

Introduction to Public Health and Epidemiology

**King Cholera dispenses contagion:
the London Cholera Epidemic of 1866**





Learning Objectives

- Define Epidemiology
- Summarize the epidemiologic approach
- List the uses of Epidemiology
- Describe the interactions between host, agent, and environment



Epidemiological Principles

- Diseases (or other health events) don't occur at random
- Diseases (or other health events) have causal and preventive factors which can be identified



Epidemiology

Epi = upon

Demos = population

Logos = study of



Definition

The study of the distribution and determinants of health related states or events in specified human populations and its application to the control of health problems

Last, 1988



Key Words:

The study of the **distribution** and determinants of health related states or events in specified human populations and its application to the control of health problems.

Distribution



Time, place, person



Key Words:

The study of the distribution and **determinants** of health related states or events in specified human populations and its application to the control of health problems.

Determinants ▶▶

Cause, risk factors



Key Words:

The study of the distribution and determinants of health related states or events in specified human **populations** and its application to the control of health problems.

Population



Public health



Key Words:

The study of the distribution and determinants of health related states or events in specified human populations and its **application** to the control of health problems.

Application
action



Information for



Uses of Epidemiology

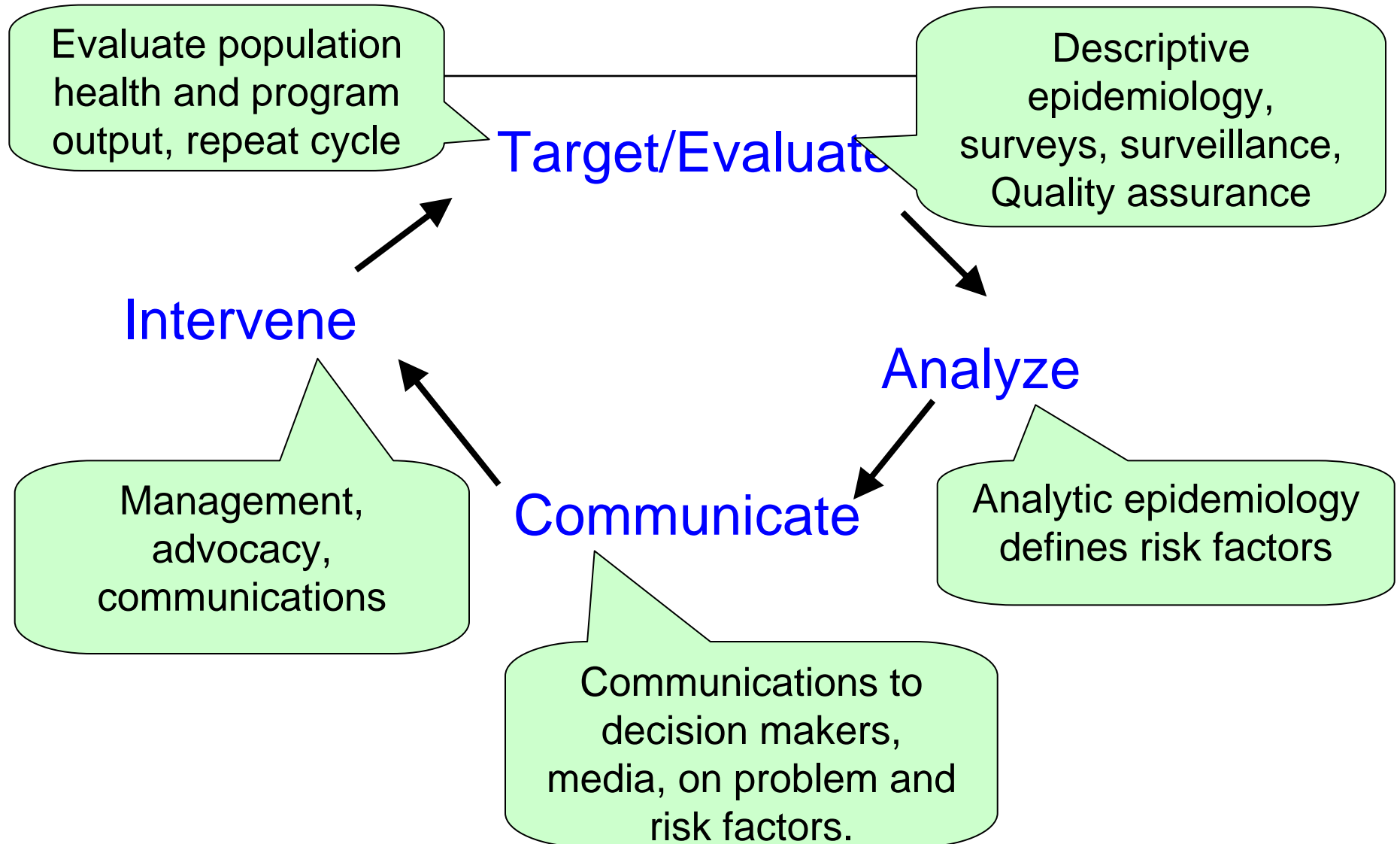
- Determine the magnitude and trends
- Identify the etiology or cause of disease
- Determine the mode of transmission
- Identify risk factors or susceptibility
- Determine the role of the environment
- Evaluate the impact of the control measures



Epidemiologist Core Functions

- ❑ Public health surveillance
- ❑ Investigation
- ❑ Data analysis
- ❑ Evaluation
- ❑ Communication
- ❑ Management and teamwork

Public Health Cycle




Basic Epidemiologic Approach

- Observe
- Count cases (events)
- Describe
 - Time, place, person
 - Calculate rates,
- Compare rates
- Develop hypothesis
- Test hypothesis
- Implement actions (control, prevention)

**Descriptive
Epidemiology**

**Analytical
Epidemiology**

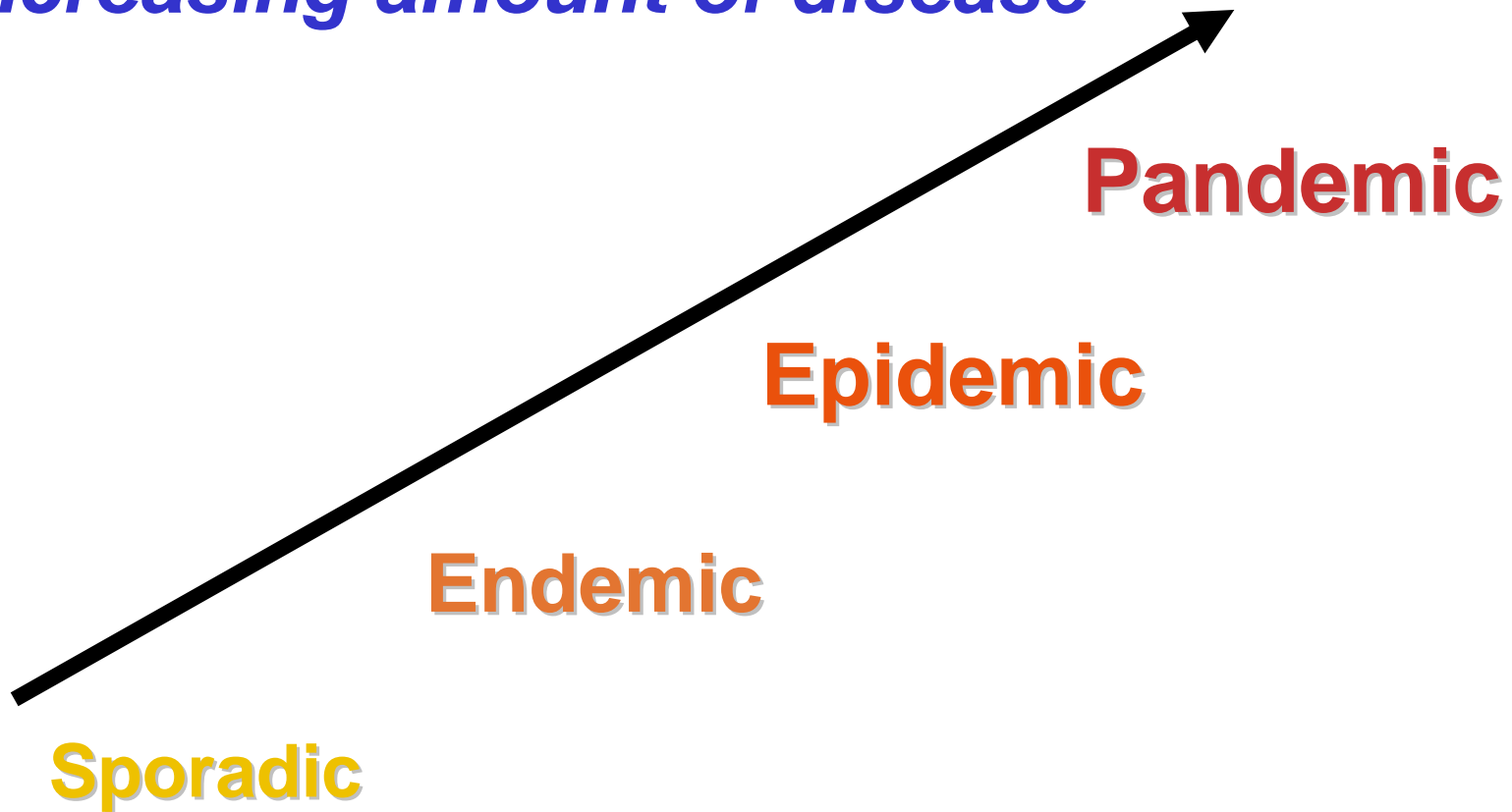
Medicine Versus Epidemiology

	Clinical Medicine	Epidemiology
Focus	Individuals	Populations
Main Goal	Diagnosis and Treatment	Prevention and Control
Questions	What is wrong with this patient? What treatment is appropriate? 	What are the leading causes of death or disability in this population? What can be done to reduce/prevent them?

Epidemiology and Disease

Levels of Disease

Increasing amount of disease





Epidemiologic Triad





Host, Agent, Environment

Host

Age

Sex

Religion

Exercise

Behavior

Co-morbidity

Genetics

Food

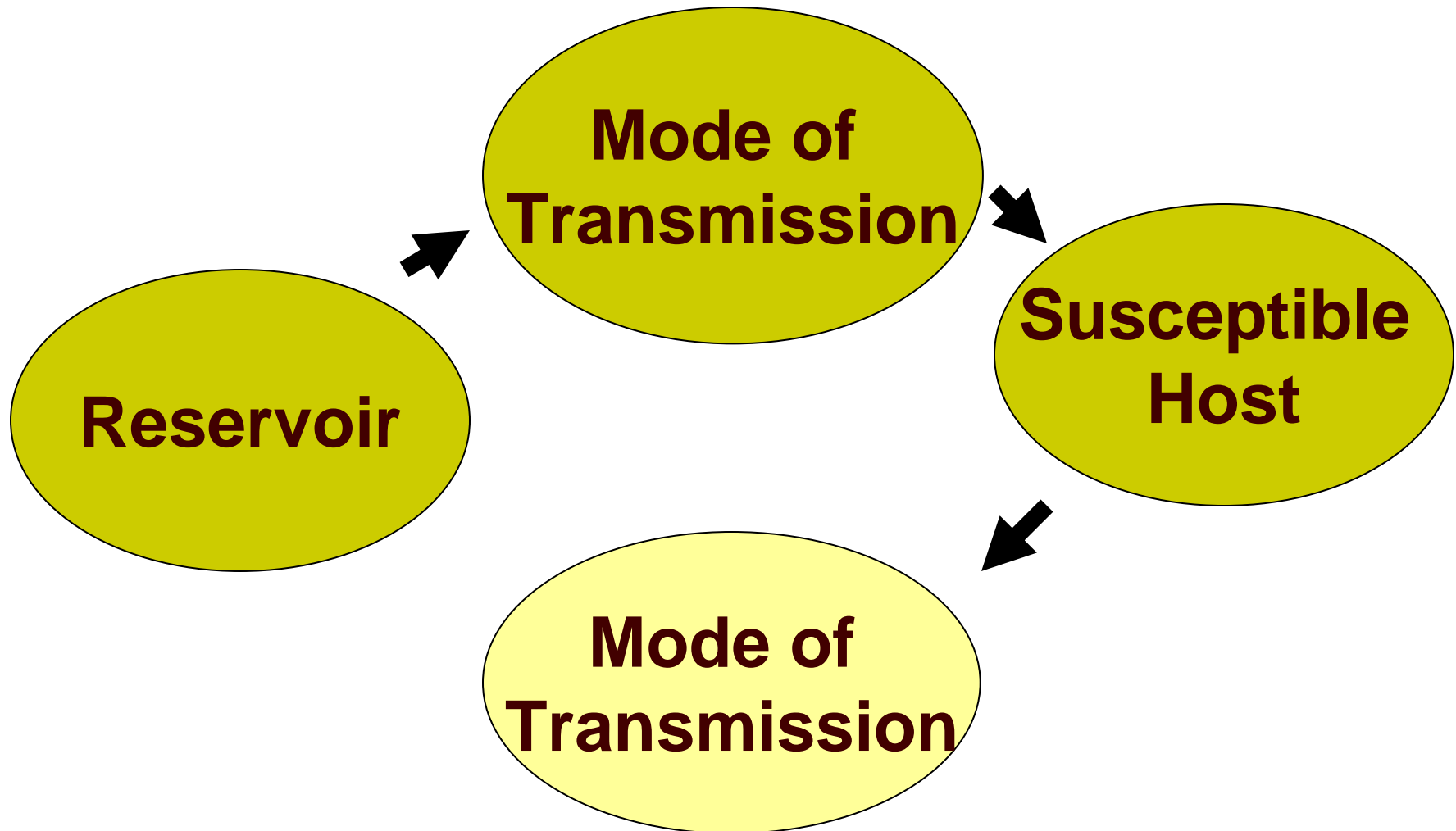
Host, Agent, Environment

Host	Agent
Age	Biologic
Sex	microorganisms
Religion	Chemical toxins
Exercise	Physical trauma
Behavior	Nutrition
Co-morbidity	
Genetics	

Host, Agent, Environment

Host	Agent	Environment
Age	Biologic	Disease vectors
Sex	Microorganisms	Population density
Religion	Chemical Toxins	Air quality
SES	Physical Trauma	Weather
Exercise	Nutrition	Noise
Behavior		Food and water sources
Co-morbidity		
Genetics		

Chain of Infection





Reservoir

Habitat in which the disease normally lives and multiplies

- People
 - Symptomatic - Smallpox
 - Asymptomatic - HIV
- Animals (Zoonoses)
 - Brucellosis
 - Plague
- Environmental
 - Histoplasmosis
 - Legionnaires' bacillus



Mode of Transmission

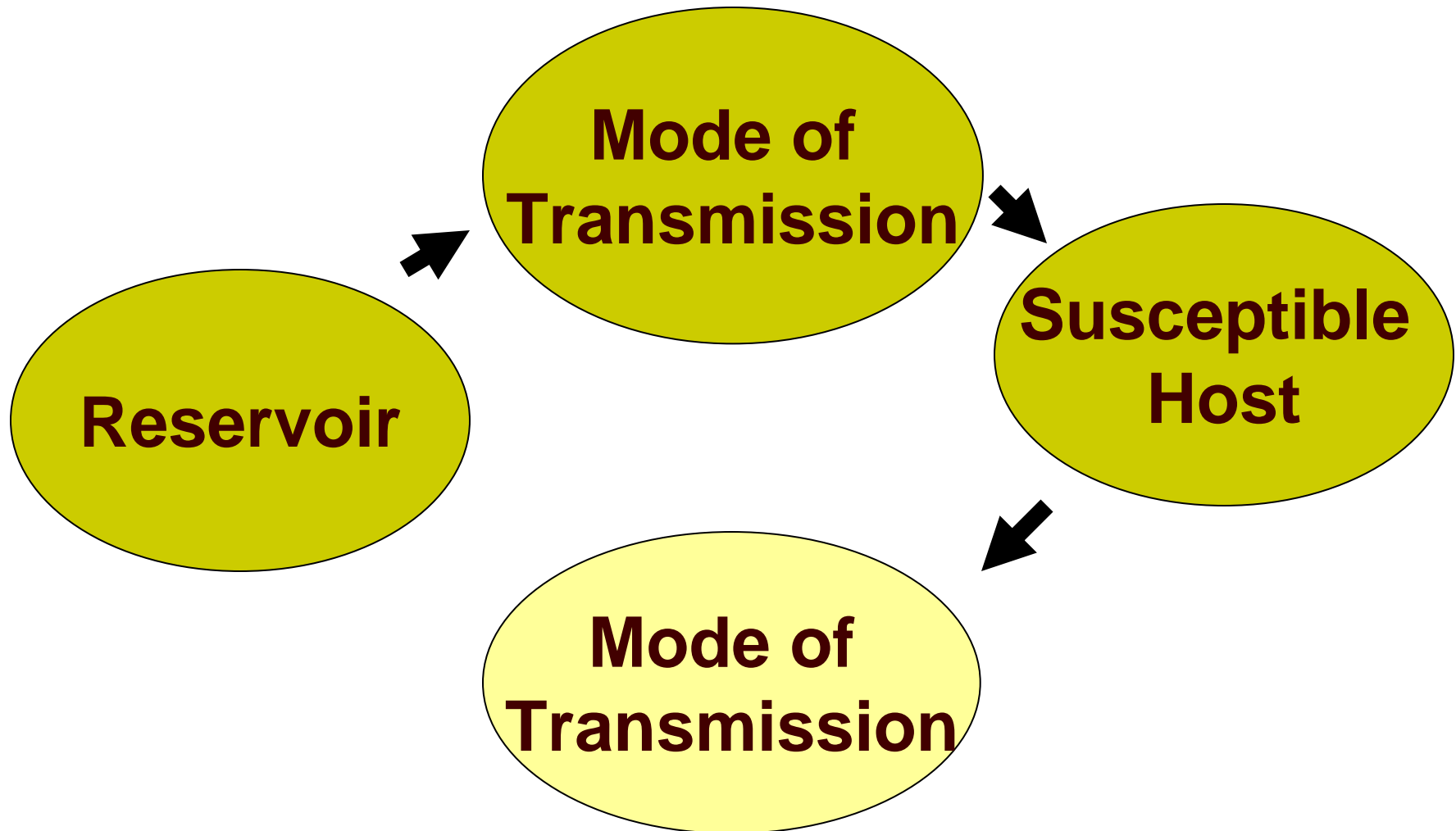
□ **Direct**

- Contact - Cutaneous Anthrax, Hookworm
- Droplet –Smallpox

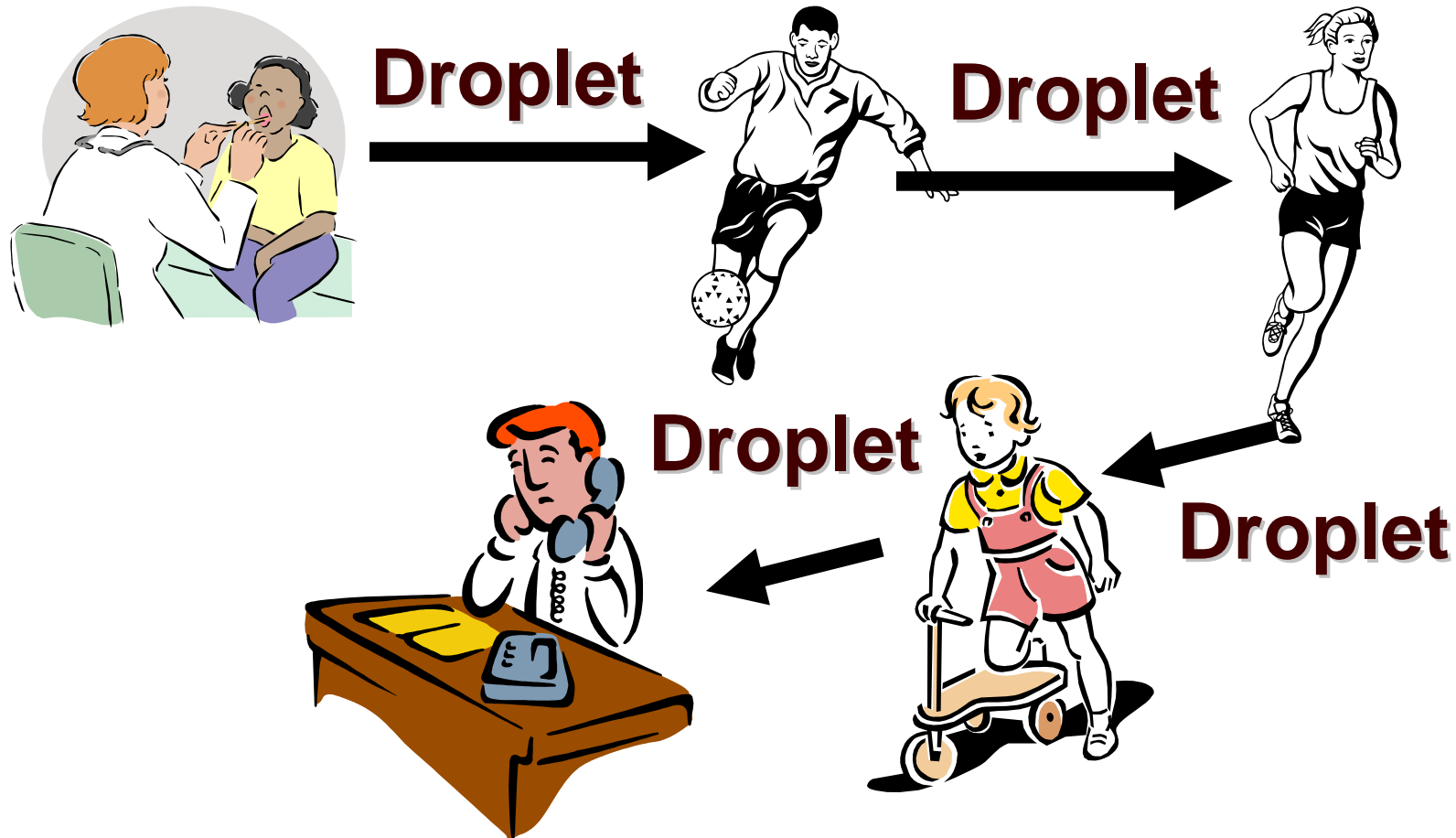
□ **Indirect**

- Airborne – Histoplasmosis, Inhalation Anthrax
- Vehicle-borne food or water - Salmonella
- Vectorborne
 - Mechanical – Shigella by fly limbs
 - Biological – Malaria (maturation)

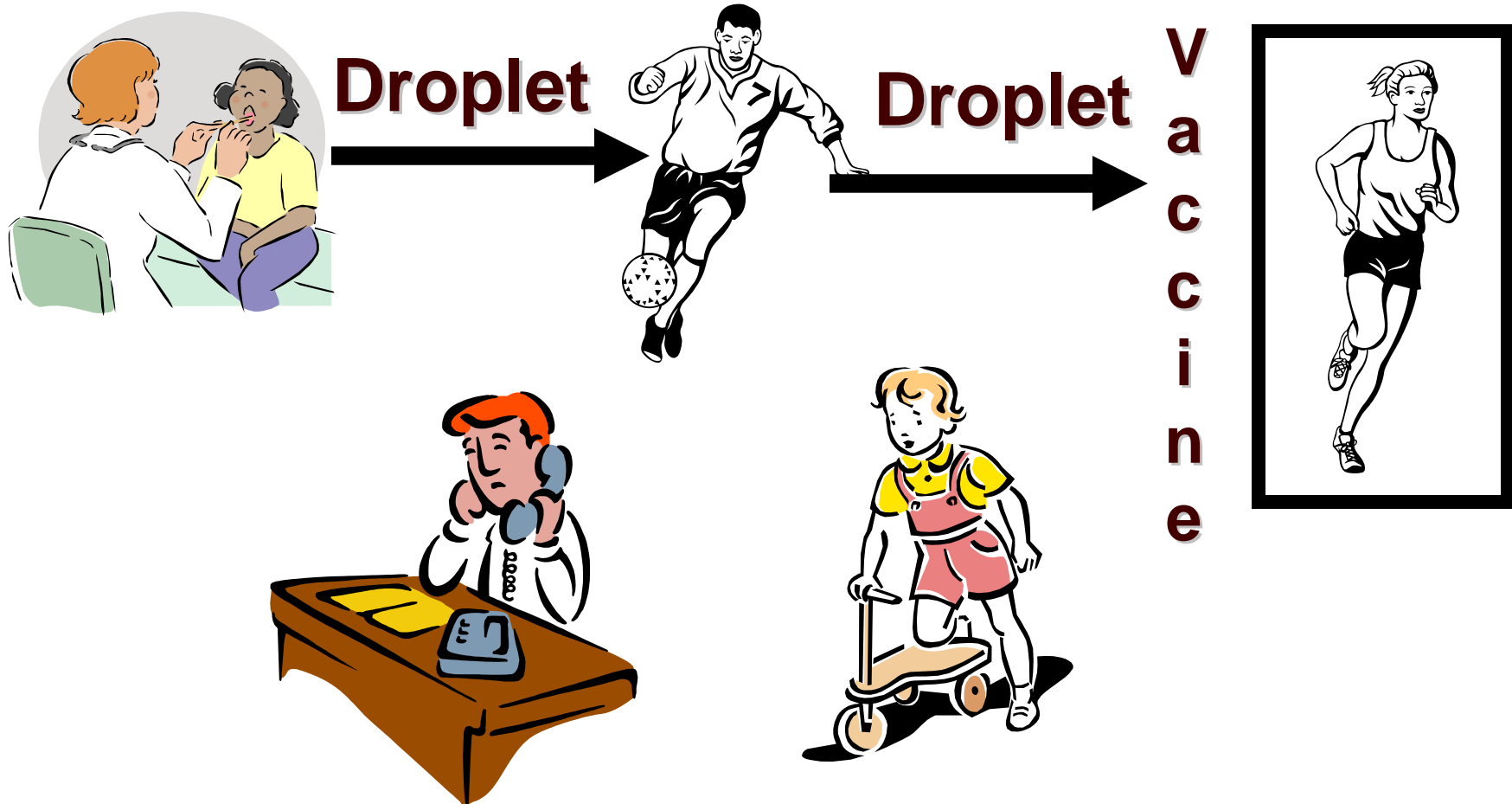
Chain of Infection



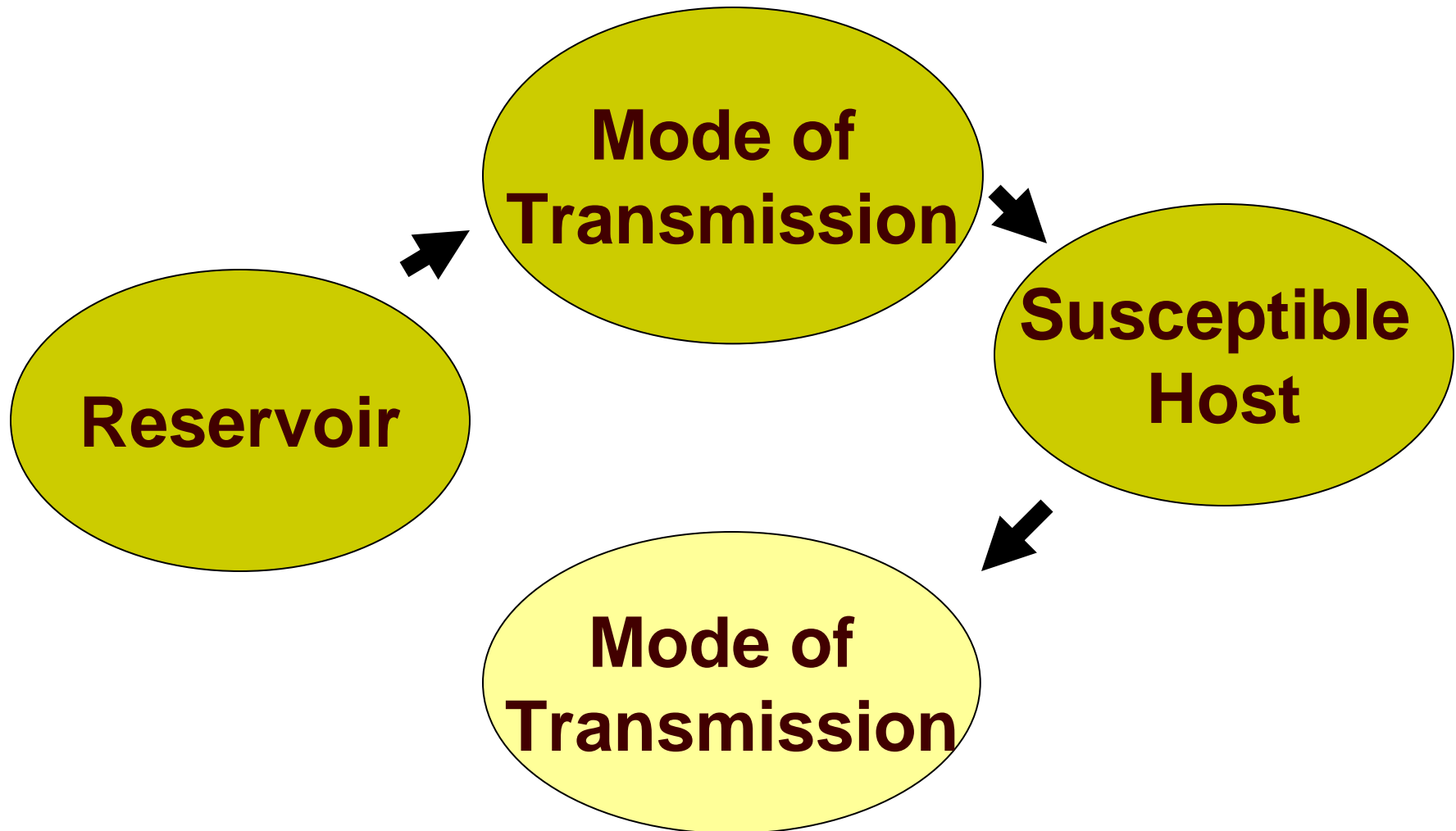
Smallpox Chain of Infection



Smallpox Chain of Infection



Chain of Infection





Do you need to identify the agent to control it?

<u>Disease</u>	<u>Control measure</u>	<u>Year</u>	<u>Agent</u>	<u>Year</u>
Scurvy	Diet	1753	Vitamin C	1928
Pellagra	Diet	1754	Niacin	1924
Smallpox	Vaccination	1798	Orthopox virus	1958
Cholera	Water quality	1849	Vibrio cholerae	1893
Yellow fever	Mosquito control	1901	Flavivirus	1928



Epidemiologic Transition - Public Health Response

- Shift in primary emphasis of public health priorities.....
- from: microbiologic investigation of communicable diseases
- to: the etiologic role of behavioral and environmental risk factors and methods



Infectious and Chronic Diseases

- Epidemiologists investigate both infectious and chronic (non-communicable) diseases



Why have chronic diseases increased in importance?

- Favorable demographic changes and public health successes during the 1900's (quality and availability of food, water, housing, sanitation; communicable disease control)

- “Epidemic transition” (i.e. change)
 - Lower overall death rate
 - Greater life expectancy
 - Shift in major causes of death (from infectious to non-communicable)
 - Change in lifestyles (access & economy)



Epidemiologic transition – Life expectancy in U.S.

1900

Infant mortality:

- **150.0** *deaths /1000 live births*

Life expectancy:

- **47** *years*

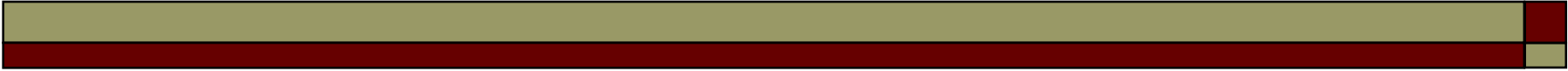
1990

Infant mortality:

- **9.2** *deaths /1000 live births*

Life expectancy:

- **75** *years*



Epidemiologic transition – Leading causes of death in U.S.

1900

- Pneumonia/Flu
 - (202 deaths/100,000)
- Tuberculosis
 - (194 deaths/100,000)
- Gastro/Enteritis
 - (143 deaths/100,000)

1990

- Heart disease
 - (281 deaths/100,000)
- Cancer
 - (204 deaths/100,000)
- Stroke
 - (60 deaths/100,000)

Chronic Diseases

(Non-communicable or Degenerative Diseases)

-
- ❑ Cardiovascular disease (Coronary heart disease, Stroke, hypertension)
 - ❑ Cancer
 - ❑ Chronic lung diseases
 - ❑ Diabetes Mellitus
 - ❑ Osteo Arthritis
 - ❑ Obesity
 - ❑ Chronic neurological disorders
 - ❑ Musculoskeletal diseases



Defining characteristics of chronic diseases

- ❑ Prolonged course of illness
- ❑ Multiple risk factors
- ❑ Long latency period
- ❑ Non-contagious origin (non-communicable)
- ❑ Uncertain etiology (causation)
- ❑ Functional impairment or disability
- ❑ Incurability



Is Descriptive Epidemiology of chronic and infectious diseases similar?

- Some of the purposes, methods, data sources, and types of variables to be analyzed are similar for the descriptive epidemiology of chronic diseases and infectious diseases

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**Descriptive
Epidemiology**

**Analytical
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Chronic Disease vs. Infectious Disease

- How might data patterns for person, place, and time-specific variables differ for Chronic Disease and Infectious Disease?



The art of epidemiological thinking

is to draw conclusions

from imperfect data

George W. Comstock



Acknowledgements

□ Presentations

- M. Valenciano and D. Coulombier, WHO Lyon
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- E. Simoes, CDC

□ Reference books

- M. Gregg, *Field Epidemiology, 2nd ed.*
- R. Timmreck, *An Introduction to Epidemiology*