth Defect</th>
<th>Ascertainment at birth</th>
<th>Follow-up past birth</th>
<th>Percent difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down Syndrome</td>
<td>6.7 (n=4)</td>
<td>10.6 (n=25)</td>
<td>+57%</td>
</tr>
<tr>
<td>Rectal and large intestinal atresia/stenosis</td>
<td>1.4 (n=3)</td>
<td>4.2 (n=24)</td>
<td>+206%</td>
</tr>
<tr>
<td>Renal agenesis/hypoplasia</td>
<td>1.8 (n=3)</td>
<td>4.6 (n=23)</td>
<td>+159%</td>
</tr>
<tr>
<td>Spina bifida</td>
<td>2.4 (n=3)</td>
<td>4.3 (n=25)</td>
<td>+79%</td>
</tr>
</tbody>
</table>

Note: Includes the three states with birth certificate data.
### Active vs. Passive

Table 8: Average birth defect rates (per 10,000 births) 1989-1996 for states with passive and active surveillance systems for selected birth defects.

<table>
<thead>
<tr>
<th>Birth Defect</th>
<th>Passive</th>
<th>Active</th>
<th>Percent difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anencephaly</td>
<td>1.7 (n=15)</td>
<td>2.8 (n=11)</td>
<td>+62%</td>
</tr>
<tr>
<td>Obstructive genitourinary defect</td>
<td>12.0 (n=12)</td>
<td>16.0 (n=8)</td>
<td>+33%</td>
</tr>
<tr>
<td>Renal agenesis</td>
<td>2.8 (n=14)</td>
<td>7.2 (n=10)</td>
<td>+160%</td>
</tr>
<tr>
<td>Atrial septal defect</td>
<td>23.6 (n=12)</td>
<td>45.7 (n=7)</td>
<td>+94%</td>
</tr>
<tr>
<td>Transposition of great arteries</td>
<td>3.0 (n=13)</td>
<td>4.3 (n=9)</td>
<td>+45%</td>
</tr>
<tr>
<td>Tricuspid valve atresia and stenosis</td>
<td>1.6 (n=13)</td>
<td>15.7 (n=7)</td>
<td>+870%</td>
</tr>
</tbody>
</table>
Key Components of a Surveillance System

- Follow-up of the newborn past birth
- Active vs. passive surveillance
- Inclusion of stillbirths
- Timeliness
- Analytic capability
- Comprehensiveness
CANCER

Based on Surveillance, Epidemiology and End Results (SEER) Data

Trend in age-adjusted annual incidence for NHL

Based on Surveillance, Epidemiology and End Results (SEER) Data
Non Hodgkins Lymphoma

dzerbe, 1/20/2005
Clues for the Causes of the Rise

• Similar increasing pattern (3~4% annual increase) all over world
• Incidence higher in developed areas, e.g., USA and Europe
• The rise is real, as opposed to purely artifactual as a result of, e.g.,
  – Increased detection
  – Change in classification
• Only a part of increase is due to HIV
Health project maps cancer hot spots

By Kathleen Fidelman usa today

On the World Wide Web today: a map of the cancer hot spots in the U.S. and the toxic chemicals lurking nearby.

A national public health project supported by the Pew Charitable Trusts is launching the Web site Health-Track (www.health-track.org) giving Americans an easy way to get information on cancer death rates and environmental threats in their vicinity that have been linked to cancer.

The group is using the Web site as a first step of its kind. People using the Web site can pull up a map of the entire country or they can zoom in on a state, county or even a town.

"This gives communities information they’ve never had before," says Jim O’lana, Health-Track’s executive director.

Health-Track’s death statistics collected by the National Cancer Institute for eight cancers—bladder, breast, brain, colon, Hodgkin’s disease, leukemia, lung and non-Hodgkin’s lymphoma—and provides color-coded maps showing hot spots (red) or regions with cancer deaths in the top 20% for the nation. Then users can pull up an overlay that highlights areas where the Environmental Protection Agency has gotten reports of carcinogenic chemicals that were released into the environment by industries.

Among trends portrayed by the maps:
- A hot zone for bladder cancer in the Northeast.
- Public health experts suspect an environmental cause for bladder cancer, particularly for men in the New England states who have worked in jobs using chemicals to clean machinery or engines. The overlay pulls up solvents and many other toxins in those states.
- A hot zone for brain cancer in the Northwest.
- Public health experts suspect a environmental cause for leukemia in the Southern states.

The group is meeting its Web site as a first step of its kind. People using the Web site can pull up a map of the entire country or they can zoom in on a state, county or even a town.

Web site health project maps cancer hot spots

Online mapping system provides cancer statistics

New Web site will offer maps of cancer deaths

Cancer: Fight for registry a lengthy process

Among trends portrayed by the maps:
- A hot zone for breast cancer in the Northeast.

West Coast and Great Lakes regions, no one knows why these parts of the country have elevated rates of deaths from breast cancer. One theory is that local industries may increase the risk.

Goldman says.
- High death rates for non-Hodgkin lymphoma in the Northeastern and Great Lakes regions.

The maps show a proliferation of toxic chemicals in these states.

An advocacy group for US. industry asserts there is no evidence that exposure to trace amounts of chemicals in the environment causes human cancer. Elizabeth Whelan, president of the American Council on Science and Health in Washington, D.C., says the maps are a vehicle for radical environmentalists to foment fears of toxic chemicals.

"We’re not arguing causal effects. Instead, we’re saying the information will enable people to ask local health officials about cancer and the places that may be housing them at, least or worse.
Farming-related Exposures

• Higher incidence for mid-west states
• Farming as occupation increases risk (RR of 1.1 in a meta-analysis)
• Farming related to various potentially causal exposures to
  – Pesticides
  – Zoonotic viruses
  – Diesel exhaust
  – Sunlight
  – Hay/Dust
  – Healthy life style, etc
Pesticides

- Phenoxy herbicides (2,4-D, 2,4,5-T, etc)
  - Agent orange (largely negative)
  - Dioxin as a contaminant
    - RR=2.6 in manufacturing workers
    - Increasing exposure-response relationship in farmers

- Triazine herbicides (largely negative)

- Organochlorines
  - Chlordane remains suspected
  - DDT & chlordane (effects diminishes after considering other pesticides)
Other Persistent Chemicals

• Organophosphates & carbamates
  – Positive epidemiological studies
  – Immunotoxicity from animal studies

• PCB
  – mixed results w/ a positive study of high qual.

• PBB (one positive study)

• Dioxins (Large Occup. Cohort, Seveso)

• Polybrominated Diphenyl Ether (PBDE)
  – Used as flame retardant for plastics and fabrics
  – one positive study
Polybrominated Diphenyl Ether (PBDE)

Human breast milk monitoring results for Sweden reported by Noren & Meironyte (2000)
Other Environmental Exposures

• Solvents (mixed results)
  – trichloroethylene, tetrachloroethylene, benzene (controversial), other solvents, painter as occupation

• Wood dusts & wood-related work
  – Potential roles of chlorinated phenol wood preservatives

• Nitrate in groundwater
  – Connection with use of fertilizer
How much of increase is explained by known factors?

- Let’s think of a period of 20 years, 1970-90
- Annual increase of 3~4% means doubling of rate in 20 years
- A factor solely responsible for the increase
  - would have population attributable risk percent (PAR%) of 50% in a study done in 1990 and
  - should have become more common over time
How much of increase is explained by known factors? (cont’d)

• Some environmental exposures were consistently associated with NHL across studies
• Each of them accounts only up to about 10% of the risk in each study
• In a single study, only one or a few of them considered
• Prevalence of some factors, e.g., farming, has decreased
• Taken together, the known/suspected factors can explain only a part of increase
Other aspects of suspected or known risk factors/exposures

- Disruption of immune system confer high risk
  - HIV (RR~200)
  - Immunosuppressive therapies (RR~50)
  - Involvement of Epstein-Barr virus (EBV)

- Some pesticide “suspects” also are immunotoxic

- Some agents found in occupational setting as well as in non-occupational setting, e.g.,
  - Persistent chemicals in diet
  - Herbicides for crops and lawn
  - Solvents
Policy issues

• “Epidemic” detected
• Policy development
  – Identify and reduce toxic exposure
  – Some basis for reducing exposure, e.g., encourage IPM

→ FURTHER SEARCH FOR CAUSES

• Once policies implemented → Assessment
  – Have we been successful in reducing exposures?
  – Have we been successful in preventing disease?
  – Need to “track” changes

→ PREPARE FOR FUTURE ASSESSMENT
Health Tracking

State and National Data Collection Systems

Public Health Actions
- Track health, disease, and risks to target interventions
- Detect new health events and unusual occurrences
- Monitor effects of interventions and policies
- Raise awareness of public health issues
- Guide research initiatives

Integrated Health Tracking, Analysis, Evaluation And Dissemination

(Source: CDC, 2002)
“Chance Favors the Prepared Mind”

Louis Pasteur