

Environmental Health Tracking: perspectives & needs

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Environmental Health Tracking

- Purposes
- Historical development
- Keys to effectiveness
- Obstacles
- Relationship to research
- Consumers of EHT information
- Public health empowerment

Purposes

(Hertz-Picciotto)

- Understand current state and trends
... plan
- Predict future hazards and disease
... develop policy
- Learn about etiology
... devise intervention & prevention

Purposes: Pew Charitable Trust Commission

- To facilitate examination of the relationship between environmental and disease
- To guide intervention and prevention strategies

Purposes:

Centers for Disease Control

- Link information on environmentally related diseases, human exposures, and environmental hazards
- Detect epidemics or clusters
- Document distribution and estimate magnitude of a health effect
- Evaluate interventions
- Facilitate planning

Purposes:

California SB 702 Expert Working Group

- To guide prevention through exposure/hazard tracking
- To identify time trends in health outcomes by subpopulation and geography
- To support research by developing linkage between exposure and health information
- To inform policies for disease prevention and environmental protection
- To provide access to information on environmental health

Environmental Health Tracking: definitions, historical roots

- What is it?
- Where and when did it all begin?

Definition: Surveillance, Monitoring, Tracking

- Collection
- Integration
- Analysis
- Interpretation
- Dissemination

...of data on hazards, exposure, and health of populations

...with special reference to patterns in time and geography

The 17th Century

Natural and Political

OBSERVATIONS

Mentioned in a following INDEX,

and made upon the

Bills of Mortality.

By JOHN GRAUNT,

Citizen of

L O N D O N.

With reference to the *Government, Religion, Trade, Growth, Ayre, Diseases,* and the several Changes of the said C I T Y.

— *Non, me ut miretur Turba, laboro.*
Contentus paucis Lectoribus —

L O N D O N,

Printed by *Tho: Roycroft*, for *John Martin, James Allestry,*
and *Tho: Dicus*, at the Sign of the Bell in *St. Paul's*
Church-yard, MDCLXII.

1662

15. The third Observation is, that of the said 229. thousand about 70. died of *Chronical* Diseases, which shews (as I conceive) the state, and disposition of the Country (including as well it's *Food*, as *Air*) in reference to health, or rather to *longævity*: for as the proportion of *Acute* and *Epidemical* Diseases shews the aptness of the *Air* to suddain and vehement Impressions, so the *Chronical* Diseases shew the ordinary temper of the Place, so that upon the proportion of *Chronical* Diseases seems to hang the judgment of the fitness of the Country for *long Life*. For, I conceive, that in Countries subject to great *Epidemical* sweeps men may live very long, but where the proportion of the *Chronical* distempers is great, it is not likely to be so; because men being long sick, and alwayes sickly, cannot live to any great age, as we see in several sorts of *Metal-men*, who although they are less subject to acute Diseases then others, yet seldome live to be old, that is, not to reach unto those years, which *David* saies is the age of man.

The 18th Century

- Late 1700's, measures to improve the death registration
- Haygarth observed (1773) more people aged 10-50 died from 'consumption' (TB) than all other causes combined
- Birth registration also introduced



FROM A NEGATIVE BY LOMBARDI, PALL MALL.

Ever yours faithfully
W. Fox

VITAL STATISTICS :

A

MEMORIAL VOLUME OF SELECTIONS FROM
THE REPORTS AND WRITINGS

OF

WILLIAM FARR, M.D., D.C.L., C.B., F.R.S.,

LATE SUPERINTENDENT OF THE STATISTICAL DEPARTMENT OF THE
REGISTRAR GENERAL'S OFFICE, ENGLAND.

EDITED FOR

THE SANITARY INSTITUTE OF GREAT BRITAIN

BY

NOEL A. HUMPHREYS,

OF THE REGISTRAR GENERAL'S OFFICE, MEMBER OF THE COUNCIL OF THE
STATISTICAL SOCIETY OF LONDON.

LONDON :

OFFICES OF THE SANITARY INSTITUTE, 74A, MARGARET
STREET, W.

EDWARD STANFORD, 55, CHARING CROSS, S.W.

1885.

5.—DEFECTS OF BIRTH REGISTER

Two grave defects in the registers of the United Kingdom deprive them of much of their utility as pedigrees, and as records of facts for the solution of the great problems of population. Neither the age of mothers at the births of each of their children, nor the order of birth, is recorded ; so that the number of children borne by women at different ages, and in the course of their lives, cannot be ascertained.

It is apparent that the specificity of death-rates may be extended to any degree, provided the necessary data relative to population and to deaths are available. For a really penetrating insight into the forces of mortality, both for purposes of research and the administration of public health, death-rates ought to be made specific for the following factors:

1. Age.
2. Sex.
3. Race (or country of birth of person and parents at least).
Race will include color.
4. Occupation.
5. Locality of dwelling (urban or rural).

Each of these factors more or less profoundly influences the force of mortality. Death certificates carry the necessary data (at least theoretically, and actually if properly filled out) regarding deaths. Every ten years the census collects the necessary data regarding the population. If only these data could be properly tabulated and published it would be possible to calculate in census years the death-rates specific for the above five factors. Eventually this will surely be done. The sciences of medicine and hygiene will imperiously demand it.

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Farr was right

- Late 1800's, Census data combined with vital statistics data
- London Epidemiologic Society; Statistical Society; Actuarial Society
- Life-tables, life expectancy, age adjustment

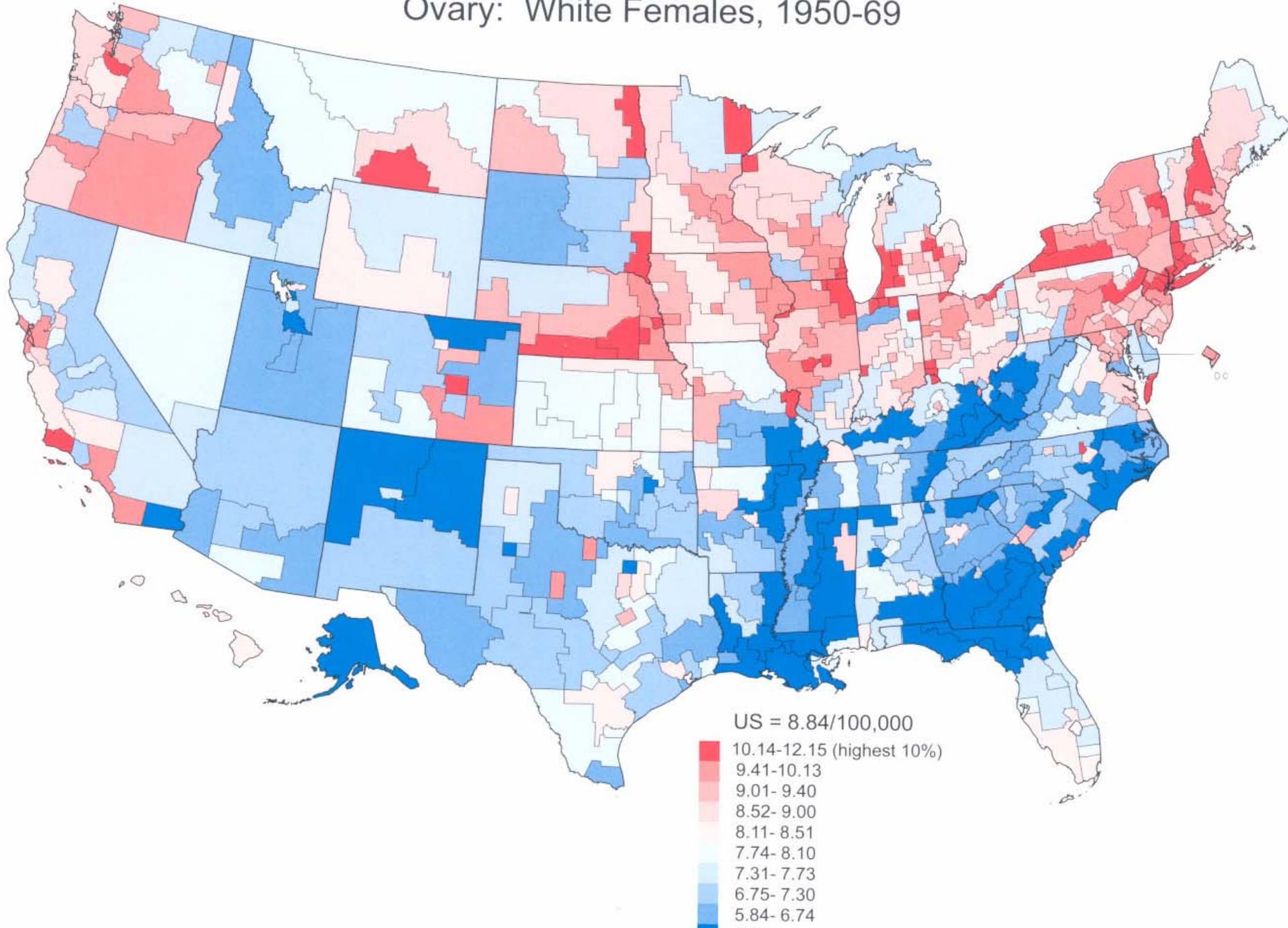
Vital Statistics:
pillar of public health surveillance

Into the 20th Century...

(...but still before the era of personal computers)

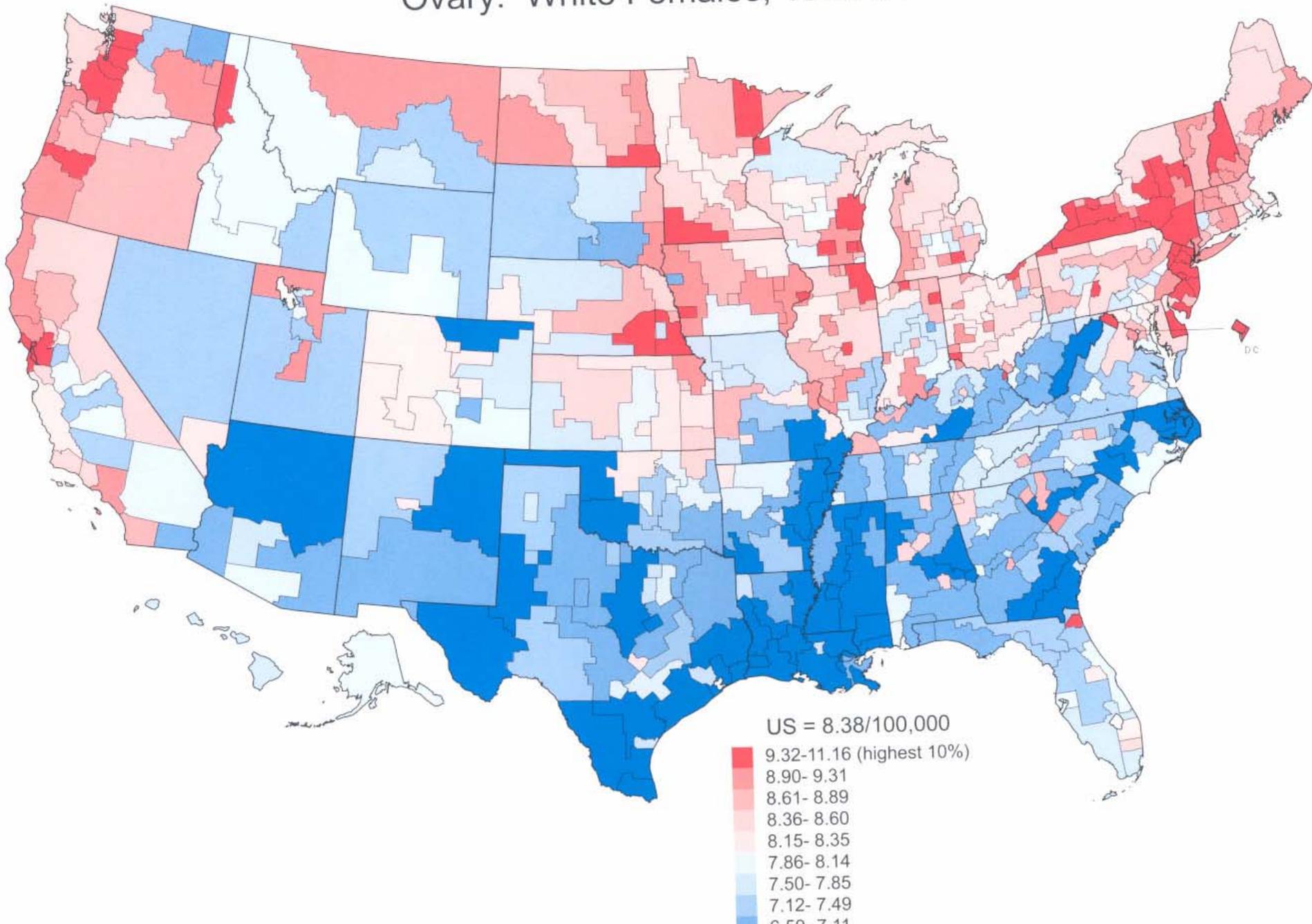
Mapping of chronic diseases

Cancer Mortality Rates by State Economic Area (Age-adjusted 1970 US Population) Ovary: White Females, 1950-69

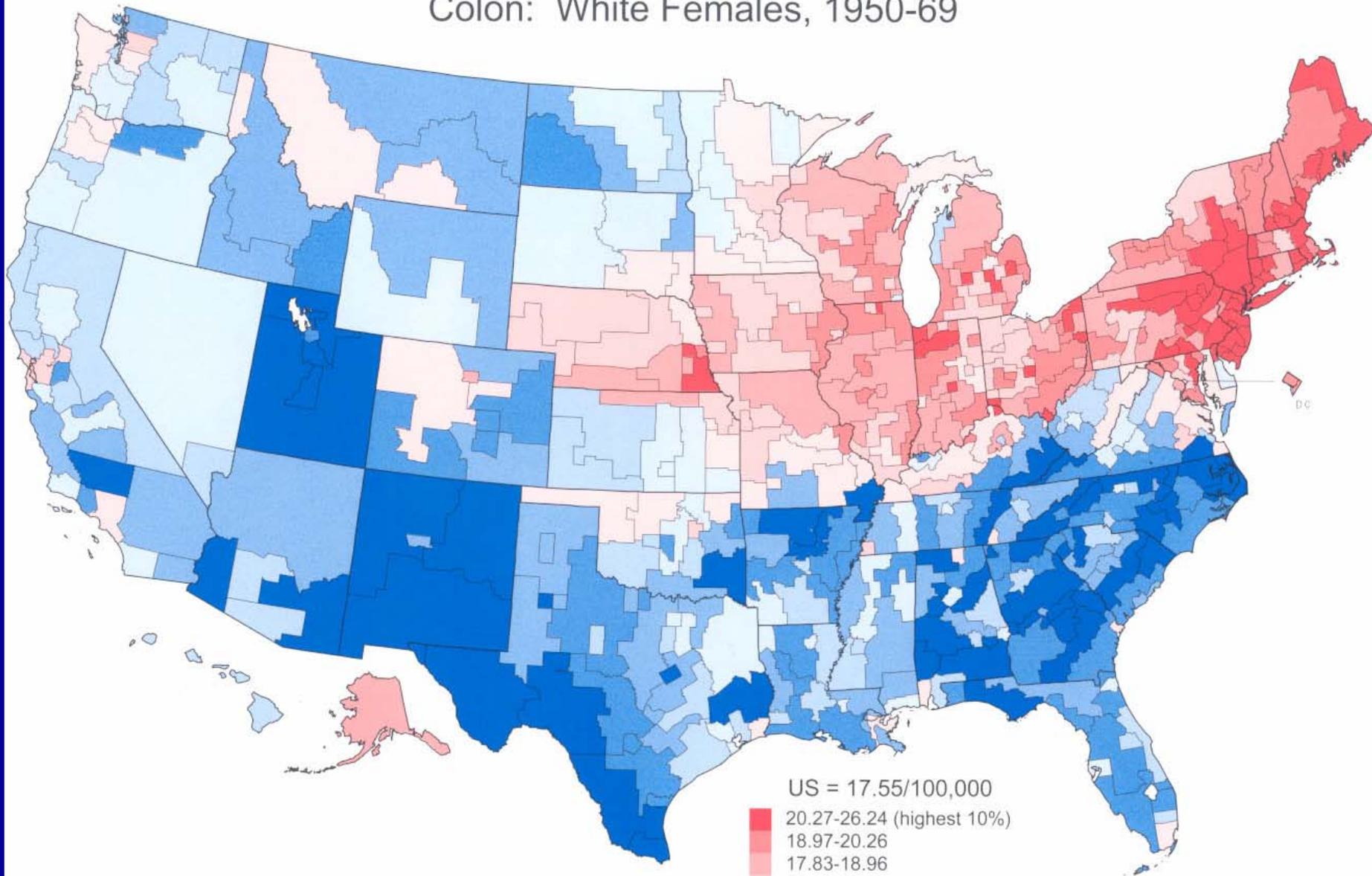


Cancer Mortality Rates by State Economic Area (Age-adjusted 1970 US Population)

Ovary: White Females, 1970-94



Cancer Mortality Rates by State Economic Area (Age-adjusted 1970 US Population)
Colon: White Females, 1950-69



National Cancer Institute Strategy

- Maps of disease
- Linkage to spatial distribution of industries
- Ecologic correlation: disease rate vs. a proxy for exposure* (proportion of population employed in industry)
- Followed by death certificate review to collect individual-level data (occupation, e.g.)
- Followed by case-control study to improve on exposure assessment and collect covariate info

Successes

- Nasal cancer and furniture making
(Brinton et al 1977)
- Bladder cancer and chemical industries
(Hoover et al 1975)
- Lung cancer and petrochemical factories
(Blot & Fraumeni 1976)
- Oral cancer and snuff use
(Blot & Fraumeni 1977)

Contribution of surveillance to research

GIS has revolutionized mapping & overlay processes

Usefulness/Validity of Ecologic Data

- Exposure is relatively homogeneous within unit of aggregation
- Covariate data are meaningful at the 'group' level

[Aggregation can occur over time, or over space, or both]

New Opportunities for Environmental Health Tracking

- Distinguished 3 types of relevant data
 - Hazard (what is in the environment)
 - Exposure (extent of human contact with hazards)
 - Health outcomes (disease, disability, developmental deficits)
- Catalogued a wide variety of databases

Elements of an "Ideal" Environmental Health Tracking System

- High quality mortality & morbidity data, with residence information
- Updated population data, with sociodemographic info (intercensal adjustments for migration, etc.)
- Exposure data bases, enhanced by modeling where appropriate, covering emissions and ambient concentrations, temporally relevant
- Geographic linkage among these types of data, where boundaries have been harmonized
- Fine enough resolution to enable evaluation of localized exposures

Additional Elements

- Exposure data from biomonitoring
- Tools for linkage, and for descriptive and small area analyses
- Tools for dissemination
- Support for public health action

The Time is Ripe?

- IOM Reports, 1988, 2003
- Pew Charitable Trusts Commission
- CDC launch of EHTP
- Aftermath of 9/11: need for public health infrastructure

Obstacles to Effective Environmental Health Tracking

- Fragmentary nature of exposure databases
- Incomplete ascertainment for some diseases (diabetes or neurodevelopmental disorders such as ADHD, autism)
- Data not available for small areas
- Different geographic units for exposures, health outcomes and covariates
- Non-standardized data collection on exposures, behaviors, and some health outcomes
- Non-homogeneity within geographic areas
⇒ ecologic analysis can be misleading

Candidate Diseases for Environmental Health Tracking: The California SB 702 Expert Working Group Report

- Respiratory: asthma, COPD
- Reproductive Outcomes
- Cancer
- Dermatitis
- Developmental: autism, learning impairment
- Diabetes
- Cardiovascular Disease
- Autoimmune Diseases: lupus, multiple sclerosis
- Kidney Disease
- Neurological Diseases: Alzheimer's, Parkinson's, Lead poisoning
- Potential Environmentally Related Diseases: multiple chemical sensitivity, chronic fatigue syndrome

Figure 1A - Annual Growth in Number of Persons with Autism (Codes 1 & 2) from December 1987 through December 2002

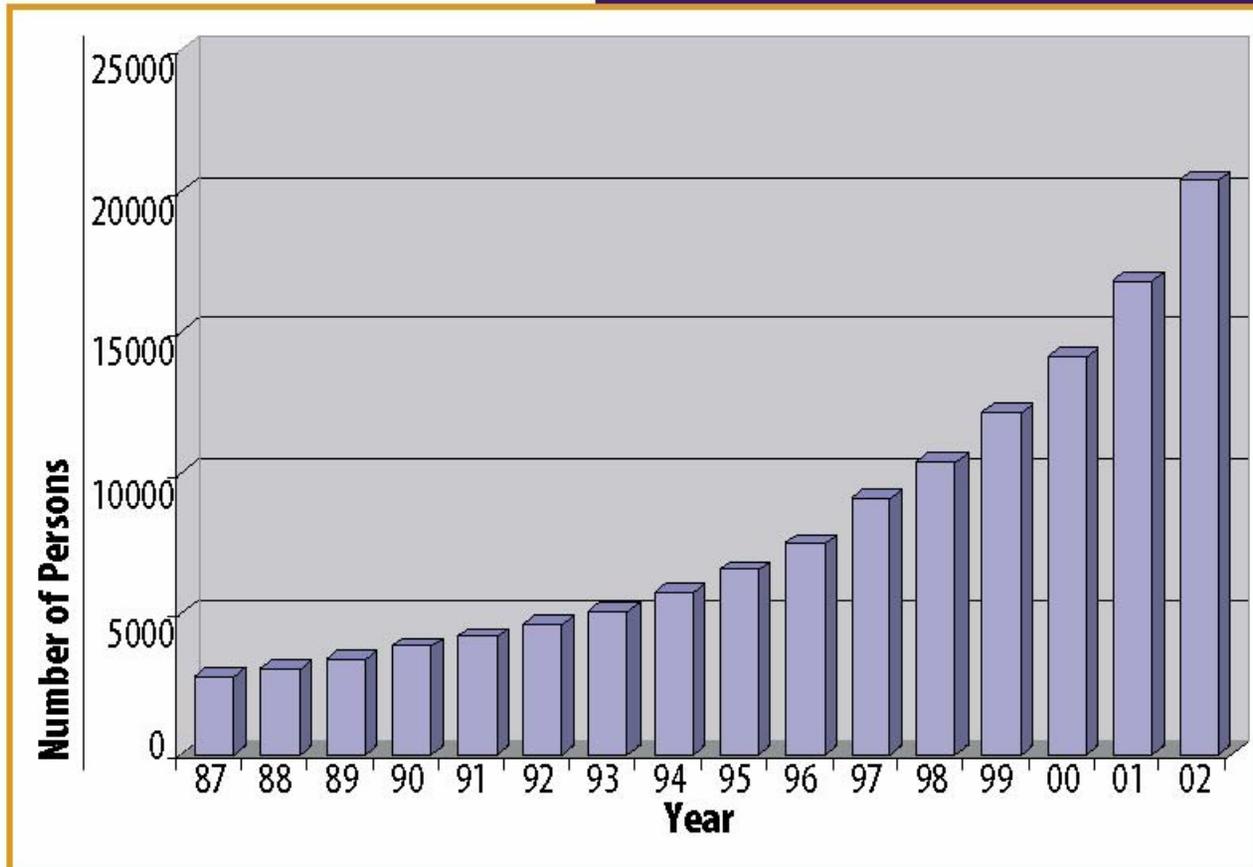
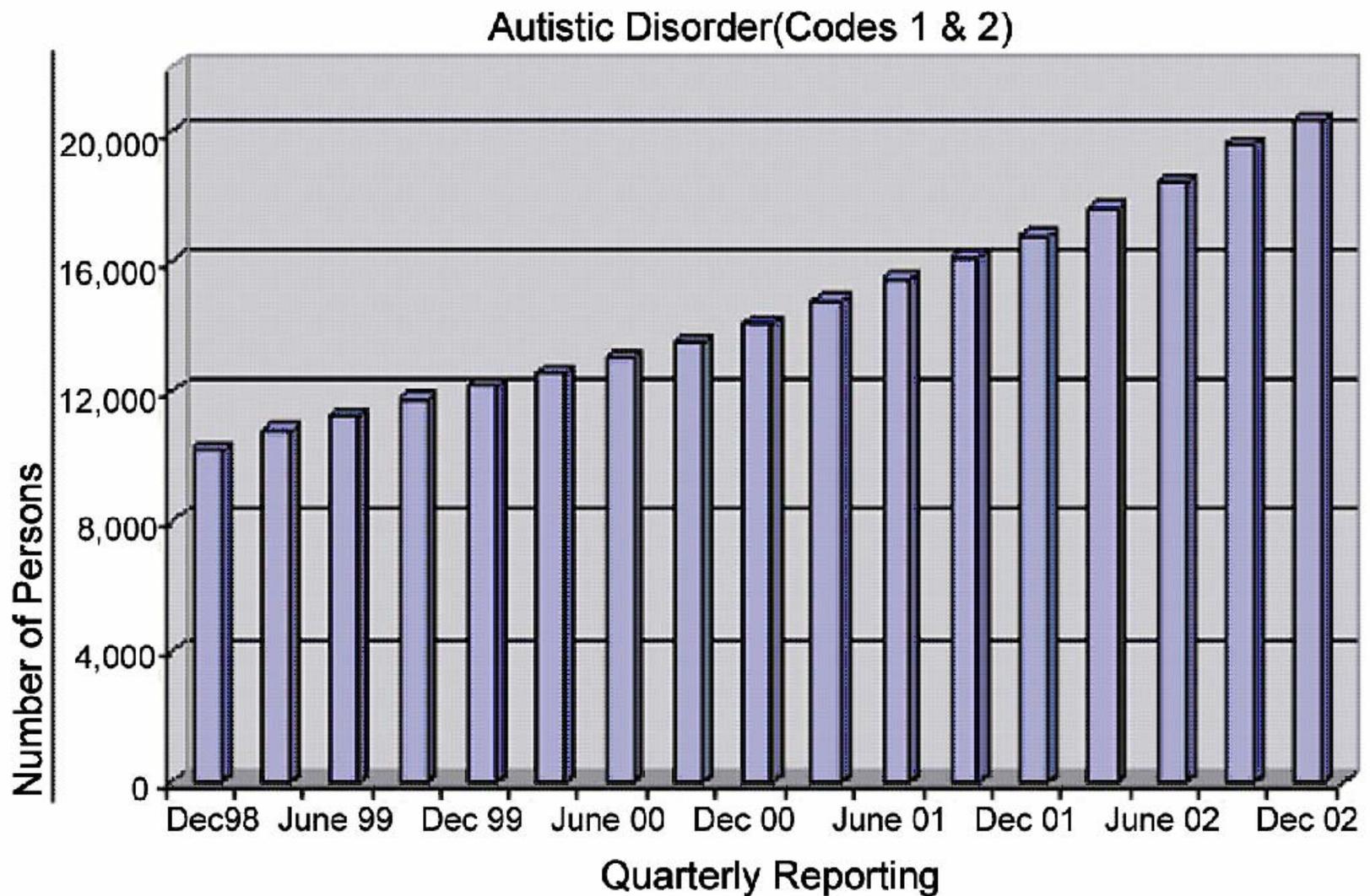


Figure1- Quarterly Growth In Number of Persons with Autism (Codes 1 & 2) from December 1998 through December 2002



Characteristics of Health Tracking Database: The California SB 702 Expert Working Group Report

- Unique dx code for health outcome
- Name or unique identifier to link between databases
- Gender
- Date of birth
- Date of dx
- Race/ethnicity
- Residence address, or latitude/longitude
- Occupational hx
- School name and location
- Smoking history

Characteristics of Exposure Tracking Database (additional items):

The California SB 702 Expert Working Group Report

- Name or unique identifier to link between databases
- Sociodemographics (gender, date of birth, etc.)
- Residence hx
- School name and location
- Smoking history
- Level of contaminant, including units
- Routine or continuous monitoring data
- Statewide geographic coverage of exposure or set of samples representative of state
- Pathway and/or route of exposure

Data Collection:

disease registries; hospital dx & discharge data;
medication and env exposure databases;
market basket & food consumption survey
data; hazard info

Tracking Systems:

linkage across databases,
integration, and mapping

Etiologic Research:

individual-level studies, cases from
registries and/or exposure
assessment from tracking systems

Public Health Action:

policy, intervention, prevention program



What is the Link Between Tracking and Research?

- CDC: Not part of tracking per se, but essential to its usefulness
- California workgroup: Essential part
- Research can
 - Highlight how to improve tracking systems
 - Extend results to individual-level studies
 - Develop methods for rigorous analysis
- Tracking can
 - Identify where exposures are high, where disease rates are high or increasing
 - Generate hypotheses

Valid conclusions about etiology are essential for planning prevention and intervention efforts

Who's Involved?

Private Sector

Industries, hospitals, environmental advocacy organizations, consultant firms



Government

National, state, local, regional,
CDC, EPA, FDA, NOAA, NASA



Academia

Audience: Politician, Public, Physician

Message to Politicians: Costs of Environmentally Related Disease

- Gather quantitative information on disease burden
- Combined with costs of disease
- Audience: policy makers
- Highlight cost savings by policies that reduce exposure (and hence disease)
- Protecting health, preventing disease *is* cost-effective

Message to Public

- Understand risks
- Provide quantitative information on which environmental factors are most dangerous
- Distinguish worrisome from innocuous exposures
- Disseminate information on how to reduce exposures
- Educate public

Finally.....

- Current plans for EHT focuses on non-infectious disease only
- Global climate change:
- Implications for land use
- Increase in extreme weather events:
heat waves in Europe
precipitation in Los Angeles
- Waterborne-disease outbreaks due to heavy rainfall (1948-1994)
- Infectious disease surveillance needs to be linked to EHT... and soon!

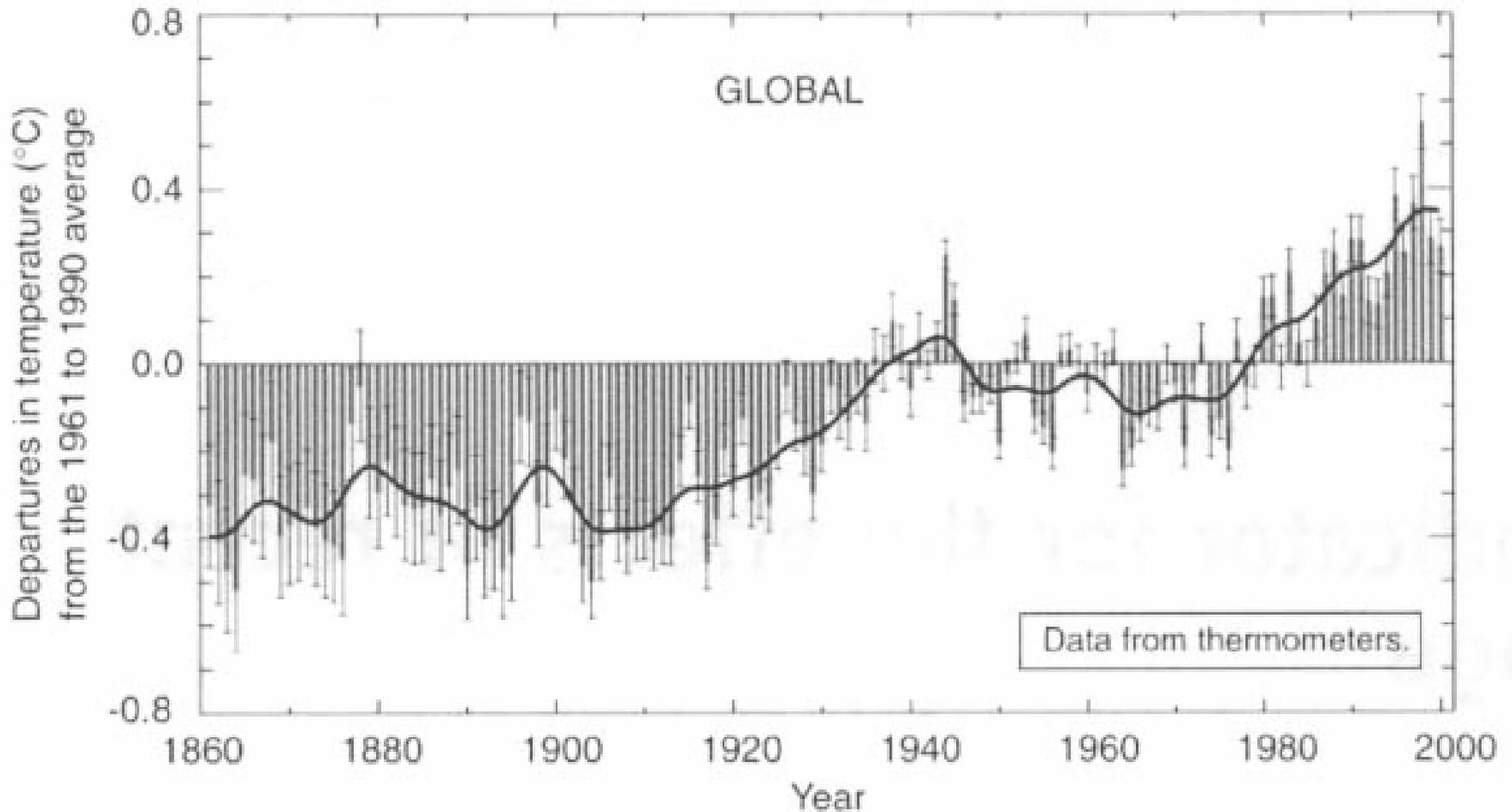


Fig. 1. Average global surface temperatures (in centigrade) from 1860–2000, showing deviation from the baseline 1961–1990 average temperature. [Reproduced with permission from ref. 19 (Copyright 2001, Intergovernmental Panel on Climate Change).]

- Turning point in environmental health?
 - Building infrastructure
 - Opportunities for new partnerships
 - Link between tracking and research
 - Cannot forget infectious diseases

- Thank you!