Epidemiologia e Geologia Médica

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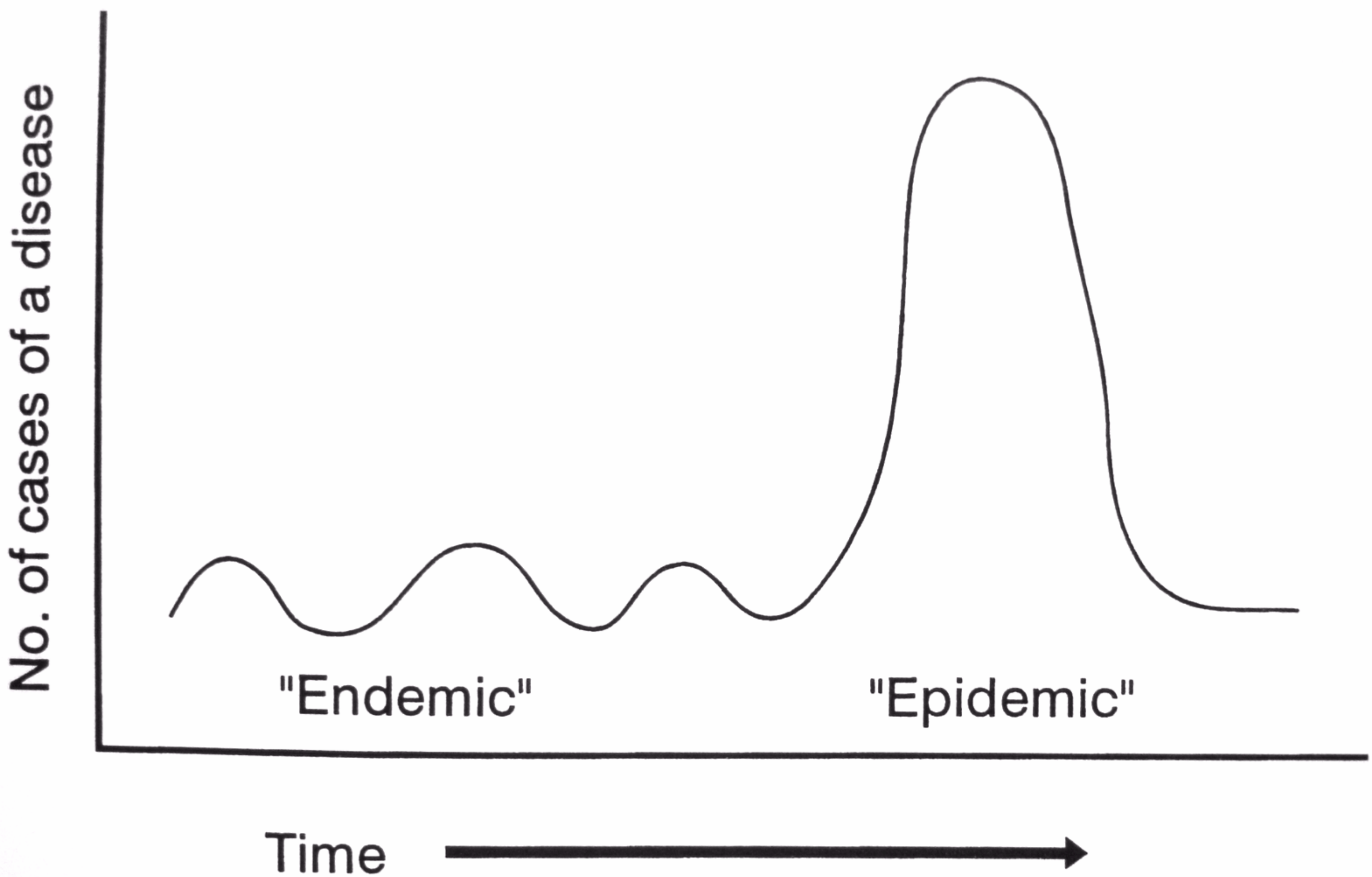
Epidemiology

- **Study of <u>HOW</u> disease is distributed in populations and <u>WHICH FACTORS</u> influence or determine this distribution**
- **Descriptive**
  - **Time – when**
  - **Place – where**
  - **People – who**
- **Analytical**
  - **Related to cause-effect relationship, and risk factors**

- Disease or Health-related states or events
  - Symptoms (subjective complains)
  - Signals (objective perceptions)
  - Laboratory alterations
  - Levels of exposure

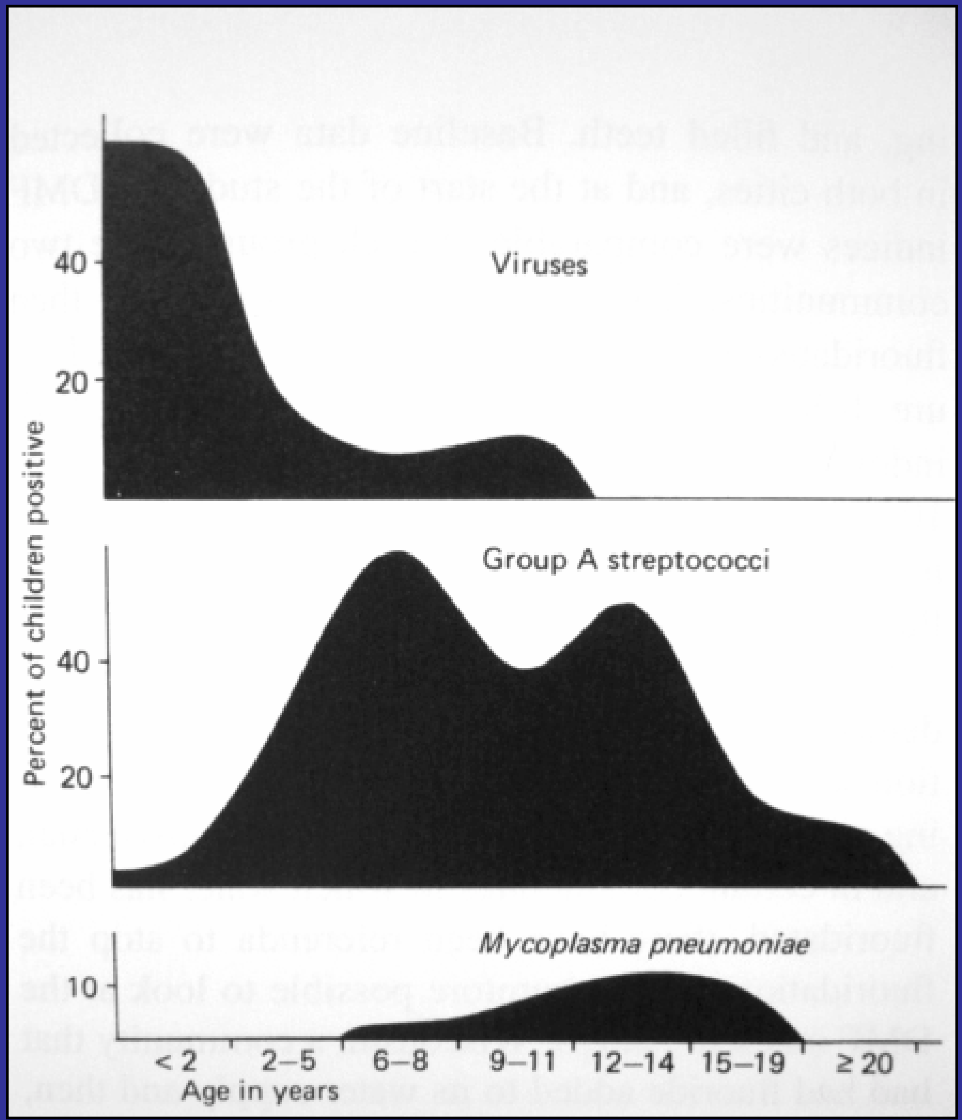
Objectives of epidemiology

- Determine the extent of the event in the population
- Study the natural history of the event:
  - How it begins, evolves, and finishes
- Determine the etiology:
  - Specific / multiple causal agents
  - Risk factors: genetics; environment; habits, etc.
  - Pattern of transmission
  - Pattern of exposure


No. of cases of a disease
"Endemic"
"Epidemic"
Time

EMDC2 EMDC3

Frequency of agents by age of children with pharyngites, 1964-65



Source: Denny FW, 1969

Slide 6

EMDC2

Denny FW. The replete pediatrician and the etiology of lower respiratory tract infections. Pediatr Res 3:464-470, 1969
Eduardo Mello De Capitani; 17/5/2005

EMDC3 Cited in Gordis L, Epidemiology. Philadelphia, WB Saunders Co, 1996.p 7.
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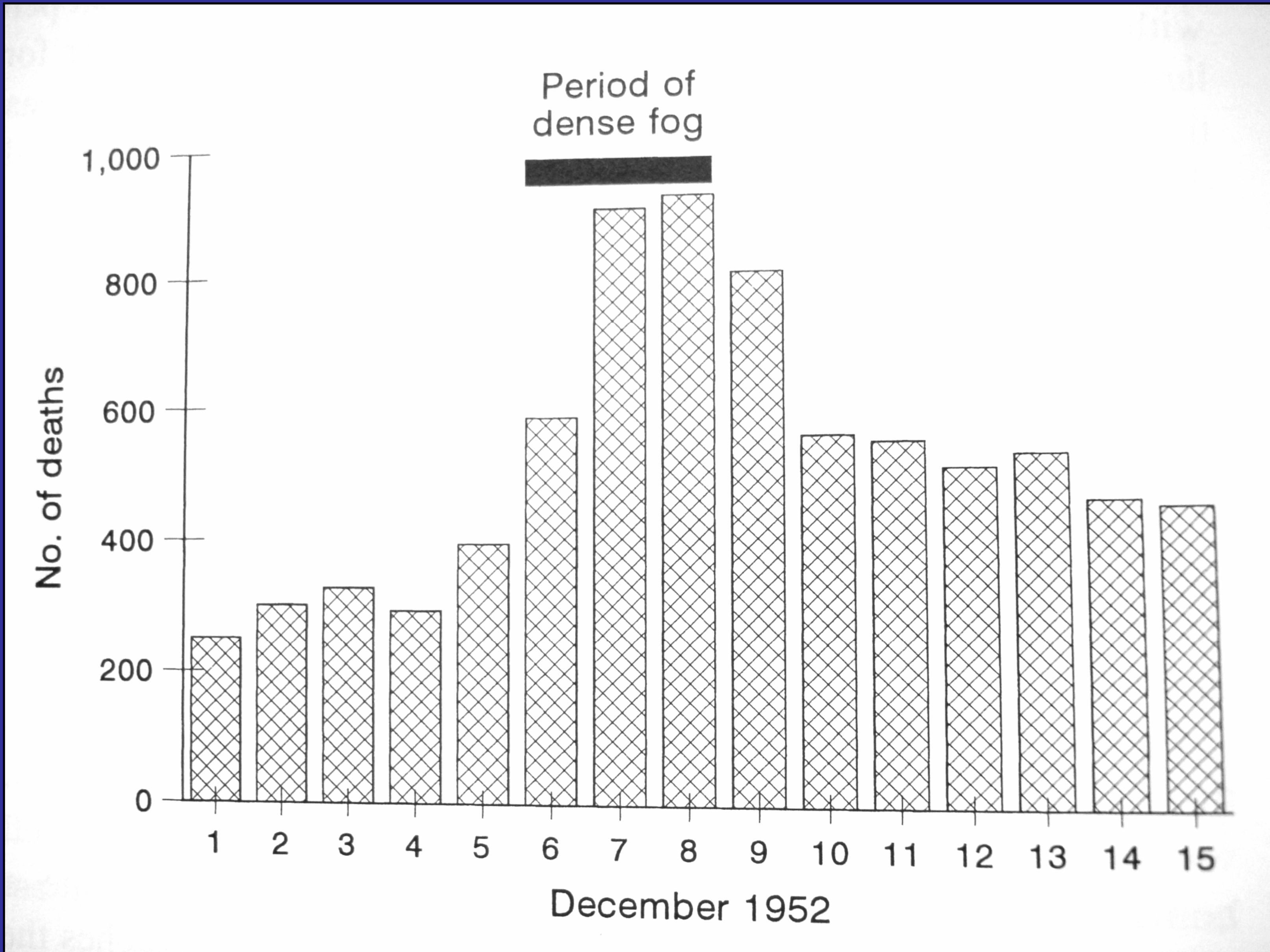


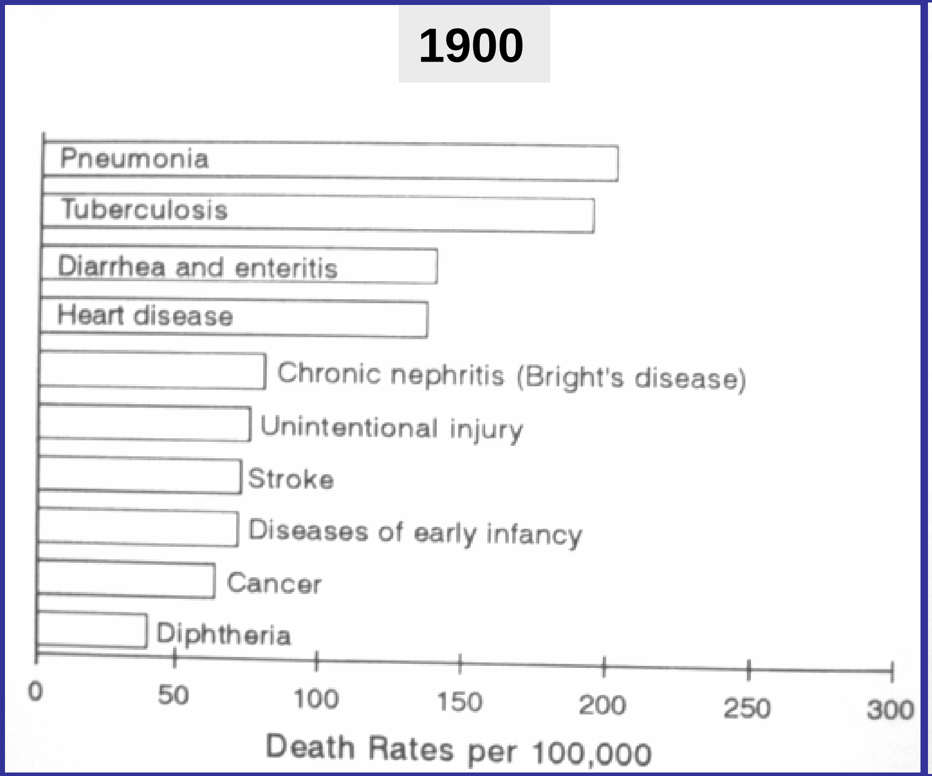
Logan WPD. Mortality in the London fog incident, 1952. Lancet 1:336, 1953

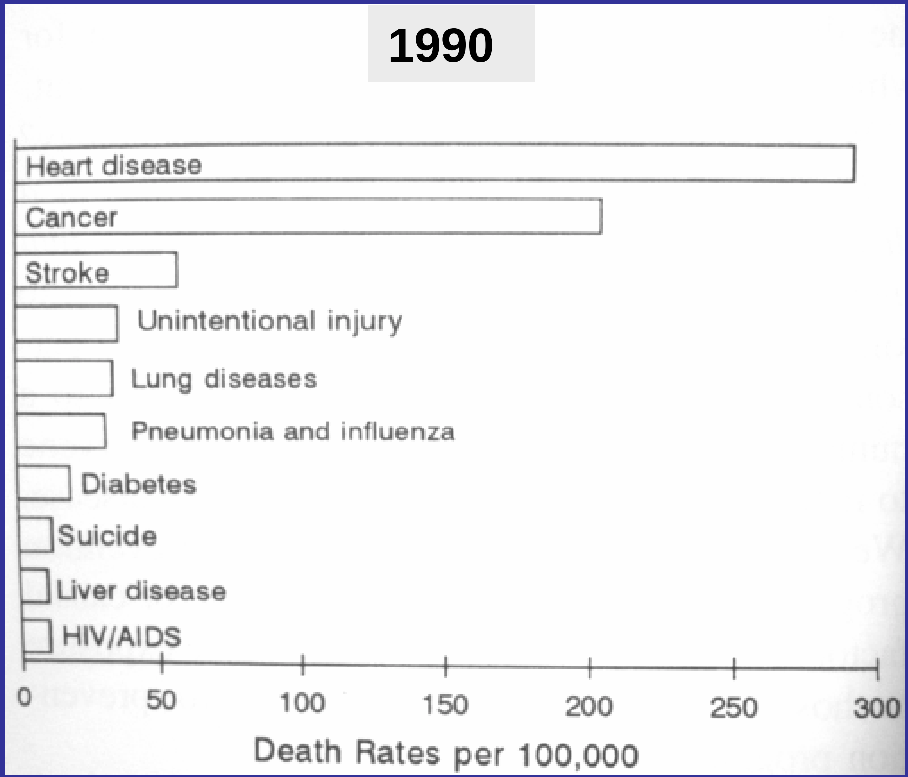
Objectives of epidemiology

- Study the pattern of change of distribution of the event over time
- Define and assess therapeutic, preventive or control measures
- Provide rationale to public policies and regulatory decisions

EMDC1

Ten leading causes of death in the USA, 1900-1990





Adapted from Grove RD & Hetzel AM, 1993

EMDC1

Grove RD, Hetzel AM. Vital statatistics of the USA, 1940-1960. Washington DC, US Government Printing Office, 1968, and National Center for Health Statistics: Advance report of final mortality statistics, 1990, Monthly Vital Stat Rep 41(7) suppl, 1993

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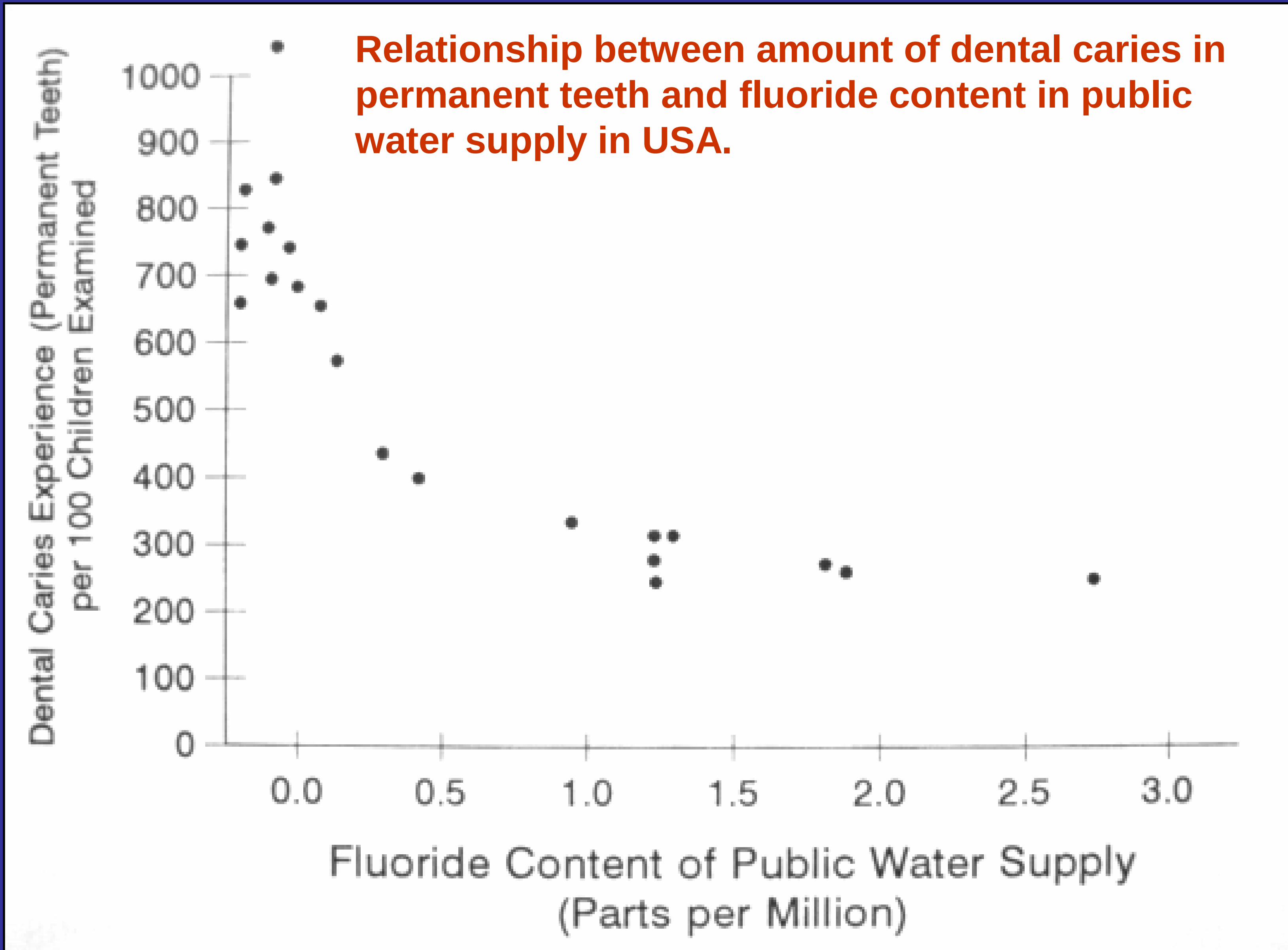
EMDC4



Adapted from Dean HT et al, 1942

EMDC4 Dean HT, Arnold FA Jr, Elvore E. Domestic water and dental caries: V. Additional studies of the relation of fluoride in domestic waters to dental caries experience in 4,425 white children aged 12 to 14 years of 13 cities in 4 states. Publ Health Rep 57: 1155-79, 1942. Citaed by Gordis L. Epidemiology. Philadelphia, W.B. Saunders Co, 1996.

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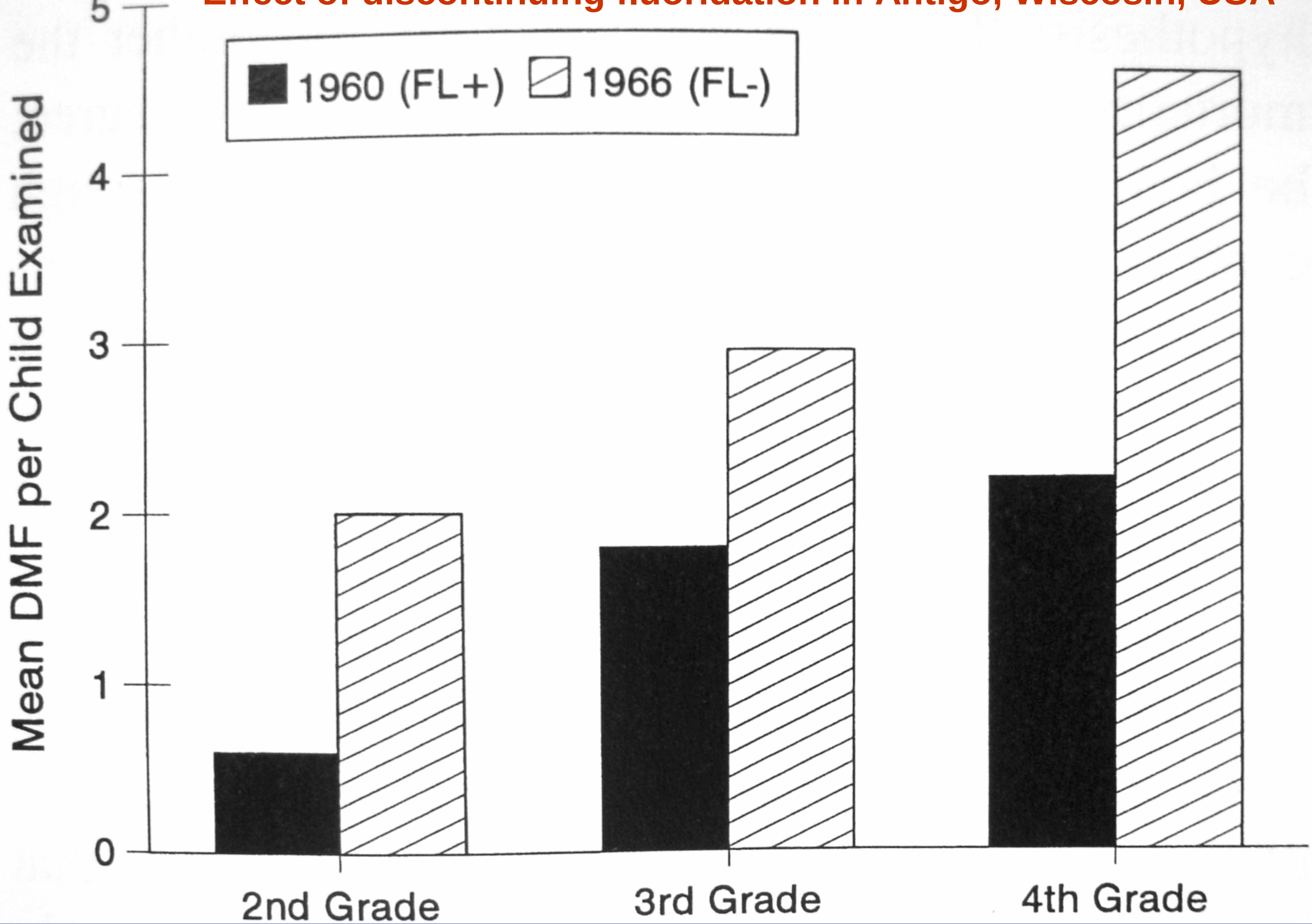
Effect of discontinuing fluoridation in Antigo, Wiscosin, USA



Adapted from Lemke CW et al, 1970

Epidemiological approach

- 1. Determine whether an association exists between factor and the development of the disease or event
  - Describing characteristics of the factor and event
    - Incidence / prevalence
    - Exposure characteristics
    - People, Time, and Place
  - Association X Causation
- 2. Derive inferences regarding a possible CAUSAL relationship between the two.

Types of epidemiological studies

- Observational
  - Descriptive
    - Prevalence / Incidence
    - Cross sectional
  - Analytical (search for etiology)
    - Case-control study
    - Cohort
    - Ecologic study
- Experimental
  - Randomized Clinical Trial
  - Community intervention

Hill’s criteria for causation

- **Strength**
  - high relative risk
- **Consistency**
  - Causal relationship is supported by multiple studies in different populations, models or species
- **Specificity**
  - The observed effect does not occur without the presumed cause

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Hill’s criteria for causation

- **Temporality**
  - **Cause should precede effect**
- **Biological gradient**
  - **There should be a good dose-response curve** **(“the threshold issue”)**
- **Plausibility**
  - **Current biological knowledge should support the association**

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Hill’s criteria for causation

- **Coherence**
  - The association should not conflict with generally known facts
- **Experiment**
  - The association should be demonstrable with a well design study
- **Analogy**
  - Resemblance with another causal relationship already accepted

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Cadmium pollution in the Usui river basin in Japan

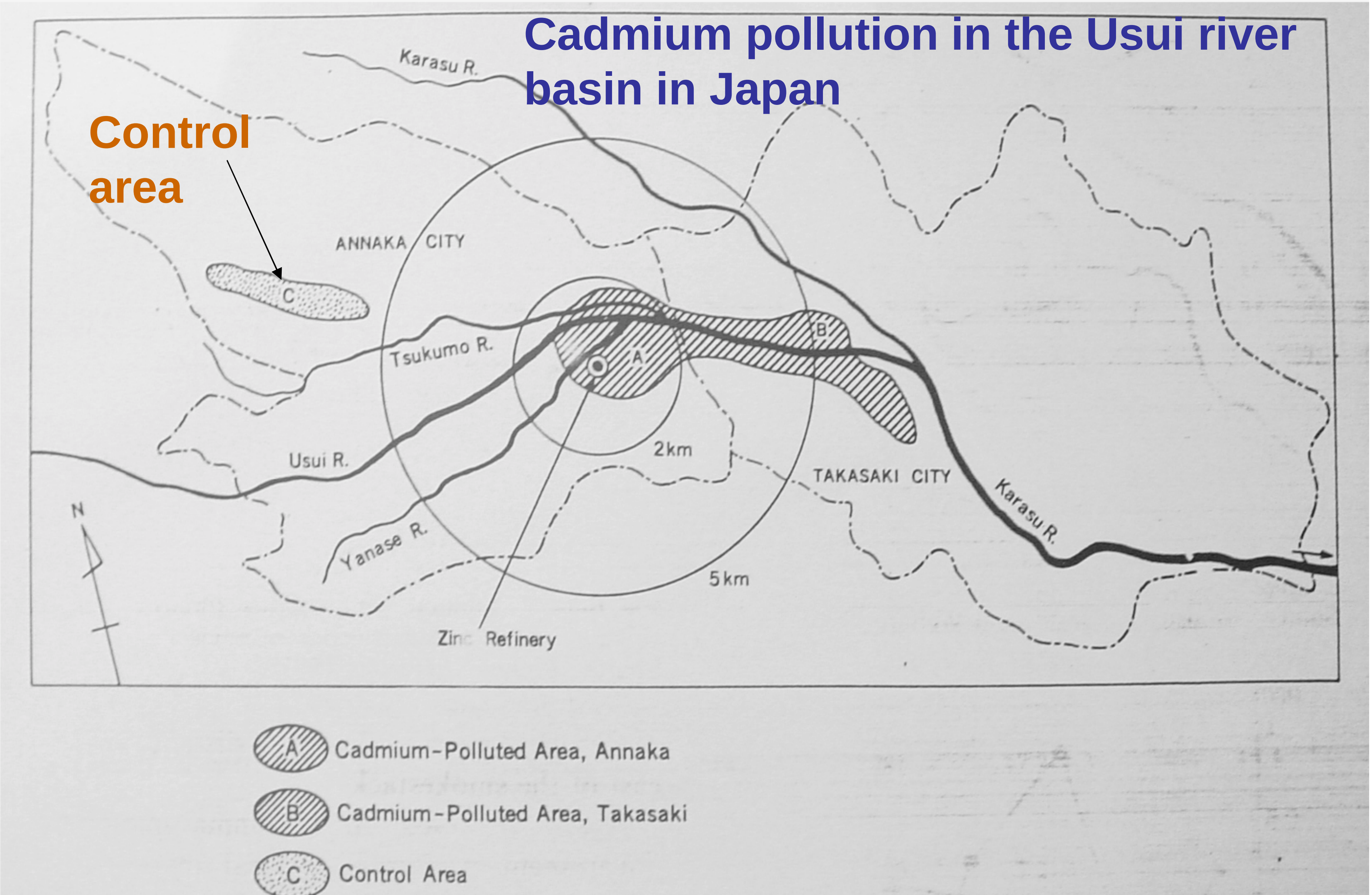


Fig. 6–11. Area polluted by cadmium in the Usui River Basin; control area for health survey.

Questions to be answered

- Disease or event:
  - detailed description (osteomalacia / osteoporosis; deformity; pain)
- Local incidence / prevalence
  - (strength)
- Difference with other similar area
  - control area
- Kind of “abnormal” exposure
  - Cd and other metals

Questions to be answered

- Dose response relationship
  - Women in far areas with less symptoms
- Temporality
  - Situation before WWII and after
- Plausibility
  - Cd is a known cause of renal damage
- Specificity
  - disease can occur in absence of Cd exposure (discard other possibilities)

Causal-effect validation criteria

• Strength	+ / -
• Consistency	-
• Specificity	+ / -
• Temporality	+
• Biological gradient	+
• Plausibility	+
• Coherence	+
• Experiment (lab)	+
• Analogy	+ / -